Sherburne County (David Lucas)

Below represents the comments for Sherburne County.

In re Matter of Elk River Landfill North Development Area Scoping Process	**Comment Letter of Sherburne County to Minnesota Pollution Control Agency**

Minnesota Pollution Control Agency
520 Lafayette Rd
St. Paul, MN 55155

INTRODUCTION

Sherburne County submits this public comment letter in response to the Scoping Environmental Assessment Worksheet (SEAW), Draft Scoping Decision Document (DSDD), and supporting documents published on October 28, 2025 in the Minnesota Environmental Quality Board (EQB), Volume 49, Number 43, regarding the Elk River Landfill North Development Area Environmental Impact Statement scoping process. The SEAW and DSDD address a proposed expansion (the "Project") by Waste Management of the Elk River Landfill ("ERL"). The proposed Project Site, to the north of the existing ERL site, is in Sherburne County (the "County"). The overall scale and term of the expansion is massive. The proposed Project would nearly double the landfill's acreage (adding a 162.36-acre area), proposing to pile waste at an increased slope than what is allowed by Minnesota Rules or County ordinance.[1] The proposed capacity would more than double the existing permitted volume – from 19.06 million cubic yards to 45.73 million cubic yards. This capacity is projected to last for a staggering 60 years into the future, with the SEAW raising the potential for additional landfilling at the Project Site after that capacity is reached.[2] A development of such size and magnitude requires all parties to examine

[1] With the proposed expansion in Livonia Township, the County Board would set the final grade elevations of a solid waste landfill. Sherburne County Ordinance No. 180, Section 7.2(A).
[2] SEAW at p. 13.

exhaustively not only the Project as proposed, but all viable alternatives, in accordance with Minnesota's state and local laws and rules. Per the EQB directive, Sherburne County's comments address the accuracy and completeness of the SEAW and DSDD, including identifying potential impacts that warrant further investigation.

As the DSDD notes, the purpose of the EIS is to generate information "for use by governmental units as a guide in considering permits or approvals for the Project and in identifying measures necessary to avoid or mitigate adverse environmental effects."[3] As the host county to the Project, Sherburne County will be involved throughout the Project, for example by making licensing, permitting, and zoning decisions.[4] Sherburne County therefore is uniquely interested in an appropriately scoped EIS that fully assesses the potential environmental impacts from significant landfill expansion and in ensuring proper restrictions are applied. Importantly, the Minnesota Pollution Control Agency's ("MPCA") role in enforcing the legislature's waste hierarchy on the processing and landfilling of waste should also be studied as part of the project's EIS to determine if there are actions the MPCA and Waste Management should take, or may be required to take, to minimize the need for landfilling. Such actions could reduce the need for landfill permitted capacity, as well as elongate the time before the ERL will reach its permitted capacity, both as it exists now and with any expansion.[5]

Sherburne County's interest in an adequately scoped EIS is deepened because ERL has an existing contaminant plume that is difficult to monitor and remediate, raising serious questions as to the feasibility of monitoring both the existing plume and potential contaminant releases from

[3] DSDD at p. 3.
[4] *See* SEAW at p. 25 (listing Sherburne County's responsibility over various required permits).
[5] The MPCA projects that the ERL will reach its current permitted capacity in three years. Ex. 1, MPCA bulletin. Waste Management, the owner of the ERL, represents that the remaining permitted capacity is 15 million cubic yards. Ex. 2, Waste Management fact sheet.

the proposed Project. Further, Sherburne County is concerned that it may be the disproportionate recipient of metropolitan waste. While Sherburne County hosts ERL and the waste deposited there for all time, the County's own waste accounts for only 6.6% of the 434,414.88 tons of MSW landfilled at the existing landfill in 2024,[6] with over 62% of the waste hauled from Hennepin and Anoka Counties.[7] The County's small percentage of waste is especially important given that the MPCA has stated that without the expansion, "area businesses and residents won't have a local facility where they can send their waste," presumably because Metro Area counties' waste will fill it to capacity.[8] While Sherburne County is the host of the proposed site for tens of millions of cubic yards of mixed municipal solid waste, Sherburne County's own waste production would not require expansion of landfill capacity anywhere near the capacity proposed and may not require any expansion at all.

EXECUTIVE SUMMARY OF COUNTY COMMENTS

Based on its current analysis, Sherburne County comments that:

- the SEAW and DSDD fail to address the Minnesota Rules on siting of landfills, and in particular the existing challenges the Project Site and surrounding areas present to monitoring and remediation both an existing plume of contamination and any potential contaminant releases from the Project;
- the SEAW and DSDD should be amended to include an Alternative Site analysis for numerous reasons, including:
    - the hydrogeology and characteristics of surrounding areas are problematic for monitoring and cleanup in the event of a release;

[6] SEAW at pp. 6-7.
[7] SEAW at p. 13.
[8] Ex. 1, p. 3, MPCA bulletin.

- residents in areas near ERL have already been impacted by an existing plume of contamination, the scope and scale of which is not currently precisely defined, and they face serious consequences in the event of a future release that cannot be feasibly monitored and/or mitigated;
- wetlands and protected wild rice areas are at risk in the event of a future contaminant release; and
- other sites may exist that would not face these challenges and should be considered;

- the SEAW and DSDD should be amended to evaluate as an Alternative a modified, smaller scale/magnitude for numerous reasons, including:
  - the Project capacity as planned is based on various design decisions, such as slope height and liner construction, that appear not to comply with Minnesota Rules or Sherburne County ordinance and may require variances from MPCA and a Waiver from Sherburne County as permitting authorities that are not guaranteed to be granted;
  - the overall scale and magnitude of Project capacity is based on an approach for continued landfilling that is inconsistent with Minnesota's statutory hierarchy, which makes landfilling the least preferred method of solid waste management,
  - the overall scale and magnitude of Project capacity is inconsistent with MPCA's Solid Waste Management Policy Plan, which includes projections showing a precipitous drop in the need for landfilling capacity starting by no later than 2030;

- the SEAW and DSDD should be amended to consider additional alternative technologies for the processing of waste, including details on how the MPCA plans to meet the state's waste hierarchy, MPCA rules, and specifically action plans on waste processing; and
- the SEAW and DSDD rely upon various other questionable assumptions that must be addressed, corrected and remedied, as detailed herein.

I. The SEAW and DSDD fail to address Minnesota Rules mandating that the Project Site be located only in areas where environmental impact is minimized and where monitoring and corrective action are feasible.

The State of Minnesota has enacted a solid waste management hierarchy and the MPCA issued rules to manage to that hierarchy.[9] Per the rules set by the MPCA, the "waste management goal of the state" is to manage waste in a way that protects "the state's land, air, water, and other natural resources and the public health."[10] Ultimately, per MPCA rule, waste may be disposed in land "only after other feasible options have been evaluated or for environment protection."[11] The MPCA is the agency responsible for the cumulative impact of waste on the State's natural resources.

Despite the need for landfilling as part of the state's multifaceted approach to waste management, landfill location remains expressly limited. Per the MPCA, "landfills must be located only in an area where:"

- a landfill may be maintained to minimize environmental impacts;[12]
- ground water flow paths and the soil/bedrock are known so that "reliable tracking of pollution movement" is possible when pollution is released form the facility;[13]

[9] Minn. Stat. 115A.02(b).
[10] Minn. Rule 7035.0350 (referencing Minn. Stat. 115A.02).
[11] Minn. Rule 7035.0350.
[12] Minn. R. 7035.2815 subp. 2(A)(1).
[13] Minn. R. 7035.2815 subp. 2(A)(2).

- a reliable monitoring system is possible to detect and track pollutants in the event of a release from the facility;[14] and
- containment and corrective action of pollutants is possible to "prevent adverse impacts on water supplies and to return the facility to compliance with ground water and surface water quality standards."[15]

The existing ERL site has proven to be a difficult location for landfill operations. That site is home to a large, existing contamination plume that has emanated from the existing landfill operations, discussed in detail below. Sherburne County and its scientific consultants have been analyzing the available data related to that existing plume. The analysis shows there are documented gaps in data and difficulties in the ongoing ability to monitor movements of contaminants. Such monitoring is especially difficult due to surrounding marshlands, wetlands, and a protected wild rice lake. Unfortunately, the available data and scientific analysis are concerning as they are suggestive that the contaminants have moved and are moving in the direction of Rice Lake,[16] Minnesota Department of Natural Resources (DNR) Lake ID 71001500, a natural environment lake with physical geography rendering groundwater monitoring impracticable. The County's concerns are further exacerbated by recently obtained data raising scientifically significant questions regarding the effectiveness of the current plan for addressing the plume (monitored natural attenuation and well replacement) to address the existing health risks posed to nearby residents and other pollution, impairment and destruction of the environment.[17]

[14] Minn. R. 7035.2815 subp. 2(A)(3).
[15] Minn. R. 7035.2815 subp. 2(A)(4).
[16] Water ID 71001500. The SEAW incorrectly classifies Rice Lake as a wetland. SEAW at p. 27.
[17] Ex. 5 at p. 30, EOR's ELK RIVER LANDFILL: Review of Groundwater Contamination Issues for Sherburne County (hereinafter "EOR Report"), 10/13/25.

These concerns are particularly relevant here because, as the SEAW recognizes, potential future releases from the Project Site are expected to flow in similar ways to that of the existing facility. The SEAW states that the groundwater patterns for the proposed Project Site act "[s]imilarly to the existing Facility, [with] groundwater in the upper outwash (and surficial outwash) discharg[ing] to Rice Lake/Tibbits Brook to the west."[18] Evidence shows that discharges into these areas are difficult to monitor.

Without addressing the challenges posed by the physical geography of the areas surrounding the proposed Project Site, the SEAW states with minimal analysis or explanation that the "Site is monitorable with a high degree of confidence."[19] Likewise, the DSDD states that "an alternative site is unlikely to provide significant environmental benefits compared to the Project as proposed."[20] The fact that some monitoring infrastructure exists as a result of a contamination plume emanating from the ERL, which has historically polluted (and continues to pollute) nearby land beyond the footprint of the landfill, does not address whether the monitoring is appropriate or feasible should a release occur from the Project Site. Nor is it a basis for excluding consideration of available alternatives, as discussed further below.[21]

Both the monitorability of the Project Site and surrounding areas and the DSDD's conclusion that it is unlikely that other sites could be environmentally beneficial must be corrected and factually addressed. This likewise requires corrections to the scope of the EIS and the need to assess alternatives to the Project.

[18] SEAW at p. 31.
[19] SEAW at p. 32.
[20] DSDD at p. 7.
[21] SEAW at p. 32 ("Given that the distribution and hydraulic properties of the hydro stratigraphic units at the Site have been thoroughly characterized, and groundwater flow conditions match well with the physical flow setting.")

A. ERL has a contamination plume that is out of compliance with MPCA's own standards.

When waste is buried in land, a landfill is born and pollution created.[22] Unless appropriately managed, leachate (liquid created as organics decay in landfills) from landfills "can seep into groundwater."[23] When the leachate goes into wastewater treatment plants, it in part "ends up in surface waters due to lack of treatment technologies for many of the contaminants."[24] For obvious reasons, management is key.

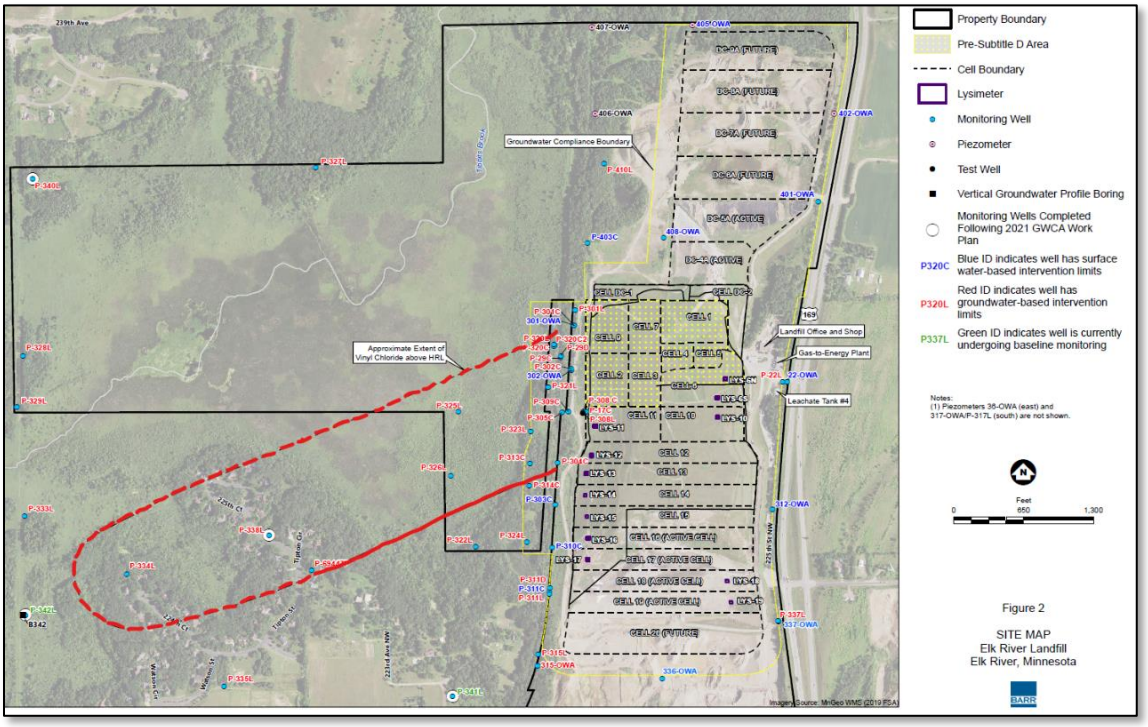
Due to the permanent nature of pollution once a landfill is sited, the law imposes strict requirements on landfill location. For example, the law mandates that no landfill exist in an area that cannot be easily tracked and monitored through a feasible monitoring system with enough monitoring points to detect pollutants. A landfill must also be located where, in the event of a contaminant release, corrective action may be taken to "prevent adverse impacts on water supplies."[25] If such monitoring and corrective action cannot be taken, by law a landfill cannot exist in that area.[26] Sherburne County is concerned that the existing contaminant plume has not been properly monitored or corrected/mitigated, meaning that any potential future releases will likewise experience the same problems.

The primary contaminant of concern in the existing ERL contamination plume is vinyl chloride, ("VC").[27] This plume has been confirmed by MPCA, Barr Engineering (consultant for Waste Management), and EOR (consultant for Sherburne County). The contaminant plume

[22] Ex. 3 at p. 44, Metropolitan Solid Waste Management Policy Plan for 2022-2042.
[23] *Id.*
[24] *Id.*
[25] Minn. R. 7035.2815 subp. 2(A)(4)
[26] Minn. R. 7035.2815 subp. 2(A) (land disposal facilities "*must* be located *only* in an area where" pollution can be easily tracked and monitored through a feasible monitoring system with enough monitoring points to detect pollutants and where corrective action may be taken to stop pollutants from reaching water supplies).
[27] Ex. 5 at p. 1 (Executive Summary), EOR Report.

currently stretches 4,700 feet to the west/south-west of the landfill—just south of Rice Lake and through multiple residential neighborhoods.[28]

Waste Management's environmental consultant, Barr Engineering, identified the plume contours as follows (highlighted in red below):



In addition to VC, the contaminant plume contains elevated levels of sulfates and other volatile organic compounds, including known carcinogens like trichloroethene ("TCE") and cis-1,2-dichloroethene (cDCE).[29] Over time, TCE and cDCE may break down in further concentrations of VC. In the 2024 Annual Water Quality Monitoring report, Table 7, Groundwater Concentrations Exceeding Groundwater-Based Intervention Limits, three

[28] Ex. 6 at 15, at Fig. E10, at Attachment H1, Groundwater Corrective Action Report-Initial Performance Evaluation, Elk River Landfill, Barr Engineering.

[29] *See also* various well results and figures: Ex. 5 at page 4, EOR Groundwater Contamination Report; Ex. 11 at page 9, Table 7, Groundwater Concentrations Exceeding Groundwater-Based Intervention Limits, 2024 Annual Water Quality Monitoring Report, Barr Engineering); Ex. 12 at page 3-5, Table 3, Groundwater Detections Exceeding Groundwater-based Intervention Limits, 2025 Spring Quarterly Report, Elk River Landfill, Barr Engineering.

compliance wells had TCE detections, P-304C, 323L, and P-326L, P-304C and P-326L had detections above the IL (0.1 µg/l) but below the HRL (0.4 µg/l).[30] P-323L had detections above the HRL both times that it was sampled that year, 0.927 µg/l and 0.740 µg/l. Similar to 2024, in 2025 P-304C and P-326L had detections above the IL but below the HRL.[31] In the 2024 Annual Water Quality Monitoring report, Table 7, Groundwater Concentrations Exceeding Groundwater-Based Intervention Limits, 1,2-Dichloroethane (cDCE)[32] compliance wells P-302C and P-323L above the IL, The detections were above the 0.25 µg/l intervention limit as listed in Sampling and Analysis Plan, Elk River Landfill, 2015, Appendix B, Reporting Limits and Groundwater Intervention Limits. Likewise, these two wells were above the IL for cDCE during the spring 2025 sampling event.[33] Recently, existing contaminants were identified, including Freon and PFAS. The identification of PFAS requires additional study.[34] Sherburne County's consultant's report is attached as Exhibit 5. From the results of the 2025 spring groundwater split sampling results, PFAS contaminants have been detected in wells located within the VC plume, and Freon 21 is evident in many monitoring wells.[35] At the County, we are not only concerned with VC, but other detections that are harmful to human and environmental health. As for any land matter, location is key. ERL is located next to a large wetland complex, a Natural Environment Lake (Rice Lake) which is a protected wild rice water, and Tibbits Brook. These land features and the geology of the area make the Project Site a poor location for a landfill. Admittedly, the ERL landfill already exists. Regardless, the fact that the existing location is a poor site for landfill,

[30] Ex. 11 at Table 7, 2024 Annual Water Quality Monitoring report.
[31] Ex. 12 at Table 3, 2025 Spring Quarterly Report, Elk River Landfill.
[32] Ex. 11 at Table 7, 2024 Annual Water Quality Monitoring report.
[33] Ex. 13, Eurofins Analytical Report, Prepared for EOR, Elk River Landfill-Split Sampling, Job Number 310-304430-1, 4/30/2025; and Ex. 5, EOR Report. Ex. 12, p. 3, 2025 Spring Quarterly Report, Elk River Landfill.
[34] Ex. 5 at p. 2, EOR Report; Ex. 12 at p. 2, 2025 Spring Quarterly Report, Elk River Landfill.
[35] Ex. 5 at p. 2, EOR Report; Ex. 12 at p. 2, Table 3, Groundwater Detections Exceeding Groundwater-based Intervention Limits, 2025 Spring Quarterly Report, Elk River Landfill.

due to existing and potential environmental impacts that are not under control or easily monitored in the event of a future contamination, is reason enough not to expand it. At the very least, the idea that the ERL is an easily monitored site and a site that allows for containment before adverse impacts on water supplies is scientifically incorrect and should be corrected in the SEAW and DSDD.

B. Monitoring and containment of the existing contamination plume have failed, meaning that potential future releases based on the same monitoring system would likewise likely fail.

MPCA's long-term plan to manage the existing ERL contamination plume through monitored natural attenuation (or MNA) and well replacement now appears unlikely to be protective of Sherburne County's nearby drinking water supplies.[36] Essentially, MNA watches and waits for the plume to reduce and dilute in concentration over time as it spreads out over a wider area. Sherburne County's consultant EOR recently tested the success of the MPCA's plan. MNA can be a proper approach, but here, three problems exist with the MPCA's use of MNA to monitor and contain the existing plume.[37]

First, although MNA is an acceptable plan for analyzing pollution plumes, the conditions at ERL do not fit one of the primary assumptions required for MNA.[38] To use MNA, the plume must be stable/not expanding. The ERL plume is not stable (or in steady state) because the higher concentrations of VC left ERL 35-45 years ago, cannot be validated by use of monitoring well P-342L since the plume is not predicted to have reached that well yet (so the MPCA's reliance on a non-detect at that well to assume stability is meaningless), and the contaminant mass was never measured.[39]

[36] Ex. 5 at pp. 27-30, EOR Report.
[37] Ex. 5 at pp. 1, 4, EOR Report.
[38] Ex. 5 at p. 11, EOR Report.
[39] Ex. 5 at p. 12, EOR Report.

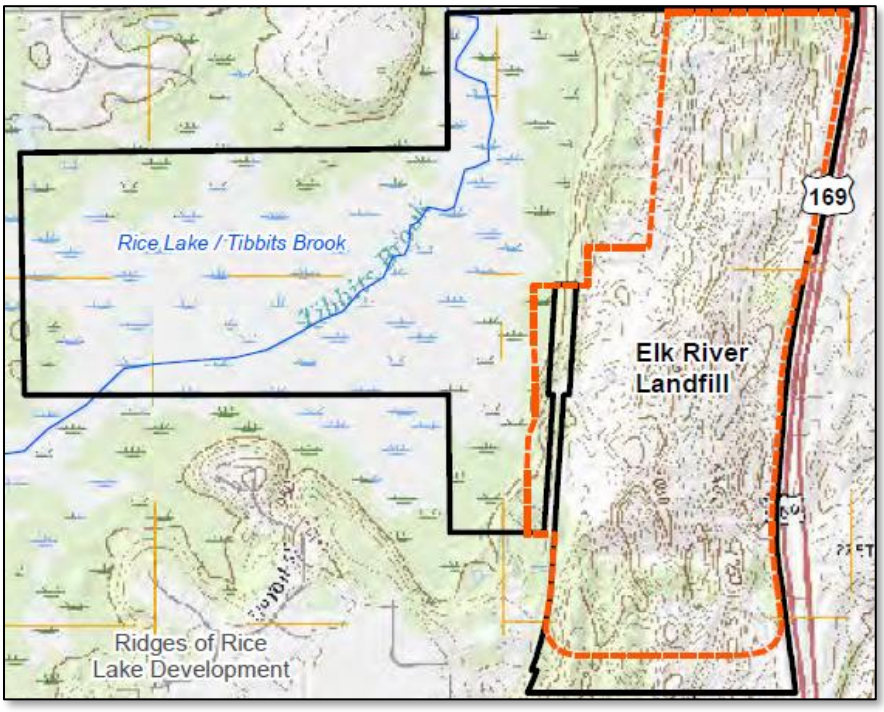
Second, certain scenarios were used to evaluate the plume's movement away from ERL. The evidence shows, however, that higher VC concentrations exist in the plume far downgradient from the compliance boundary (a boundary to ensure pollution does not migrate to a point that could be harmful to human health) near the landfill. In short, new analysis is needed for what is essentially a Human Health Risk Assessment to ensure that the plume is not harmful to residential wells.[40]

Third, bulk attenuation rates were measured using certain VC predictive results. Problems were found with those prediction values. Different results are calculated when the predictive values are substituted with recent VC values for mid plume wells and the appropriate well distances.[41] These new predictive values are magnitudes higher and raise concerns that VC concentrations will not be below acceptable health risk limits.[42]

The recent scientific analysis shows additional concerns. These include that (a) VC trends are increasing in certain downgradient wells, (b) most of the observed rate at ERL is due to a decrease in dilution (physical processes) with minimal degradation, (c) the groundwater flow indicates the southern side of the plume is most likely to impact private wells over time, but there is a lack or gap of monitoring wells in that area, and (d) likewise the northern side of the plume is not well delineated and there are no wells beyond the wells (P-325L and P-323L) having higher VC concentrations. Although more wells are needed to define and monitor the northern edge, the area is inaccessible for wells due to unstable conditions presented by Tibbits Brook and Rice Lake.[43] Overall, MNA is not a reliable solution to protect drinking water wells and water quality. Further, the physical geography surrounding both the existing ERL plume and the

[40] Ex. 5 at pp. 13-14, 19, EOR Report.
[41] Ex. 5 at p. 14, EOR Report.
[42] Ex. 5 at p. 14-19, EOR Report.
[43] Ex. 5 at pp. 20, 1-2, EOR Report.

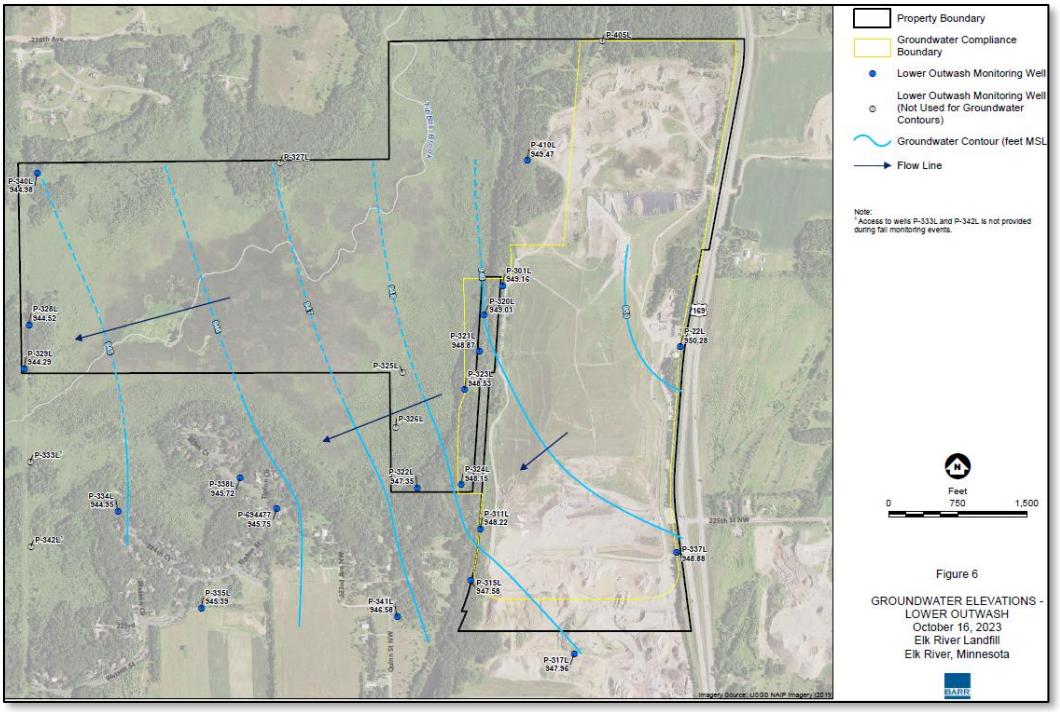
proposed Project Site render monitoring challenging. Specifically, immediately west of the proposed Project Site lies Rice Lake, Tibbits Brook, and a large wetland complex:



Groundwater flows west and southwest towards Tibbits Brook and Rice Lake. Groundwater flowing toward Tibbits Brook already has "sulfate levels in monitoring wells reaching up to 132 mg/L, suggesting a potential plume moving toward Rice Lake."[44] This is a problem because monitoring is difficult in the Rice Lake area, and "limited data exist on groundwater-surface water interactions" in that location.[45]

If the Project Site expands north of the existing ERL footprint (as proposed), any potential future contaminant releases are likely to flow in the same direction of the wetland complex, Rice Lake, and Tibbits Brook area, with groundwater in the area naturally flowing toward the south of Rice Lake in a westerly/south-westerly direction:

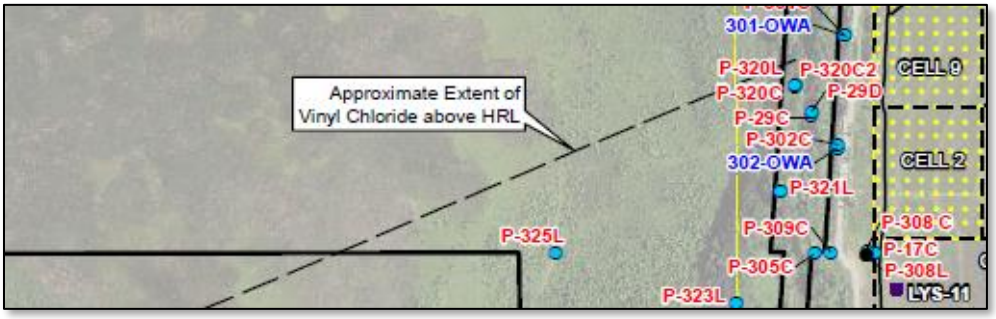
[44] Ex. 5 at p. 2, EOR Report.
[45] Ex. 5 at p. 2, EOR Report.



Contrary to Rule 7035.2815(A), the topography of Rice Lake and its geology preclude adequate monitoring systems or containment of any plume. The natural physical geography of Rice Lake and its marshy surroundings do not allow for placement of monitoring wells with ability to generate sufficiently detailed data to reliably monitor potential pollutant releases from any ERL expansion. At the very least, the feasibility of monitoring in these conditions needs to be assessed and explored in detail in an EIS, rather than monitoring being simply assumed to be feasible, as is stated currently in the SEAW.

The inability to confirm the northern extent of the plume is not new. When VC exceedances were discovered outside the compliance boundaries in 2007 and 2008, Waste Management was tasked with delineating the groundwater contamination boundaries. Waste Management suspended its investigation efforts into the Rice Lake/Tibbits Brook area, however,

citing safety concerns regarding access.[46] Again, this shows the existing ERL fails the location standards under Rule 7035.2815, and at the very least shows that careful study is needed in the EIS regarding these issues for any potential expansion.[47]



Given the mandates of Rule 7035.2815 and the scientific data Sherburne County recently obtained, the Project to expand ERL, which could potentially exacerbate environmental impacts, is premature if not outright in violation of the MPCA's Rules. Action is needed on developing an effective plume management plan to protect the citizens and drinking water wells of Sherburne County from future contamination, and these issues need to be studied in the forthcoming EIS beyond the information proposed in the SEAW and DSDD.

C. The consequences of releases are severe, impacting nearby residents and Rice Lake, which is a Natural Environment Lake and a protected water body for wild rice.

The consequences of the existing contamination plume may be serious and inform the need for thorough examination of alternatives in the upcoming EIS for the Project. The current ERL plume requires alternative groundwater sources to be provided to affected residents, including abandonment of existing residential water supply wells and replacement with deeper

[46] Ex. 14 at p. 9, Work Plan for 2014 Groundwater Monitoring Network Augmentation, Elk River Landfill, February 2014, Barr Engineering; Ex. 15, App. F, p. 15, Groundwater Corrective Action Evaluation Report, Elk River Landfill, June 2020, Monitoring Well Network Considerations and 2.2 Site Hydrogeology.
[47] Ex. 6 at Fig. 2, Groundwater Corrective Action Report-Initial Performance Evaluation, Elk River Landfill.

wells due to the contaminants.[48] It is unknown whether further remedial measures and associated costs will ultimately be necessary. In the Groundwater Corrective Action Evaluation Report,[49] options for corrective actions were considered to address the groundwater contamination plume, such as:

- Alternative #1, Monitored Natural Attenuation (MNA) and Residential Water Supply Replacement
- Alternative #2, Groundwater Extraction and Treatment with Focused MNA and Residential Water Supply Replacement
- Alternative #3, Pre-Subtitle D Landfill Excavation and Placement on Liner
- Alternative #4, Groundwater Extraction (on and off-site) and Treatment

Further, within the potential path of pollutants lies Rice Lake, which contains protected wild rice. "Wild rice is an important part of the biological community in many Minnesota lakes, streams, and wetlands. Wild rice is also a cultural resource to many, particularly members of Minnesota's Dakota and Ojibwe tribal nations, and it is an important economic resource to those who harvest and market it."[50] Wild rice is a sacred food to the Ojibwe and Dakota people. The EAW lacks any tribal engagement or mention of this connection that indigenous people have with the plant. Ojibwe migration stories began with prophecies telling them to go west to avoid the invaders from the sea, and to go where the food floats on water, wild rice. Ojibwe and Dakota people regard wild rice as a sacred being with a spirit and is a relative. As wild rice lakes were developed in post-glacial periods, indigenous people would have harvested rice from wild rice lakes since the glaciers receded, including Rice Lake. In Minnesota, land has been ceded and

[48] Ex. 6, at p. 6, Groundwater Corrective Action Report-Initial Performance Evaluation, Elk River Landfill.
[49] Ex. 15 at p. v, Executive Summary, Groundwater Corrective Action Evaluation Report, June 2020, Barr Engineering.
[50] Ex. 7, MPCA Bulletin on protecting wild rice waters.

reservations were created, with the aid of the Dawes Act of 1887. The land that is in present day Sherburne County was a part of two major land cessions, 1837 Dakota and 1837 Ojibwe (Indian Land Cessions in the United States, Royce, 1899). Rice Lake is in the area of the 1837 Dakota ceded territory. Private land ownership has changed access to Rice Lake and other wild rice lakes similar to it. Ojibwe and Dakota people no longer have access to harvest rice lakes as they did before being put on reservations. The letter from the MN SHPO is incomplete. There may not be structures located within the proposed expansion area, yet there may be archaeological evidence that cannot be recovered on the shores of Rice Lake. Further study is recommended such as wild rice phytolith extraction from lake sediments evidence or environmental DNA would be suggested methods for findings. Rice Lake was listed in the Natural Wild Rice in Minnesota study document submitted to the Minnesota Legislature by the Minnesota Department of Natural Resources, February 15, 2008, as a wild rice lake in Sherburne County.[51] The MPCA designated Rice Lake in Sherburne County as a protected wild rice water.[52] Rice Lake is also a Class 2B water under Minn. R. 7050.0140 and Minn. R. 7050.0222. These rules prohibit waste discharges and pollutants that would impair the quality of such waters and their aquatic biota, among other prohibitions.[53] To protect wild rice, which is found primarily in low-sulfate waters, the state of Minnesota and MPCA implemented water quality standards limiting sulfate to 10 mg/L in waters identified for "production of wild rice."[54]

Sulfate is a known groundwater contaminant produced from landfills. For example, according to historical EPA studies that evaluated and sampled groundwater near landfills,

[51] Ex. 16 at 78, Natural Wild Rice In Minnesota, a Wild Rice Study document submitted to the Minnesota Legislature by the Minnesota Department of Natural Resources, February 15, 2008.
[52] Ex. 8, MPCA Bulletin on wild rice.
[53] *See, e.g.,* Minn. R. 7050.0222 subp. 7.
[54] *See* Minn. R. 7050.0224.

"[g]roundwater samples from under and downgradient from landfill showed elevated levels of sulfate in every case."[55]

Within the groundwater monitoring network, there are detections of sulfate. With Rice Lake and Tibbits Brook abutting the landfill to the west of ERL, the concern for creating conditions non-conducive for wild rice production is a concern. The Work Plan for 2014 Groundwater Monitoring Network Augmentation, February 2014, pg. 9, states that there is upwelling occurring in the floating bog. It is well documented that shallow groundwater flows east to west, toward Rice Lake and Tibbits Brook. When shallow groundwater discharges into Rice Lake and Tibbits Brook, additional sulfate levels are possible. Sulfate contamination above the 10 mg/L violate the state limit for wild rice lakes.[56] Sulfate by itself is not toxic to wild rice, however, the reduction of sulfate to sulfide in the wild rice lake sediments is detrimental to the wild rice plant.[57] Accordingly, there is a present concern with ERL, and any expansion could exponentially make this concern worse. Robust study of contaminants in and around ERL is needed now, which is another reason why alternatives to the Project site should be mandated – contrary to the SEAW's dismissal of alternative siting.

Overall, Sherburne County requests that further analysis be required to show compliance at least with Minn. Stat. 115A.02, and MPCA Rules 7035.0300, 7035.0350, and 7035.2815, for the monitoring and containment of the existing plume and for potential future releases that could result from the Project.

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[55] Ex. 9 at p. iv, US EPA, *Chemical and Physical Effects of Municipal Landfills on Underlying Soils and Groundwater,* (May 1978).
[56] Minn. R. 7050.0224, subp. 2 (Class 4A waters).
[57] Ex. 17, Sulfide Generated by Sulfate Reduction is a Primary Controller of the Occurrence of Wild Rice (Zizania palustris) in Shallow Aquatic Ecosystems, Myrbo, et al., 2017; Ex. 7, MPCA Bulletin on protecting wild rice waters.

II. The DSDD and SEAW should be amended to consider analysis on Alternative Sites and other site-specific limitations.

The apparent foundational rationale for the proposed Project is that ERL is already a landfill so its potential capacity should be maximized. This reasoning overlooks that the rules for siting apply equally to landfill expansions as to the creation of a new landfill; to expand further into an unfit site simply compounds an error made long ago.

The DSDD states that MPCA will *not* consider any other location for a landfill beyond proposed maximum expansion, stating that "[a]n Alternative Site analysis will be excluded from the alternatives studied in the EIS."[58] The decision to exclude Alternative Sites from the EIS scope is erroneous, rests on incorrect assumptions, and overlooks key aspects of the topography near the Project Site that is likely to experience contamination in the event of a release.

A. Alternative Sites exist that do not share the pitfalls of the Project Site.

As shown above, the topography, geology, the existing plume, and monitoring challenges of the Project Site and surrounding areas should disqualify it as a location for landfilling, or increased landfilling, in the state. The DSDD nonetheless proposes not to consider any potential Alternative Site.[59] While the analysis in the DSDD on this point is minimal, it appears to rest on two premises, the first being the incorrect presumption that the Project Site is a well-suited location for a landfill (the County's response on location addressed above).

B. Per the MPCA's own projections, there is no urgent need to maximize landfills.

The second rationale appears to rely on a perceived need for increased landfilling within and beyond the next three years.[60]

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[58] DSDD at p. 6.
[59] DSDD at pp. 6-7.
[60] DSDD at p.7 ("Therefore, an alternative site is unlikely to provide significant environmental benefits compared to the Project as proposed. Additionally, the need for the expansion arises from the projected MSW capacity reached within the next three years; timing associated with relocation of the landfill to an alternative site would not meet the Project's purpose and need.")

The DSDD's apparent urgency to maximize the ERL expansion runs contrary to the MPCA's 2024 Metropolitan Solid Waste Management Policy Plan for 2022-2042.[61] The Plan documents a precipitous drop in the amount of waste to be landfilled, starting in 2030 (just one year after the Project would be set to start accepting waste) and persisting for more than a decade into the future. The MPCA's projections on the rebalancing away from landfills is illustrated in MPCA Figure 6 for Twin Cities Metro Area's ("TCMA") solid waste:

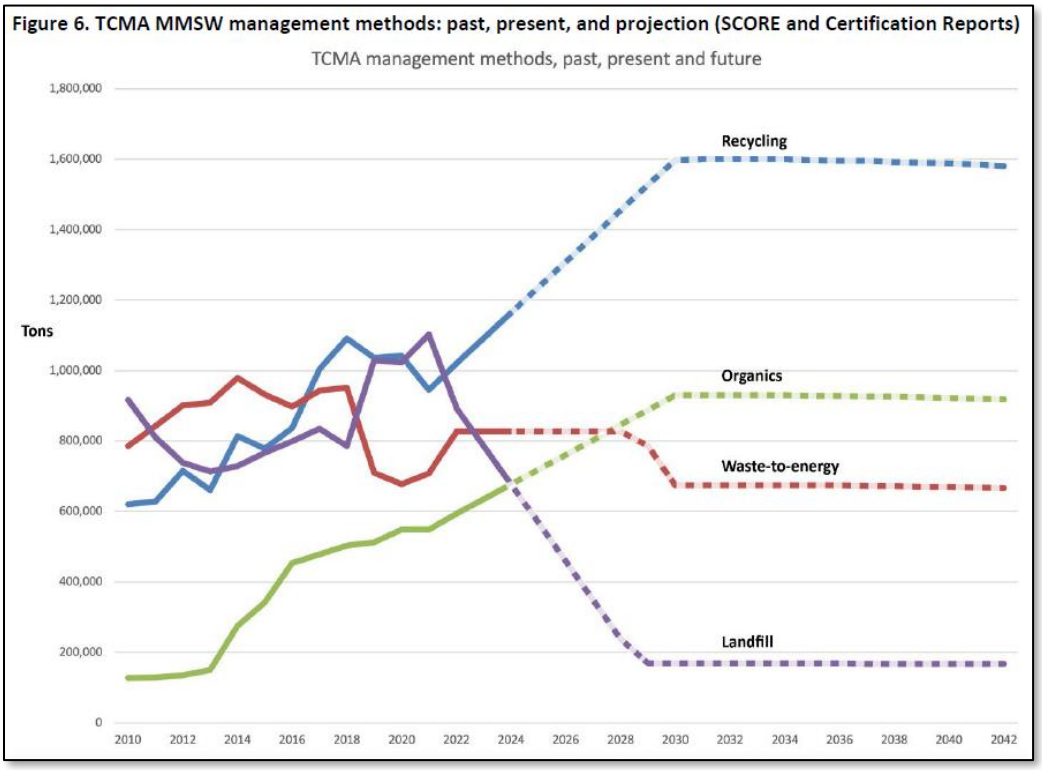


Figure 6 shows a precipitous drop in landfilling (from roughly 1.1 million tons in 2022 to 180,000 tons in 2030) when the ERL expansion is predicted to open. Presumably, the MPCA intends for its Plan, including Figure 6, to be accurate and relied upon by Sherburne County and all participants in Minnesota's waste management industry. Moreover, additional landfill space has been approved with an approximate 13 million cubic yard expansion at WM's Burnsville

[61] Ex. 3, p. 17, Figure 6, 2024 Metropolitan Solid Waste Management Policy Plan for 2022-2042.

Landfill, which extends its operational live through 2062, and approximately 8.2 million cubic yard expansion at Republic Services Pine Bend Landfill, extending its operational live through 2045. Given MPCA's approved landfill expansions elsewhere, the need for a massive, immediate expansion of ERL is questionable. As discussed below, the MPCA's prediction of more processing of waste and less landfilling is also critical to both the MPCA exercising its authority and to planning.

The SEAW and DSDD do not reference this anticipated drop in landfilling projected by the MPCA's Policy Plan. Instead, the SEAW projects landfilling to increase, relying on a small sample size of landfilling from a five-year window to project future increases for the next 60 years.[62] This is contrary to the MPCA's Policy Plan, which projects 2024 levels of over 600,000 tons of TCMA MMSW will drop to 200,000 tons in 2030, and remain at that lower level until at least 2042. Meanwhile the SEAW projects an annual 0.15% increase in landfilling to persist for over half a century; never accounting for the state's projection of a roughly 66% drop in landfilling from 2022 to 2030. As discussed below, this drop necessitates an alternative scale or magnitude analysis be conducted for a landfill capacity far below the massive size proposed by the Project. In addition, this anticipated decline in the percentage of TCMA MMSW to be landfilled undercuts the rationale given in the DSDD of an urgent need for greater capacity to justify the decision to exclude any assessment of an Alternative Site analysis.

III. The DSDD and SEAW should be amended to a modified, smaller scale or magnitude of the Project.

If the Project is to proceed at the Project Site, alternatives to maximum-permitted landfilling should be considered. These alternatives include (a) limitation to the term,

[62] SEAW at p. 9 ("The waste disposal rates from the five-year period between 2019 and 2023 indicate an average annual increase of 0.15 percent (%). If the annual increase continues at the same rate, the proposed MSW disposal area will be consumed in 2085.")

height/slope, liner construction and scale of the expansion, (b) the alternatives identified in the SEAW and DSDD, and (c) enforcing the legislative and MPCA existing mandate that before waste is landfilled it must be processed and that the MPCA must work to expand processing availability. The DSDD fails adequately to consider these options in reaching its conclusion that "the EIS will not consider modified scale or magnitude as an alternative separate from other alternatives being evaluated."[63] Sherburne County believes this decision in the draft DSDD should be reversed, and a smaller scale or magnitude of the Project should be included in the final scoping decision document, for the reasons stated below.

In stating that the EIS will not even consider the impacts of a smaller scale expansion, the primary justification given is that landfills should be "sized to reach optimal capacity."[64] But it is impossible to know whether capacity is "optimal" if the EIS does not study other possibilities and compare the relative benefits and drawbacks to a smaller sized project and then compare the sizing requirements to overall need. It appears the SEAW and DSDD equate "optimal" with "maximum," as supported by the Project's scale with 26.67 million cubic yards of additional MSW capacity beyond ERL's currently permitted 19.06 million cubic yards, a capacity which would not be consumed by the Project's estimates until 2085.[65] Applying the SEAW's assumptions, even a capacity of half that size – 13 million cubic yards – would last more than 30 years into the future, leaving ample opportunity for creation of additional capacity if and when it becomes needed. Of course, applying the MPCA's Policy Plan's assumptions about the amounts of TCMA MMSW to be landfilled from 2030 to 2042, 13 million cubic yards of capacity would last far, far longer than 30 years. Based on those MPCA Policy Plan's projections, there is reason

[63] DSDD at p. 7.
[64] DSDD at p. 7.
[65] SEAW at p. 7.

to believe that no such massive capacity needs will be necessary 60 years from now. Additionally, the scale of the Project as proposed does not comply with current Minnesota Rules and Sherburne County ordinances, providing an independent basis for considering an alternative scale or magnitude of the Project, as explained below.

A. The Project slope, grade, and proposed liners fail to comply with existing Minnesota Rules and local ordinances.

As currently proposed, the Project maximizes capacity to the fullest extent, seeking 26.67 million cubic yards of additional MSW capacity beyond ERL's currently permitted 19.06 million cubic yards, capacity which would not be consumed by the Project's estimates until 2085. A number of questionable design assumptions and decisions contribute to that size, including a proposed slope that exceeds current Minnesota Rules and Sherburne County's ordinance. Likewise, the project calls for use of a geosynthetic clay liner (GCL) in place of one-foot (1) of clay that presents significant risks to the environment and that may not comply with Sherburne County's ordinance; as such, a liner constructed out of a minimum of two-feet (2) of a soil barrier layer that would be compliant with best practices and County ordinance should be evaluated in the EIS (recognizing that use of a safer, thicker liner will lead to a modified scale or magnitude of the overall capacity).

1. <u>The proposed cover slopes exceed allowable limits.</u>

The capacity and parameters used by the Proposer exceed allowable limits under both the Minnesota Rules and Sherburne County's ordinance.

The SEAW mentions "[t]he Project's final cover includes slopes ranging from a maximum of 33% (3H:1V) on the stormwater diversion berm backslopes to a minimum of 3% on the top of the landfill."[66] Slopes of 33% exceed the applicable Minnesota Rule of a slope no

[66] SEAW at p. 11.

more than 25%.[67] The proposed final grade side slope of 33% also exceeds the applicable Section 7.2 of Sherburne County Solid Waste Management Ordinance No. 180, which provides that solid waste landfills shall not "exceed final contours of a minimum 2 percent and a maximum of 20 percent over the entire fill for solid waste landfills."

Failing to cite these standards, the SEAW cites to a "variance approved in the last solid waste permit issued in 2015 to increase the grade of the final cover slope to 33% using MPCA guidance on final cover slopes."[68] A grant of a 2015 variance is an insufficient basis to decline to even study alternatives for the Project.

First, the 2015 variance for the solid waste permit pertained to the then-existing ERL site, not any proposed expansion area. The Project is new, requiring a new permit. As the MCPA has recognized, the Project Site is distinct from the existing ERL site, the Project is a not a "connected" or "phased" action per Minnesota Rule 4410.3000, and there is a need for environmental review "based on the potential for new impacts associated with the Project."[69]

Second, the 2015 variance neither implies nor guarantees that any future variance will be granted. No ruling on a variance would be given until such time as it is applied for and considered by the applicable RGUs, including the County.

While Waste Management, and potentially the MPCA, may desire for the Project to exceed the slopes permitted by law, there is no basis to *exclude* all analysis on alternatives that fall within the law from the SEAW or DSDD, as the DSDD has proposed. At the very least, both the Rules compliant and variance scenarios should be studied so that Sherburne County may make an informed decision of the consequences associated with whether to grant a Waiver

[67] Rule 7035.2815, subp. 6 (C)(2) ("The final cover system must be graded to prevent surface water ponding and must have a minimum slope of two percent and a maximum slope of no greater than 25 percent.")
[68] SEAW at p. 11.
[69] SEAW at p. 7.

request, when and if one is made. Indeed, helping to inform RGUs in their permitting decisions is the very purpose of conducting an EIS.[70]

2. The proposed liner provides inadequate protection and may not comply with Minnesota's Rules and County Ordinance

Next, Minnesota Rules set forth various liner requirements for landfills.[71] Sherburne County's Solid Waste Ordinance incorporates those requirements and also sets forth additional liner system requirements.[72] The Project as designed indicates it may use either "[a] conventional composite liner, consisting of two feet of compacted clay overlain by 60-mil HDPE geomembrane, or [a] modified composite liner, consisting of one foot of compacted clay overlain by a doubled-sided non-woven GCL, overlain by 60-mil HDPE geomembrane."[73] Sherburne County questions whether either alternative is adequate to ensure compliance with Minnesota Rules, which require at a minimum "a barrier liner capable of containing leachate generated at the facility and surface water that has come in contact with waste."[74] To ensure compliance with the Rules and County Ordinance in this regard, Sherburne County believes that studying more than the two alternatives proposed in the SEAW the EIS is necessary. Specifically, given the characteristics of the Project, the less than suitable location, and the site's history of unmanaged contaminants, Sherburne County believes the EIS should also study a composite liner that exceeds standards set forth in Minn. Rules 7035.2815 of no less than three feet of compacted clay overlain by 60-mil HDPE geomembrane, which may be necessary to adequately contain leachate. A liner that exceeds current standards as set forth in Minnesota Rules may be

[70] DSDD at p. 3 ("EIS is for use by governmental units as a guide in considering permits or approvals for the Project and in identifying measures necessary to avoid or mitigate adverse environmental effects.")
[71] *See, e.g.*, Minn. R. 7035.2815 subp. 7.
[72] Sherburne County Solid Waste Management Ordinance, Section 7.6(K).
[73] SEAW at p. 36.
[74] Minn. R. 7035.2815 subp. 7(D)(2).

warranted given that the proposed location does not meet the locations set forth in Minn. Rules, 7035.2815, subp. 2, and Section 7.1 of the County's Solid Waste Management Ordinance.

B. The Project's scale, magnitude, and time frame should be limited, with smaller scale alternatives evaluated.

As stated, the projections in the SEAW and DSDD propose a Project that will last until 2085, with an additional assessment of whether more landfilling at the Project Site should proceed then.[75] The County believes that 60 years is too long to wait before conducting another environmental assessment. If the proposed Project was cut in half, the Project would have capacity for landfilling until roughly 2055. No compelling reason is given in the SEAW or DSDD for not at least *considering* a smaller scale project at this time, and none would be convincing given that, as discussed above, MCPA's projections call for a massive drop in waste landfilling over the relevant time period.

For informed decision-making regarding viable alternatives to proceed, the DSDD should consider a smaller scale project and compare that smaller scale expansion's relative strengths and weaknesses to the Project as designed.

IV. Landfilling is disfavored by state law, necessitating study of a smaller scale Project.

The State of Minnesota has a waste hierarchy that ranks landfilling as the least desirable way to manage waste. In accordance with that policy decision of the Legislature, the SEAW and DSDD should explore alternatives to direct landfilling of waste. This would require the MPCA to exercise the authority it already has and enforce its rules as written. The MPCA dedicating resources (or even exerting influence to do so and to guarantee a waste stream) to the

[75] SEAW at pp. 9; ("If the annual increase continues at the same rate, the proposed MSW disposal area will be consumed in 2085."); 13 ("it is understood that the Facility will eventually reach its permitted capacity, at which point any potential expansions or development will be evaluated based on need, regulatory requirements, and environmental review at that time.")

establishment of processing centers to comply with the waste hierarchy and redirecting unprocessed waste outside of ERL are necessary steps that should be considered in the forthcoming EIS. Sherburne County, along with the Tri-County Solid Waste Management Commission (a joint powers board consisting of Stearns, Benton, and Sherburne counties) is exploring options for managing solid waste and reducing overall dependance on indiscriminate landfilling. The Tri-County Solid Waste Management Commission is specifically looking at options regarding its current waste disposal agreement with Pope-Douglas Solid Waste Management which requires delivery of waste generated within the Tri-County service area to Pope-Douglas. This agreement is set to expire on December 31, 2031, and identifying methods to reduce overall landfilling is paramount to Sherburne County and Tri-County at this time.

A. To comply with the State's waste hierarchy mandate, the MPCA must change course and prioritize waste processing.

A brief history of waste management shows that before the 1960s, open or burning dumps were used for waste disposal. In the Great Depression and post-war era, people generated less waste and commonly scavenged dumps. In the late 1960s, there was a shift toward environmental awareness. The 1969 Minnesota Solid Waste Act authorized the MPCA to manage waste. In the 1980s, the Minnesota Waste Management Act (MN Stat. 115A) prioritized waste, creating a waste hierarchy (with landfilling of waste as the lowest priority), a landfill siting process, and SCORE (Select Committee on Recycling and the Environment) was passed to financially support implementation of the hierarchy, including processing facilities.[76]

[76] The Minnesota Legislature created a capital assistance program to develop waste processing facilities. Minn. Stat. § 115A.49(a). The program encourages development of "feasible and prudent alternatives to disposal." Minn. Stat. § 115A.49(b). MPCA runs the program. *See also, e.g.*, MN Stat. 115A.0716 subd. 1 (empowering the Commissioner to "make grants to any person for the purpose of researching, developing, and implementing projects or practices related to collection, processing, recycling, reuse, resource recovery, source reduction, and prevention of waste"); *id.* at subd. 2 (empowering the Commissioner to "make loans, or participate in loans, for capital costs or improvements related to any of the" same activities).

The State of Minnesota has environmental protection statutes mandating the "protect[ion of] the state's land, air, water and other natural resources," declaring it state policy to improve "waste management in the state" by adhering to certain objectives and a waste hierarchy. Those objectives include: (1) reduction of waste, (2) separation and recovery of materials from waste, (3) reduction on "indiscriminate dependence on disposal of waste," (4) coordination of waste among political subdivisions, and (5) "development and financial security of waste facilities."[77]. To meet these goals, the Legislature passed a waste hierarchy declaring the State's statutory preference for how waste is to be handled. The MPCA illustrates this hierarchy:[78]

Figure 2. Minnesota's solid waste management hierarchy of preferred methods



MPCA "is bound by statute to follow" this waste hierarchy.[79]

In the late 1980s, there was a boom of waste to energy processing centers, including Hennepin Energy Recovery Center (HERC) and Great River Energy (GRE). In the 1990s, recycling increased, awareness for groundwater protections at landfills became mainstream, and landfill growth became an established problem.[80]

[77] Minn. Stat. § 115A.02(a).
[78] Ex. 3 at p. 6, Fig. 2, Metropolitan Solid Waste Management Policy Plan for 2022-2042.
[79] Ex. 3 at p. 44, Metropolitan Solid Waste Management Policy Plan for 2022-2042.
[80] *See generally* Ex. 10, Chapter 1. Solid Waste Management.

A state law was enacted restricting disposal of waste so that the weight of the waste remaining after processing and to be disposed in a landfill is "not more than 35 percent of the weight before processing."[81] This waste processing mandate should have created a guaranteed waste stream for processing centers, like GRE, so that they could operate at maximum capacity, thus allowing for financial stability. Instead, the MPCA did not seek active enforcement of its waste rules, and GRE struggled to have enough waste to process. With GRE never operating at full processing capacity – despite no shortage of waste in need of processing – eventually GRE was forced to close as not economically viable. GRE offered to sell its facility for $1, but with no guaranteed waste stream for processing not even that offer allowed GRE to remain open.

Closure of GRE led to at least 250,000 tons of additional waste being landfilled instead of being processed as waste to energy.[82] With HERC's anticipated closure, an additional 365 tons of waste (roughly 45% of Hennepin County's waste) will be landfilled. To the County's knowledge, there is no identifiable plan to increase waste processing centers. The MPCA does not appear to be enforcing its rules as written, which require waste processing. Instead, the MPCA encourages landfill expansion as an alternative to processing of waste.

The MPCAs indifference for enforcement of the waste hierarchy is now being openly exploited. Despite decades of environmental awareness and waste management laws, the Restriction on Disposal law allows waste to be landfilled when no "resource recovery facility serving the metropolitan area is capable of processing the waste." MN Stat. 473.848, subd. 1. This loophole is used for waste to be directly landfilled – as a result – the MPCA seems intent to allow landfills to fill up at an alarming rate. The MPCA is the gatekeeper for waste to be

[81] Minn. Stat. § 473.848, subd. 5.
[82] MPCA admits GRE's closure "resulted in more than 250,000 tons of waste going to landfill," and "directly increased landfill expansions." Ex. 3 at p. 5, 2024 Metropolitan Solid Waste Management Policy Plan for 2022-2042.

landfilled,[83] with the State's mandate to process waste to 35% of its original waste before landfilling. The MPCA is armed with existing authority to fund processing centers to create a processing pipeline of waste. Yet, the MPCA's decades-long failure to follow the waste hierarchy and enforce its own rules is responsible for closure of GRE's waste processing center and the failure of new ones to open. Failing to consider alternatives of additional waste processing in EIS such as for the Project is another step in the wrong direction of not following the waste hierarchy.

This is not waste management; it is a failure of the system. When failures are recognized, solutions emerge. Before the ERL is expanded, there should be a requirement for front end processing of waste to remove recyclables and source separated compostable materials. This will be a new beginning to achieving the state's mandate of landfilling as the last resort.

B. Landfilling pollutes.

By definition, landfilling waste pollutes the State's natural resources.

With the anticipated closure of HERC, landfilling will likely skyrocket unless alternatives to landfilling are required.[84] For example, in recent years the waste received at ERL from Hennepin County has increased significantly, with over 131,000 tons being attributed to Hennepin County in 2024 alone[85]—utilizing more and more cubic air space on an expedited timeframe to fulfill just one TCMA county's needs.[86] An estimated 93% of all metropolitan

[83] The MPCA is the only statewide regulatory body with authority to manage waste processing and disposal and is empowered to implement the State's waste policy. *See* e.g., Minn. Stat. § 115A.02; § 115A.06; § 473.801-473.834; Minn. R. Chapter 7035.

[84] In 2021, approximately 1,102,177 tons of waste generated in the metropolitan area was deposited into landfills, "with 93% of total waste headed to landfill classified as unprocessed MMSW." Ex. 3 at p. 59, Metropolitan Solid Waste Management Policy Plan for 2022-2042. The waste was considered "unprocessed" due to lack of processing availability – making this a negative spiral.

[85] SEAW at p. 6.

[86] The MPCA's goal and legislative directive is to reduce "waste generated and recycling/composting by 75% of our solid waste by 2030." Ex. 3 at p. 9, Metropolitan Solid Waste Management Policy Plan for 2022-2042. In 2021 the metropolitan area generated 3.3 million tons of waste, and the MPCA forecasts this will "grow to 3.92 million tons by 2042." *Id.* at p. 10.

waste[87] being landfilled is unprocessed – meaning this waste goes from home garbage cans to a landfill.

MPCA's public projections show significantly less need for landfilling, which if true, show no need to expand ERL especially when other TCMA landfill(s) have newly approved landfill expansions. As shown in Figure 6 above on waste projections, MPCA projects landfilling need to drop significantly, waste-to-energy to drop slightly, and recycling waste and organics (by homeowners) increasing dramatically.

MPCA has resources (financial and legislative) to achieve these reductions. If this happens, partnership opportunities between government and private entities could emerge.

C. Alternative technologies to landfill expansion, such as increasing processing capacity, should be investigated and evaluated in the forthcoming EIS.

As the sole entity with cumulative authority over management of waste processing and disposal, the MPCA is mandated to improve waste management in the State by ensuring separation and recovery of materials and energy from waste[88] and by ensuring reduction in indiscriminate dependence on disposal of waste.[89] When MPCA makes clear that it will enforce its own rules requiring waste to be processed and sorted before landfilling, opportunities will arise.[90]

[87] In 2021 "93% of total waste headed to landfill classified as unprocessed MMSW." Ex. 3 at p. 59, Metropolitan Solid Waste Management Policy Plan for 2022-2042.
[88] Minn. Stat. § 115A.02(a)(2).
[89] Minn. Stat. § 115A.02(a)(3).
[90] Minnesota has a capital assistance program for waste processing facilities – yet it appears it is not being leveraged. Minn. Stat. § 115A.49(a) ("There is established a program to encourage and assist cities, counties, solid waste management districts, and sanitary districts in the development and implementation of solid waste management projects and to transfer the knowledge and experience gained from such projects to other communities in the state."). This "program must be administered to encourage local communities to develop feasible and prudent alternatives to disposal," including not only the reduction of waste generation, but also "resource recovery," "waste separation by generators, collectors, and other persons," and "waste processing." Minn. Stat. § 115A.49(b).

Feasible alternatives range from simple processing solutions (from encouraging residents to raise chickens to eat food waste, to manually sorting waste, encourage and support source separated organics composting facilities, or use of automated technology to process waste) to large private/public agreements (including potentially with Sherburne County) to fund new processing centers. Of course, until local processing centers are feasible, the MPCA could require waste to be processed outside of the County.

As currently constructed the DSDD states that the "EIS will evaluate several Alternative Technologies that may reduce the volume of waste placed in the landfill."[91] A focus on the reduction of waste placed in landfills is proper, but in a number of instances, such as for "composting" and "source-separate materials," the DSDD states it will review these technologies to "extend the landfill's life."[92] But rather than assuming any processing of waste merely enables a longer lifetime for massive landfilling capacity, the DSDD should be amended to consider the effects of these alternative technologies in their ability to reduce the permitted and necessary capacity – that is, to make the Project smaller. Even if these alternative technologies will not fully "replace the land disposal capacity proposed for the project,"[93] potential processing capacity which may become available should be considered to the extent it can reduce the need for landfilling and therefore affect the scale or magnitude of the expansion capacity.

Further, the DSDD appears to assume that processing capacity will remain stagnant over the next 60+ years of the project. As one example, the DSDD states that the "EIS will not evaluate incineration because the system-wide incineration capacity does not currently exist to

[91] DSDD at p. 7.
[92] DSDD at p. 7.
[93] DSDD at p. 7.

replace the land disposal capacity proposed for the project."[94] This reasoning is flawed and does not justify refusing to consider alternative technologies in the EIS.

The lack of present-day processing capacity (whether for waste to energy or another type of processing) does not mean that processing capacity will not become available in time, throughout the 60+ year proposed life of the Project. On the contrary, given the state's hierarchy and MPCA's mandate to ensure that cumulative landfilling across the state is minimized, the MPCA should be considering the impacts of proactive steps to increase processing capacity, whether those be: the MPCA providing funding and financial support to increase the amount of processing capacity; exploring public/private partnerships for processing, guaranteeing waste streams to entities interested in processing waste (such as the now-closed GRE plant), or other means. Those methods and more should be considered in the forthcoming EIS as alternative technologies, which may reduce the necessary landfilling capacity and allow for a smaller scale expansion in the Project.

V. The SEAW includes various mistakes as to County groundwater behavior, landfill design, leachate collection system, stormwater management, and other topics.

The County attaches as an Appendix hereto a spreadsheet with detailed observations on various page-by-page comments to the SEAW and DSDD, categorized by topics such as Location Criteria, Groundwater and Monitoring, Leachate Management, Design. Comments raised therein include but are not limited to include the following:

- Project Description:
    - Use of GCL poses various construction and operational challenges and concerns such as potential for differential settlement, slippage and slope

[94] DSDD at p. 7.

failures, punctures from underlying waste materials, and possible impacts to groundwater.

  - Upper end value of 68,000 gallons per day of leachate generated equates to 90 percent of the permitted capacity of both the MCES treatment plant and the city of Elk River wastewater treatment plant. Contingency plans need to be developed if leachate generation exceeds anticipated volumes and/or MCES or city of Elk River no longer accept leachate.
  - Minn. R. 7035.2815, subp.6(C)(2) provides that final cover slopes shall not exceed 25 percent. Section 7.2 of Sherburne County SWO also provides that final contours do not exceed 20 percent slope.

- Geology:
  - Further documentation is needed to demonstrate how a possible release of contaminants will remain in the upper outwash aquifer, when the lower outwash aquifer is already impacted.
  - Further documentation is needed to demonstrate the ability to provide for downgradient monitoring and mitigation in the event of a release of contaminants from the landfill.
- Groundwater:
  - Page 42 of the Scoping EAW states: *"The downgradient-most extent of the groundwater detections has been defined (i.e., a clean downgradient well exists) and natural attenuation is occurring."* Explain how it was determined that "a clean downgradient well" indicates that natural

attenuation is occurring, when instead the plume just hasn't reached that monitoring point.

- Groundwater monitoring needs to account for PFAS.
- Lower Outwash needs to be included in the narrative.
- Further information is needed to demonstrate placement of downgradient monitoring wells in the wetland complex and Rice Lake. Also demonstrate how mitigation/corrective action could occur in the event that contamination occurs beyond the compliance boundary.

- Additional concerns were identified in review of the SEAW such as, Noise, Transportation, Landfill Gas Emissions, and Visual, of which information is missing and need further study.

A number of the topics commented upon in this comment letter and its Appendix touch on the EIS Scoping Criteria categories for which the SEAW and DSDD rank topics as A, B, or C.[95] Those topics include Geology, Soils and Topography/Landforms, Water Resources, Contamination/Hazardous Materials/Wastes, Visual, and Transportation. [96] Sherburne County notes that the EQB recommends using criteria designated as A-D, with "D" being "the topic is significant and information beyond what was in the EAW will be included in the EIS."[97] Based on Sherburne County's comments throughout this comment letter and the attached Appendix, Sherburne County believes that the "D" category is appropriate, with additional information needed beyond that in the SEAW, for at least the topics of:

- Geology, Soils and Topography/Landforms

[95] DSDD at p. 8.
[96] DSDD at p. 8.
[97] 2010 EQB Guide to Minnesota Environmental Review Rules p. 25.

- Water Resources
- Contamination/Hazardous Materials/Wastes

And a "C" category is appropriate for:

- Visual
- Transportation
- Cover Types

The County agrees with the remaining EIS scoping criteria as listed in Table 4.

Further, the SEAW has various mistakes impacting wetlands, land use, required permits, and zoning. For example, on page 24 of the SEAW, 2.24 acres of wetland are listed as being eliminated by the Project. SEAW Figure 17, however, lists 2.494 acres of wetland removal areas. Clarification is needed. This mistake is repeated throughout. *See* Table 8.1, page 30 at 12(a), page 40, 12(b)(4), page 63, 21(c).

SEAW page 25-26, Table 9-1 lists an amendment as needed to the Wetland Conservation Permit Act. That previously issued permit, however, was for a mining operation to a different company. Now a landfill is proposed, and the impacts have changed for this new Project. A new Wetland Conservation Act Permit/Replacement Plan is required.

SEAW, page 26-27, at 10.a3 states: "Sherburne County classifies Rice Lake as a Natural Environment" lake in Section 14 of its zoning ordinance. Industrial development is not prohibited in a shoreland district of a Natural Environment Lake." This statement is false. The chart for Sherburne County Zoning Ordinance, Section 14 – Shoreland District – 4.23 Land Uses for Lake Classification has an N, which stands for "Not Permitted Uses" for the industrial Land Use under a Natural Environment Lake.

SEAW page 27 at 10.b shows that although the Sherburne County 2040 Comprehensive Plan's Future Land Use Map (Figure 13) shows Heavy Industrial, the proposed areas of expansion are not zoned Heavy Industrial. A landfill must be located in a Heavy Industrial Zone; therefore, the project proposer will need to request to have applicable parcels rezoned. In addition, a Conditional Use Permit is needed to be applied for and approved for a landfill to expand to the north.

SEAW page 27 at 10.c, references "Rice Lake wetland complex." Rice Lake is a Natural Environment Lake and should be listed as such.

Additional concerns are raised in the attached spreadsheet, *see* Appendix.

C. Protective limitations are needed given the risk to healthy drinking water and the environment

The SEAW and DSDD should be limited to require certain protections to the environment given the documented difficulty to monitor and control the existing ERL pollution plume. These include the following:

- Installing more monitoring wells on the north and south side of the plume to provide for sufficient downgradient monitoring to assure that pollutants can be detected and tracked in the event of a contaminant release, as would be detailed typically in a plan for consideration and approval by the County.
- To help in containing any potential contaminant release, sufficient setbacks should be required to allow for downgradient monitoring points.
- The liner and leachate collection system should be required to be engineered and constructed to provide for containment, using the best-known technology.[98] This could

[98] The best-known technology changes over time. This is another reason not to permit the entire ground now for a 60 year term, and instead permit a much smaller area. This ensures that in 30 years the then state-of-the-art system will be used for any needed future landfill.

include a double lined system or an additional foot of clay that provides for, at minimum, three (3) feet of a soil barrier layer that meets the requirements set forth in Section 7.7 (C) of the County's Solid Waste Management Ordinance. .

- As explained in detail above, front end processing of waste should be required to remove recyclables and source separated compostable materials prior to landfilling. This is consistent with the state's mandate to reduce overall landfilling and increase processing.

Dated: November ____, 2025

SHERBURNE COUNTY

/s/ Gary H Gray

Digitally signed by Gary H Gray
Date: 2025.11.25 14:36:55 -06'00'

Gary Grey

Chair, Sherburne County Board of Commissioners

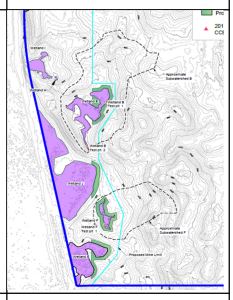
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Number	Area of Concern	EAW Section	Page	Reasoning for Comment	Comment	Relevant Links & References
1	Facility specific information	Notice of Availability on Scoping Environmental Assessment Worksheet (SEAW)	1	Ralph Collins email is wrong, should be rcollin4@wm.com, not "rcollins4@wm".	Need correct contact information for Facility contact.	
2		Notice of Availability on Scoping Environmental Assessment Worksheet (SEAW) and Draft Scoping Decision Document (DSDD)	2	NDA	Explain acronym.	
3		5. Project location	2	Typos on PIDs 30-00024-2200 and 30-00024-2201. Last PID listed in the group, should be omitted (30-00523-011)? It's missing the last digit.	Need correct PIDs for Project location.	
4		6.a. Project description	5	NDA	Explain acronym.	
5	Landfill Design	6.b. Project Description	5	Differential settlement of the "piggyback" new landfill over the existing landfill is not adequately addressed by the Proposer	What is not explained and not discussed is the rationale for use of an alternative geomembrane material (linear low-density polyethylene, LLDPE, textured) proposed for the new landfill liner system, although the material selection suggests accommodation of expected settlement, differential settlement and low shear strength conditions.	
6	Wetlands	6 b. Wetlands	8	Wetlands	Last sentence is incorrect. Only 0.25 ac. of wetland impacts were impacted for mining.	
7	Groundwater	6.b. Project Description	9	Groundwater pond created during mining requiring 33 million gallons of water per year.	Cite DNR permit # to allow this activity.	
8	Differential Settlement of "Piggyback" Landfill	6.b. Project Description	9	No evaluation of existing landfill conditions (waste age, composition, moisture, compaction) that influence settlement.	Lack/limited of discussion on operational controls (void prevention, hard spot mitigation) to prevent liner puncture. It is important to conduct geotechnical study of existing waste stability under new loading or clearly explain the findings.	https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-258
9	Landfill Design	6.b. Project Description	9	Differential settlement of the "piggyback" new landfill over the existing landfill is not adequately addressed by the Proposer	There is no discussion of the existing landfill settlement especially considering the previously placed waste age, composition, moisture, compaction, conditions of placement.	
10	Landfill Design	6.b. Project Description	9	The effect of the proposed landfill weight loading on the existing landfill under the piggyback configuration has not been considered and described.	Specific effects potentially detrimental to the existing landfill integrity include settlement and differential settlement effects on liner systems, closure cap systems, leachate collection systems, and landfill gas management systems, groundwater monitoring systems, and leak detection.	
11	Wetlands	6 b. Project Design	9	Project design and Wetlands	Figure 6 is referenced. Pre-project grading. The pre-project grading footprint is not approved from a wetland standpoint.	
12	Waste Disposal Rate	6.b. Project Description	9	The waste disposal rates from the five-year period between 2019 to 2023 indicate an average annual increase of 0.15%. If the annual increase continues at the same rate, the NDA will be consumed in the year 2085.	With the Minneapolis HERC potentially closing, the solid waste that originally went to this facility will need a new location to go to including Elk River. This may shorten the timeframe for when the NDA is consumed.	
13	Liner/Cap Design	6.b. Project Description	10	Soil properties	No properties for soils that will be used for liners or caps are provided.	7035.2815 Subpart 8 and Ordinance 180 Section 7.6.K.1
14	Base Liner Design	6.b. Project Description	9-10	Issue with proposed layer in the liner system.	GCL is know for low frictional strength of the both the internal and interface shear planes. No consideration is made of the potential for slope failure due to low interface or layer strength; neither evaluation nor protective configuration are provided.	
15	Base Liner Design	6.b. Project Description	10	Geosynthetic Clay Liner (GCL) OR 2 FT clay liner, HDPE, drainage layer, geotextile	Liner design must comply with Sherburne County Solid Waste Ordinance 7.6 Additional Requirements for Sanitary Landfills.	See Sherburne County SWO 180 Section 7.6 Additional Requirments for Sanitary Landfills
16	Base Liner Design	6.b. Project Description	10	33% (3H:1V) slope	M.R. 7035.2815, Subp.6 (C) (2) provides that final cover slopes shall not exceed 25 percent. Section 7.2 of Sherburne County SWO also provides that final contours do not exceed 20 percent slope.	See Sherburne County SWO 180 Section 7.2 Final Elevations
17	Landfill Design	6.b. Project Description	10	Differential settlement of the "piggyback" new landfill over the existing landfill is not adequately addressed by the Proposer	No discussion is made of protections necessary to accommodate the lesser chemical resistance offered by the use of the alternative geomembrane material LLDPE while still meeting the chemical resistance properties of the material (high density polyethylene, HDPE) that is the standard established by the Code of Federal Regulations 40 CFR 258.40 for Municipal Solid Waste (MSW) landfill liner systems.	
18	Landfill Design	6.b. Project Description	10	Differential settlement of the "piggyback" new landfill over the existing landfill is not adequately addressed by the Proposer	No discussion is made of how the geosynthetic clay liner (GCL) liner layer, proposed for use in the liner system over previously placed waste, will accommodate potential slippage and gapping likely when confronted with differential settlement from previously placed waste under the proposed new landfill liner system.	
19	Liner Design	6.b. Project Description	10	Permit Modification Drawings, North Development Area MSW Expansion, pg. 18, 22, Coarse Aggregate Layer. An alternative liner is shown as an option on Figure 1A/18	No documentation supporting the proposed alternative liner is provided. County SWO Section sets for standards for liner systems.	7035.2815 Subpart 7.K. And, County Ordinance 180 Section 7.6 K. And Permit Modification Drawings, North Development Area MSW Expansion, pg. 18, 22, Coarse Aggregate Layer.

Number	Area of Concern	EAW Section	Page	Reasoning for Comment	Comment	Relevant Links & References
20	Landfill Design	6.b. Project Description	10-11	Differential settlement of the "piggyback" new landfill over the existing landfill is not adequately addressed by the Proposer	There is no discussion of operational aspects used during construction and filling of the existing landfill particularly addressing: void prevention; inspection and removal of materials that could create points of high stress leading to new landfill liner puncture; and "hard spot" creation such as from stacked haul road sequences.	
21	Landfill Design	6.b. Project Description	10-11	Differential settlement of the "piggyback" new landfill over the existing landfill is not adequately addressed by the Proposer	There is no discussion of and protection against potential differential settlement and angular distortion amounts deriving from potential settlement of previously placed waste under the proposed new landfill liner system.	
22	Landfill Design	6.b. Project Description	10-11	Differential settlement of the "piggyback" new landfill over the existing landfill is not adequately addressed by the Proposer	There is no discussion of the ability of new landfill liner system to withstand elongation and bridging over newly-created unsupported areas related to potential differential settlement amounts, and of the necessary resilience and strength held in reserve (factor of safety) for additional, compounding stresses related to potential unanticipated conditions associated with future (proposed) waste placement operations, as even a material with high elongation characteristic will snap, tear or separate if elongated over too short a distance.	
23	Landfill Design	6.b. Project Description	10-11	Differential settlement of the "piggyback" new landfill over the existing landfill is not adequately addressed by the Proposer	No discussion is made of how the composite of the LLDPE geomembrane and the geosynthetic clay liner (GCL) liner layer, proposed as the liner system over previously placed waste, will accommodate potential slippage and gapping likely when confronted with differential settlement from previously placed waste under the proposed new landfill liner system, in particular addressing the differing strain responses and how the composite liner protection will be maintained.	
24	Landfill Design	6.b. Project Description	10-11	The well-established occurrence of embankment foundation settlement of the new landfill under the loading associated with the filled condition is not addressed by Proposer.	The differential settlement likely to occur from an unloaded edge or exterior corner to heavily loaded locations such as under the top of proposed landfill waste and cap slope. In particular, the effect of this foundational differential settlement on the leak collection system (LCS) piping and the cell bottom drainage.	
25	Landfill Design	6.b. Project Description	10-11	Issue with proposed layer in the liner system.	The buffer soil layer (12 inches thick) and the granular drainage material (12 inches thick) above the slope liner and the base liner, respectively are very thin for liner protection from MSW. There seems to be insufficient protection from puncture possible due to landfill compaction of waste material potentially containing, glass, metal or even wood objects. No description is made of how the liner systems will be protected from puncture either by operational approaches (e.g., 6 feet minimum verified thickness prior to tracking with cleated compactor) or by layer specification (e.g., first lift above buffer soil layer or granular drainage material will be a controlled, small size fill such as wood chips or tire chips, 6 feet minimum verified depth).	
26	Final Cover Design	6.b. Project Description	11	33% (3H:1V) slope	M.R. 7035.2815, Subp.6 (C) (2) provides that final cover slopes shall not exceed 25 percent. Section 7.2 of Sherburne County SWO also provides that final contours do not exceed 20 percent slope.	See Sherburne County SWO 180, Section 7.2 Final Elevations
27	Landfill Design	6.b. Project Description	11	The leachate collection, transportation, treatment and disposal plan has omitted consideration of the expansion schedule, particularly aspects of open, covered or intermediately closed volumes of placed waste. Leachate is currently reported as 15 – 25 million gallons per year; the upper end value corresponds to 68,000 gallons per day, or about 17 fully loaded semi-truck tank trailer loads, not accounting for weekends likely to not have hauling operations or high precipitation events.	The upper end value of 68,000 gallons per day equates to 90% of the permitted discharge capacity employing both the MCES treatment plant and the City of Elk River sanitary sewer system. Increased landfill area, whether open, covered, intermediately closed or permanently closed will increase the generation amount. Permittee has not described how increased generation will be accepted for discharge at likely flows greater than permitted discharge capacity when the new landfill is opened.	M.R. 7035.2815, Subp.9. And, M.R. 7035.2815, Subp. 15
28	Landfill Design	6.b. Project Description	11	The leachate collection, transportation, treatment and disposal plan has omitted consideration of the expansion schedule, particularly aspects of open, covered or intermediately closed volumes of placed waste. Leachate is currently reported as 15 – 25 million gallons per year; the upper end value corresponds to 68,000 gallons per day, or about 17 fully loaded semi-truck tank trailer loads, not accounting for weekends likely to not have hauling operations or high precipitation events.	Permittee has not described how landfill operations likely being done on a 5-workday week could support leachate generation on a 7 calendar day week, given that the upper end discharge levels correspond to 90% of permitted capacity, i.e., how 7 days of leachate generated do not exceed a single day's limit when discharged on a 5-day basis (140% of average flow – 95,200 gallons per day – discharged each day over five days to discharge seven days of average flow generated).	M.R. 7035.2815, Subp.9. And, M.R. 7035.2815, Subp. 15
29	Landfill Design	6.b. Project Description	11	The leachate collection, transportation, treatment and disposal plan has omitted consideration of the expansion schedule, particularly aspects of open, covered or intermediately closed volumes of placed waste. Leachate is currently reported as 15 – 25 million gallons per year; the upper end value corresponds to 68,000 gallons per day, or about 17 fully loaded semi-truck tank trailer loads, not accounting for weekends likely to not have hauling operations or high precipitation events.	When the new landfill opens, the amount of leachate generated and the number of tank trailer trips will likely increase as the landfill area increases. Tank trailer operations are notoriously sensitive to weather events and can also be significantly impacted by traffic blockages or detours. Given the risk of tank trailer operational disruption and the near capacity level of permitted leachate discharge currently experienced by the existing landfill operations, description is needed of contingency operations to ensure leachate discharge is done without disruption or permit exceedance. Leachate storage is not proposed for expansion. Leachate disposal to an extended force main to the Elk River sanitary sewer system does not carry an increase in permitted discharge that could alleviate some conditions.	M.R. 7035.2815, Subp.9. And, M.R. 7035.2815, Subp. 15
30	Liner Design	6.b. Project Description	11	Leachate collection efficiency not addressed	No documentation discussing the leachate collection efficiency of either of the proposed liner designs is provided.	7035.2815 Subpart 7.J

Number	Area of Concern	EAW Section	Page	Reasoning for Comment	Comment	Relevant Links & References
31	Landfill Design	6.b. Project Description	N/A	Limited discussion on system integrity.	No discussion has been made of the effects of the proposed landfill waste decomposition and associated settlement and differential settlement on closure system integrity, particularly related to cover system protection and continuance of above cover system and within cover system drainage. No evaluation has been made and described of necessary operational controls such as prevention of overlapping haul roads that may create settlement-resistant hard spots next to zones of high waste settlement.	
32	Landfill Design	6.b. Project Description	N/A	The well-established occurrence of embankment foundation settlement of the new landfill under the loading associated with the filled condition is not addressed by Proposer.	The maximum amount of settlement is not evaluated nor considered in relation to the existing groundwater level and reduction of separation that will occur under loading by newly placed waste.	
33	Landfill Design	6.b. Project Description	N/A	The well-established occurrence of embankment foundation settlement of the new landfill under the loading associated with the filled condition is not addressed by Proposer.	The potential for cell drainage direction reversal due to the foundational differential settlement.	
34	Leachate Collection	6.b. Project Description	11	Leachate Generation	Contingency plan for increased leachate production.	7035.2815 Subp 9. And, 7035.2815 Subp. 15
35	Leachate Collection System	6.b. Project Description	11	Adequacy of leachate collection system	The water balance required by rule is not provided.	7035.2815 Subpart 9.C
36	Leachate Collection System	6.b. Project Description	11	Maintaining less than 1' of leachate head on liner.	No method of measuring leachate head on liner (needed for each individual cell) is provided.	7035.2815 Subpart 9.D
37	Leachate Collection System	6.b. Project Description	11	Long term performance of leachate collection piping	Calculations showing that the piping is capable of handling anticipated solid waste/cover loading are not provided.	7035.2815 Subpart 9.F, 7035.2815 Subpart 12.I
38	Leachate Collection System	6.b. Project Description	11	Permit Modification Drawings, North Development Area MSW Expansion, pg. 23, Plan: Tie-In to existing leachate force main wet well. Adequacy of leachate collection system	No calculations are provided to support the pipe sizes in relation to the anticipated leachate generation rates. No calculations are provided to document that the existing leachate lift station (Figure 2/23) has adequate capacity to handle the additional volume of leachate generated by the NDA.	Permit Modification Drawings, North Development Area MSW Expansion, pg. 23, Plan: Tie-In to existing leachate forcemain wet well.
39	Leachate Collection System	6.b. Project Description	11	Permit Modification Drawings, North Development Area MSW Expansion, pg. 21. Sediment drains (Figure 2/21)	Due to the location of the sediment drains (low point of leachate collection piping) sediment will accumulate at these locations. No discussion on long term viability of sediment drains due to potential sedimentation.	Permit Modification Drawings, North Development Area MSW Expansion, pg. 21.
40	Leachate Collection System	6.b. Project Description	N/A	Cleanouts	The maximum cleanout spacing required by rule is exceeded.	7035.2815 Subpart 9.B
41	Landfill Gas Management	6.b. Project Description	12	Renewable Natural Gas (RNG) and Landfill Gas Management	Need better explanation for RNG being able to manage current and future proposed gas production. If RNG is offline, is the candlestick flare burn able to manage the landfill gas? Contingency action plan needs to address how landfill gas is to be managed in the event that the RNG plant is off line.	M.R. 7035.2815, Subp.11. And, M.R. 7035.2815, Subp. 15
42	Increased capacity needs at future landfill	6.d. Project Description	13	MPCA's 20 Year Solid Waste Management (2022 to 2042) Plan	The MPCA's 20 year Solid Waste Management (2022 to 2042) plan does notes if the HERC were to shut down, aggressive programs would need to be put in place to address the increase of waste to landfills. MPCA needs to address in the EIS on what their plans are to address the diversion of potentially 365,000 tons per year (the permitted capacity of the HERC) to other solid waste facilities and specifically how much will be diverted to Elk River. Has a contingency plan been developed? Depending on the number, impacts may vary from what is discussed in this EAW.	Metropolitan Solid Waste Management Policy Plan, 2022-2042
43	Climate Adaptation and Resilience	7.a. Climate Trends	14, 15	Leachate management, faster generation of leachate	Increase precipitation will increase the need for more leachate management. How will this be addressed?	7035.2815 Subp 9. And, 7035.2815 Subp. 15
44	Climate Adaptation and Resilience	7. Climate Adaptation and Resilience	14	Climate Trends	No discussion of changes in wind patterns.	
45	Wetlands	8. Cover Types, Table 8-1. Cover Types.	24	Table 8-1. Cover Types. Wetlands and shallow lakes – they list 2.24 acres "before" and 0 "after". However, when I compare chart to Figure 17 – Wetland Removal Areas, the numbers do not match up. Figure 17 has a total of 2.494 acres impacted.	Need clarification on wetland acres impacted.	
46	Wetlands	9. Permits and Approvals Required, Table 9-1. Required Permits.	26	Permits and Approvals Required	Wetland delineation PLUS a wetland replacement or no-loss or exemption is needed.	
47	Land Use	9. Permits and Approvals Required, Table 9-1. Required Permits.	26	Permits and Approvals Required	Permit issued previously was for a mining operation and to a different company. Now a landfill is proposed and the impacts have changed. A new Wetland Conservation Act Permit/Replacement Plan will be required.	
48	Land Use	10.a.i Land Use References	26	No residential structures noted on Figure 10	The land use figure should illustrate residential properties and buffer them to show distances from cells. It should reflect the land uses as discussed in Section 10.a. 1. This map looks to illustrate land cover.	Figure 10 in EAW
49	References	References	26-27	County Plans cited	Check to make sure all County plans are listed in reference list.	
50	Land Use	10.a.3. Land Use, Zoning	27	Zoning	It is stated "Sherburne County classifies Rice Lake as a Natural Environment" lake in Section 14 of its zoning ordinance. Industrial development is not prohibited in a shoreland district of a Natural Environment Lake." This statement is false. In the Sherburne County Zoning Ordinance, Section 14 – Shoreland District – 4.23 Land Uses for Lake Classification the chart has an N, which stands for "Not Permitted Uses" for the industrial Land Use under a natural environment lake.	
51	Land Use	10.a.3. Land Use, Zoning	27		Figure 5. North Development Area– it is recommend that the project proposer identify/label what the light blue line represents in Figure 5. Is it the OHWL of Rice Lake? Please explain.	
52	Land Use	10.b... land uses, zoning, and plans...	27	Zoning	Need to add that although Comp Plan Map shows Heavy Industrial, the proposed areas of expansion are not zoned Heavy Industrial. A landfill must be located in a Heavy Industrial Zone, therefore, the project proposer will need to request to have applicable parcels rezoned. In addition, a Condition Use Permit will need to be applied, and approved for a landfill to expand to the north.	
53	Land Use	Either 10.a.4.b.	27	Litter and Odors	Given the history of complaints about the litter and odors originating from the landfill, provide details as to how the litter and odors will be managed.	

Number	Area of Concern	EAW Section	Page	Reasoning for Comment	Comment	Relevant Links & References
54	Land Use	10.c. Identify measures incorporated into the proposed project to mitigate any potential incompatibility as discussed in Item 10b above and any risk potential.	27	Land Use	10.c. currently states “Rice Lake wetland complex”, It is noted that Rice Lake is a Natural Environment Lake and should be listed as such.	
55	Landfill Design	11.a. Geology, soils, and topography/landforms: b. Soils, topography, etc.	28	33% (3H:1V) slope	M.R. 7035.2815, Subp.6 (C) (2) provides that final cover slopes shall not exceed 25 percent. Section 7.2 of Sherburne County SWO also provides that final contours do not exceed 20 percent slope.	See Sherburne County SWO 180, Section 7.2 Final Elevations
56	Geology	11.a. Geology	28	Inconsistent descriptions	"The uppermost bedrock in the NDA area includes shale and fine-grained, cemented sandstone" is not consistent with later statements that the Eau Claire is uppermost. Need a better, more complete description of the Eau Claire formation.	
57	Geology	11.a. Geology	28	Groundwater data	"The upper outwash hosts the water table across most of the NDA and saturated range from less than ten to approximately 40 feet" is not a good way to describe the water table. Suggest deleting.	
58	Wetlands	12.a.1. Water Resources	30	Wetland Permitting	The text notes an amendment to the the Section 404 wetland permit amendment is needed. Is a state wetland permit amendment also needed?	
59	Wetlands	12.a.1. Water Resources	30	Wetland Permitting	the EAW scoping document. Approximately 2.949 acres of wetland may be impacted. In additional to Section 404 Permit Amendment being submitted to impact wetlands a wetland replacement plan will need to be submitted to the County Zoning Department for	
60	Wetlands	12.a.1. Water Resources, Wetlands	30	Terminology	Wetlands "taken" or "removed" is unclear terminology and not found in this context in 8420 rule. Perhaps "impacted" is the intended term? Update throughout narrative and figures.	
61	Wetlands	12.a.1. Water Resources, Wetlands	30	Wetlands	Wetlands should be described based on the finding from the delineation. Wetland type and hydrology regime. Was a functional or quality assessment completed? An HGM classification and functional assessment will likely be needed to evaluate permitting requirements. A table of delineated wetlands would be helpful.	
62	Wetlands	12.a.1. Water Resources, Wetlands	31	Figure 17. Wetland Removal Areas	Figure 17 has a mapping glitch with Wetland J where a portion is missing.	
63	Groundwater	12.a.2. Groundwater:	32	Potential for Groundwater Impacts	Explain how in a hypothetical release the contamination stays in the upper outwash? Other reports clearly show that an existing vinyl chloride plume is in the lower outwash till. Provide for how downgradient monitoring will occur in the event of a release.	Groundwater Corrective Action. Barr, 2020a and 2018; Figures 6, 7, and 8.
64	Separation from groundwater	6.b. Project Description 12.a.ii. Water Resources	11, 32	Seasonal high water table	No documentation provided on seasonal high water table. No documentation provided on adequate separation from seasonal high water table. The seasonal high water table is not provided on the cross sections or other figures in Appendix B.	Ordinance 180 Section 7.1.E
65	Groundwater	12.a.2.Groundwater	32	Monitoring	Future groundwater monitorng should include PFAS analysis.	
66	Groundwater	12.a.2 Water Resources	32	Aquifer Characteristics	Because the lower outwash has been important in monitoring the south part of the landfill, it should be included in the narrative here.	
67	Groundwater	12.a.2 Water Resources	33	MDH Wellhead Protection	Discuss whether the WPA or the Ridges of Rice Lake Housing Development extends below the ERL.	
68	Groundwater	12.a.2. Groundwater:	33	Potential for Groundwater Impacts	Explain how the site is monitorable with a high degree of confidence. Well placement to the west of the landfill in the wetlands is extremely difficult.	Enter Rice Lake Tibbits Brook report or the P-325/P-326 project document
69	Groundwater	12.a.2. Groundwater:	33	Landfill is in current corrective action for vinyl chloride contamination.	It is true that Project Site is not within a Wellhead Protection Area, but it is inaccurate to say that no impacts have been identified. Well replacement has occurred for residents of Ridges of Rice Lake as a result of impacts.	
70	Final Cover	12.a.2. Control measures to minimize potential impacts to groundwater	37	33% (3H:1V) slope	M.R. 7035.2815, Subp.6 (C) (2) provides that final cover slopes shall not exceed 25 percent. Section 7.2 of Sherburne County SWO also provides that final contours do not exceed 20 percent slope.	See Sherburne County SWO 180, Section 7.2 Final Elevations
71	Stormwater Management	12.b.ii. Stormwater	37	Climate Trends	Meeting the state minimum construction stormwater compliance will not provide the level of protection under a future climate change scenario. Heavier intensity and higher frequency will mean that 0.5-inch water quality volume may not be enough for first flush pollutant treatment.	
72	Stormwater Management	12.b.ii. Stormwater	37	Climate Trends	Concerned with the emergency spillways being used for events greater than the 25-year event. The current 25-year period is projected to be something more frequent in the future. Account for climate change projections in the design of the drainage and stormwater management system (i.e. use the values from the upper bound of the 90th percentile confidence interval from NOAA Atlas-14).	
73	Stormwater Management	12.b.ii. Stormwater	37	Climate Trends	Consider the impact of flashier, high volume storms to the ponds which will be undersized for peak flows resulting in more bypass scenarios.	
74	Stormwater Management	12.b.ii. Stormwater	37	Climate Trends	3' minimum depth may not be adequate as we see higher sediment loading from intense storms, requiring increased maintenance frequency, and shallow ponds will be prone to heating up with longer dry spells.	
75	Stormwater Management	12.b.ii. Stormwater	37	Stormwater Calculations	Provide HydroCAD calculations and details for the stormwater management ponds.	
76	Stormwater Management	12.b.ii. Stormwater	37	Downstream Impacts	To minimize downstream impacts (to Rice Lake and wetlands) match existing peak runoff rates and volumes.	
77	Stormwater Design	12.b.ii Water Resources	38-39	Stormwater/culvert sizing	Calculations have not been provided showing compliance with stormwater regulations	

Number	Area of Concern	EAW Section	Page	Reasoning for Comment	Comment	Relevant Links & References
78	Stormwater Design	12.b.ii Water Resources	39	Length of open channel to stormwater pond	The maximum flow distance for water from the east toe of the slope of the cap to the Northwest Stormwater Pond is approximately 3,500 linear feet. Due to the length of the channel sedimentation may be an issue until the final vegetative cover is established. No discussion on interim sediment control structures on the east side (if needed) is provided.	
79	Drainage Design	12.b.ii. Stormwater	39	Climate Trends	Drainage system designed using NOAA Atlas 14 mean values. Section 7. Climate Adaptation and Resilience section acknowledges an increase in extreme precipitation events. Projected rainfall depths should be evaluated in the design of stormwater management plan.	
80	Wetlands	12.b.4. Surface Waters: Wetlands	40		Second sentence is poorly worded and it is unclear the meaning of it.	
81	Wetlands	12.b.4. Surface Waters: Wetlands	40	Wetlands	It is unclear if 6.39 acres of wetlands will remain after mining. The mining wetland permit had a conditional approval and without those conditions being met there will be additional impacts or a reduced mining footprint that is not allowed to mine in the sub watershed of wetlands B and F. This document does not reference any of the conditions of the 2022 Wetland Conservation Act Notice of Decision. The mining area used throughout this document might does not even have approval at this point.	
82	Wetlands	12.b.4. Surface Waters: Wetlands	40	Wetlands	Discussion of avoidance and minimization is not addressed. Please rigorously address. What are the alternatives?	
83	Wetlands	12.b.4. Surface Waters: Wetlands	40	Wetlands	Discussion of mitigation is not addressed. Please address.	
84	Wetlands	12.b.4. Surface Waters: Wetlands	41	Wetlands	Please reference a figure describing the proposed stormwater pond.	
85	Wetlands	12.b.4. Surface Waters: Wetlands	41	Wetland Impacts	Impact is defined as "a loss in the quantity, quality, or biological diversity of a wetland caused by draining or filling of wetlands, wholly or partially, or by excavation in the permanently and semi-permanently flooded areas of wetlands." It is unclear if the wetland impacted by the stormwater pond will have losses to the wetland quality or biological diversity. Only hydrology and quantity are discussed.	
86	Wetlands	12.b.4. Surface Waters: Wetlands	41	Wetland Impacts	Second paragraph. It is unclear how or where these assumptions are made. Please reference a study, another part of the document, or other scientific information to support the assumptions. Geotechnical soil borings, water table monitoring?	
87	Wetlands	12.a.i./12.b.iv.a. Water Resources	40-41	Wetland Impacts	However, the reports/mapping are not provided. Although reports are now expired, please provide tables and/or figures that describe delineated wetlands and direct impacts in more detail (e.g. wetland type, potential impact amount to each wetland).	
88	Wetlands	12.b.iv.a. Water Resources	41	Wetland Impacts	Is plant community the sole indicator used to determine groundwater dependence of wetland proposed for 30% impact? Are there any supporting hydrology data? Discuss groundwater dependency determination further.	
89	Wetlands	12.b.4.a Surface Waters, Wetlands	40-41	Wetland Impacts	Figures have been provided that clearly show 2017 wetland delineation locations with accompanying narrative of proposed impacts. However, the nature of the impacts proposed to 2.24 acres of wetland is not clear and if they overlap or include the potential impacts via stormwater pond construction. The text indicates an additional 1-2.5 acres of wetland will be impacted by the stormwater ponds, but it is not clear if these impacts will occur to the 2.24 acres of wetland already proposed for impact or to additional wetland areas to the west or otherwise. The text currently states on page 40 that "The remaining 4.13 acres will persist outside the Project Site to the west (Figure 17)," but that would not be true if they are proposed for stormwater-construction related impacts.	
90	Wetlands	12.b.4.a Surface Waters, Wetlands	41	Wetland Impacts	Is plant community the sole indicator used to determine groundwater dependence of the wetland proposed for 30% impact? Are there any supporting hydrology data? Discuss groundwater dependency determination further and ensure this determination is made clear during the WCA and Section 404 processes.	
91	Wetlands	12.b.4.a Surface Waters	40-41	Wetland Impacts	Are there potential offsite groundwater impacts to the western wetland under a hypothetical release scenario? Discuss further.	
92	Groundwater Contamination	13.a. Contamination/ Hazardous Materials/ Wastes	41-43	Existing groundwater contamination	Explain how groundwater contamination has occurred in the lower outwash aquifer at the current permitted location, and how the proposed NDA is different and that contamination will be limited to the upper outwash and not impact the lower outwash.	EOR Report: Elk River Landfill: Review of Groundwater Contamination Issues, dated 10/13/2025.
93	Groundwater Contamination	13.a. Contamination/ Hazardous Materials/ Wastes	41-43	Groundwater contamination receptors	List the wetlands, surface water bodies, and specific wells downgradient of the landfill that are potential receptors of groundwater contaminants.	
94	Groundwater	13. Contamination/hazardous materials/wastes: a. Pre-project site conditions:	42	Monitored Natural Attenuation (MNA)	Current data does not indicate monitored natural attenuation is occurring within the contamination plume.	EOR Report: Elk River Landfill: Review of Groundwater Contamination Issues, dated 10/13/2025.

Number	Area of Concern	EAW Section	Page	Reasoning for Comment	Comment	Relevant Links & References
95	Groundwater Contamination	13.a. Contamination/ Hazardous Materials/ Wastes	42	Groundwater contamination	Page 42 of the Scoping EAW states: "*The downgradient-most extent of the groundwater detections has been defined (i.e., a clean downgradient well exists) and natural attenuation is occurring.*" Explain how it was determined that "a clean downgradient well" indicates that natural attenuation is occurring, when instead the plume just hasn't reached that monitoring point as of yet.	EOR Report: Elk River Landfill: Review of Groundwater Contamination Issues, dated 10/13/2025.
96	GHG Emissions	18. GHG Emissions/Carbon Footprint	42-44	Carbon Sequestration/Footprint	There is no accounting for the loss of carbon sequestration associated with the loss of trees and wetlands. This loss would contribute to the overall emissions from the site.	
97	GHG Emissions	18.b. GHG Assessment	44	Mitigation Measures	EAW states that "ERL plans to implement appropriate GHG mitigation measures when feasible". How is feasibility of these mitigation practices determined?	
98	GHG Emissions	18.b. GHG Assessment	44	Mitigation Measures	Consider tree replacement as a mitigation measure.	
99	GHG Emissions	18.b. GHG Assessment	44	Mitigation Measures	Consider the use of electric vehicles as a mitigation measure.	
100	Fish, wildlife, plant communities, and rare features	14.a. Fish, wildlife, plant communities, and sensitive ecological resources	46-47	Native Plant Communities	What source does the FDs37 NPC classification come from? It does not appear to be included in the DNR NPC GIS layer.	
101	Fish, wildlife, plant communities, and rare features	14.c. Fish, wildlife, plant communities, and sensitive ecological resources	50	Native Plant Communities	Will the FDs37 area be impacted by the current mine? Will it be impacted by the proposed landfill, or will all impacts already have occurred from the mine? FDs37 subtype b may be considered a Rare Natural Community and warrant consideration under WCA.	
102	Fish, wildlife, plant communities, and rare features	14.c. Fish, wildlife, plant communities, and sensitive ecological resources	50	Native Plant Communities	In Appendix C, the DNR Regional Plant Ecologist indicated that wetlands on the site may qualify as rare natural communities subject to WCA. Discussion of potential impacts to wetland RNCs is warranted.	
103	Visual	16. Visual	53	Visual impacts to residents	The SEAW states that there are no scenic views or vistas in the ....area. However, the Great Northern Regional Trail is to the west of the NDA. The landfill will have a visual impact to adjacent residents, Highway 169, and the Great Northern Regional Trail. High winds can blow debris into trees and adjacent properties.	Section 16 - Visual of EAW
104	Visual	16. Visual	53	Visual impacts to Great Northern trail users	Vegetation should be maintained on the western boundary of the landfill to the extent possible to provide a level of screening to trail users. This will keep with the guiding principles of this trail system.	https://www.co.sherburne.mn.us/DocumentCenter/View/8513/Great-Northern-Trail-Master-Plan-2022-08-30
105	Landfill gas emissions	17. Air. a.	55	Landfill gas emissions	Explain how the emitted fugitive gas is 25%. Further explain the negative impacts resulting from this.	
106	Landfill gas emissions	17. Air. a.	55	Landfill gas emissions	Explain how landfill gas is not increasing? DSDD claims otherwise, LFG will go from 3100 to 5008 scfm by 2077 according to LandGEM.	DSDD
107	Landfill gas emissions	17. Air. a.	55	Fugitive dust emissions	Explain how future annual acceptance rates are expected to remain like 2023 with a future potential HERC closure, future counties growth of population and increase in waste generation rates.	
108	Fugitive Dust Emissions	17.a. Air	55	Waste acceptance rates	It notes again that waste acceptance rates will be expected to remain similar to the 2023 waste acceptance rate; it should be addressed if waste is to be accepted if the HERC's incinerator closes, how much of an increase there will be to this facility. Also, consideration to population growth and waste generation should be considered.	Section 17 - Air - Fugitive Dust Emissions of the EAW
109	Air	17.a. Air. Draft Scoping Decision Document (DSDD), pg. 11. Air Quality	55-60	Air Emissions Impacts to Residents	In the Air Permit Section, please explain more clearly what previous LFG gas controls (combustion devices, engines) were present and when, what is present now, and more detail of future plan for Renewable Natural Gas plant, with projected start-up date vs. landfill expansion start-up date. Even though the future RNG plant may be owned and operated by a different entity, a thorough analysis of the LFG disposition and emissions it will generate is warranted.	
110	GHG	18.a. Greenhouse Gas (GHG Emissions/Carbon Footprint. Draft Scoping Decision Document (DSDD), pg. 12. Air Quality	57-58	GHG Impacts	EAW needs more discussion of project-related CO2e combustion emissions total of zero tons/year. Is this due to offsite/other party RNG plant, no net increase in LFG emissions per year, both, other? What about additional fuel combustion due to higher total vehicle miles travelled? We realize detailed calcs may be forthcoming, but an overview/discussion in the EAW is appropriate.	
111	Noise	19.a. Noise	59	Quantitative noise levels	Will the new location of activities be closer to any sensitive noise receivers that might be impacted? Namely along 239th Avenue NW.	
112	Noise	19.a. Noise	59-60	Noise impacts	Will there be any efforts to minimize noise? Discuss that machinery will be properly maintained, including mufflers and lubrication to minimize noise. Also discuss efforts to minimize banging or dropping , and noise from dump truck gates, etc.	
113	Noise	19.a.1. Noise	59-60	Noise sources	There is no map in appendix locating the existing and future planned sources of noise as discussed in the narrative.	
114	Noise	19.a.1. Noise	59-60	Noise source operating hours	Unclear operating hours for varying noise sources: when is the facility permitted to operate, regardless of "typical" conditions? Differentiate between applicable hours for waste hauling versus equipment, etc. and provide durations of high-noise equipment use.	
115	Noise	19.a.1. Noise	59-60	Quantitative noise levels	While existing noise sources are qualitatively described, measured or theoretical quantitative noise levels are missing from this section.	
116	Noise	19.a.1./19.a.2. Noise	59-60	Quantitative noise levels	Missing discussion or data on noise monitoring around the site and nearby noise sensitive receptors.	
117	Noise	19.a.1. Noise	59-60	Impacts from HERC closure	This section states "the number of trucks delivering waste may or may not increase"; however, this project is affected by the HERC closure and rerouting of vehicles to this facility - so, wouldn't heavy vehicle traffic be increasing? If so, this should be quantified.	
118	Noise	19.a.3. Noise	59-60	Noise receivers	There is no map in appendix detailing the Noise Area Classification of the site and surrounding land use activities per Section 7030.0050 Subp. 2.	
119	Noise	19.a.2. Noise	59-60	Noise receivers	Identify number, NAC, and location of receptors within defined 0.5-mile study limit; identify change in distance between receptors and noise sources in existing vs. future scenarios.	
120	Noise	19.a.2. Noise	59-60	Noise impacts	Relative elevation is used as a justification for limited noise impacts; however, line-of-sight is the more appropriate metric to add.	

Number	Area of Concern	EAW Section	Page	Reasoning for Comment	Comment	Relevant Links & References
121	Noise	19.a.2. Noise	59-60	Noise impacts	If 50% of the capacity will be deposited at lower elevations, that implies a non-negligible amount of activity will occur at higher elevations - this does not equate to "residents will be shielded from most of the noise from the facility" as stated.	
122	Noise	19.a.2. Noise	59-60	Noise impacts	Missing duration of "closure construction activities" that are cited as occuring "once every few years"	
123	Noise	19.a. 3. Noise	59-60	Noise impacts	Missing sound intensity/pressure discussion	
124	Noise	19.a. 3. Noise	59-60	Noise regulations	Table format recommended for the Noise Area Classification L10 and L50 standards for Daytime and Nighttime.	
125	Noise	19.a. 3. Noise References	59-60	References	FHWA Construction Noise handbook is mentioned but not cited/in the References	https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/
126	Noise	19.a.3. Noise References	59-60	References	Missing reference to the state rule section 7030 and MPCA as applicable regulating entity.	https://www.revisor.mn.gov/rules/7030/
127	Noise	19.a.3. Noise References	60	Noise impacts	Specify more than the 80-85 dBA range; for noise sources in the narrative for section 19.1, include them in a table with the best applicable noise level as cited in the FHWA Construction Noise Handbook.	
128	Noise	19.a. Noise	60	Noise impacts	The quality of life section (19.4) will be of little consolation for residents. The state standards will apply regardless of any existing condition. This will be especially true for any sensitive receptor that will have development site changes that move noise sources closer to the receptor. This will also be true for any site that exceeds state standards, regardless of existing conditions.	
129	Noise	19.a.3. Noise References	60	Noise regulations	Unclear which NAC and timeframes (daytime vs. nighttime) apply for this facility given the narrative. If L50 is exceeded for nighttime hours, but no construction or operation noises are produced in night time hours, does this section the standards are met by the facility or not?	
130	Noise	19.a.4. Noise	60	Mitigation measures	Are there any mitigation measures included for noise?	
131	Transportation	20.a.2 Transportation	60	Traffic data	How was the 11/2023-10/2024 ingress/egress traffic counted? 15-minute aggregate periods are standard; more granular data would be insightful throughout this section if it's available.	
132	Transportation	20.a.2 Transportation	60	Traffic data	Of the 310 daily trips generated, what is the vehicle classification distribution?	
133	Transportation	20.a.2 Transportation	60	Traffic data	What are the existing truck volumes along US 169, and what proportion of this value are trucks from the site?	
134	Transportation	20.a.2 Transportation	60	Traffic data	Although a TIS was not required, has one been conducted for this site in recent history or can? Should one be considered if the main access location is being rerouted to the north entrance?	
135	Transportation	20.a.2 Transportation	60	Impacts from possible HERC closure	No discussion regarding the project/site being subject to increased operational traffic related to the possible HERC closure. Statement that "Project will not increase operational traffic at the landfill" conflicts with "The number of trucks delivering waste may or may not increase" from 19.a	
136	Transportation	20.a.4 Transportation	61	Potential trail	There is a designated snowmobile trail along US 169 in this vicinity; please confirm non-impact and discuss proximity in narrative even if not impacted.	
137	Transportation	20.c. Transportation	61	Traffic data	What are the daily and peak hour turning movements at each of the 3 access intersections?	
138	Transportation	20.c. Transportation	61	Traffic data	What proportion of ingress and egress traffic will be making each movement and using each of the 3 accesses?	
139	Transportation	20.c. Transportation	61	Traffic data	What are existing congestion conditions along US 169 and at the 3 accesses?	
140	Transportation	20.c Transportation	61	Traffic safety	Traffic safety is not addressed in narrative. Review of crash records along US 169, particularly at the 3 entrances, is recommended; with potential for mitigation recommendations.	
141	Transportation	20.c Transportation	61	Traffic safety	Movements of particular concern associated with higher crash and severity risk: Angle crash type for movements (a) ingress northbound lefts, (b) egress eastbound lefts.	
142	Wetlands	21.c. Cumulative potential effects, Wetland	63	Wetlands	Check/verify wetland numbers are correct.	
143	Groundwater	General	N/A	Financial Assurances	Financial Assurances for the ERL NDA must include costs to replace future contaminated downgradient residential wells.	Minn. Rules 7035.2815, Subp 15. And, Sherburne County SWO 180, Section 7.10.
144	Contact information	DRAFT SCOPING DECISION DOCUMENT (DSDD)	1	Ralph Collins email is wrong, should be rcollin4@wm.com, not "rcollin@wm".	Need correct contact information for Facility contact.	
145	Alternatives	DRAFT SCOPING DECISION DOCUMENT (DSDD)	6	Alternative sites-new landfill	Explain the reasoning why an alternative site analysis is not being considered given the location of the proposed expansion. An Alternative Site analysis should be conducted.	Sherburne County SWO 180, Section 7.1 (A) (A). And, Minn. Rules Part 7035.2815, Subp. 2 Location. Also, Elk River Landfill: Review of Groundwater Contamination Issues, dated 10/13/2025.
146	Table 4. Scoping Criteria	DRAFT SCOPING DECISION DOCUMENT (DSDD)	8	11. Geology, Soils and Topography/Landforms.	Explain what this category was given an A, instead of a B or possibly a C.	Sherburne County SWO 180, Section 7.1 (A) (A). And, Minn. Rules Part 7035.2815, Subp. 2 Location. Further, PFAS has the ability to impact soils. Also, Elk River Landfill: Review of Groundwater Contamination Issues, dated 10/13/2025.
147	Table 4. Scoping Criteria	DRAFT SCOPING DECISION DOCUMENT (DSDD)	8	13. Contamination/Hazardous Materials/Wastes (A)	Explain what this category was given an A, instead of a B or possibly a C.	PFAS. https://www.pca.state.mn.us/air-water-land-climate/pfas-studies-and-reports. Also, Elk River Landfill: Review of Groundwater Contamination Issues, dated 10/13/2025.

Number	Area of Concern	EAW Section	Page	Reasoning for Comment	Comment	Relevant Links & References
148	Table 4. Scoping Criteria	DRAFT SCOPING DECISION DOCUMENT (DSDD)	8	16. Visual (A)	The landfill will have a visual impact to adjacent residents, Highway 169, and the Great Northern Regional Trail. High winds can blow debris into trees and adjacent properties. This should be rated a B at minimum.	
149	Table 4. Scoping Criteria	DRAFT SCOPING DECISION DOCUMENT (DSDD)	8	20. Transportation (A)	Explain why this category is an A rating given the potential increase in leachate trucking, residential growth in the area, and possible closure of the HERC facility factored into traffic volume. This should be considered a B at minimum.	
150	Tribal Engagement	DRAFT SCOPING DECISION DOCUMENT (DSDD)	9	No record of engagement with Minnesota Tribes	The Scoping EAW did not identify that the project proponent or MPCA has engaged with any of the 11 federally recognized Minnesota tribes or any other tribes regarding the project and potential impacts to tribally significant resources, especially wild rice. The MPCA has standing policies regarding consideration and protection to wild rice stands and has developed a list of waters supporting wild rice stands.	Policies and tools to address the potential impacts are found here -- Protecting wild rice waters | Minnesota Pollution Control Agency. Rice Lake (WID 71-0015-00), which is a short distance west of the review area, is listed on the MPCA's Waters Used for Production of Wild Rice site -- https://data.pca.state.mn.us/views/ProtectingwildricewatersWildRiceWatersList?%3Aembed=y&%3AisGuestRedirectFromVizportal=y
151	Historic Properties	DRAFT SCOPING DECISION DOCUMENT (DSDD)	9	Lack of tribal engagement	Rice Lake (MN DNR Lake ID 71001500) is listed in Natural Wild Rice in Minnesota (2008). As Manoomin (wild rice) is a sacred food and state grain of Minnesota, more consideration and care needs to be taken for this lake.	https://files.dnr.state.mn.us/aboutdnr/reports/legislative/20080215_wildricestudy.pdf

EXHIBIT 1

MINNESOTA POLLUTION CONTROL AGENCY

Sherburne County | Elk River proposed municipal solid waste landfill expansion

Elk River Landfill, Inc. proposes to expand its existing municipal solid waste (MSW) landfill near Elk River. The landfill currently accepts MSW, industrial waste, and construction and demolition waste. It is proposing a 162.36-acre expansion of the MSW fill area, which includes the conversion of 7.21 acres of already permitted construction and demolition fill area. The proposed project will provide approximately 26.67 million cubic yards of MSW disposal capacity.

Our role

The expansion of an MSW landfill of this size requires the project to go through the environmental impact statement (EIS) process. An EIS is a more extensive form of environmental review with more detailed information about the project's potential for significant environmental impacts. The EIS also provides project alternatives and identifies methods to reduce environmental effects. This process begins with the scoping environmental assessment worksheet (SEAW) and draft scoping decision document (DSDD) to inform what is going to be studied in the project's EIS.



Comment on the draft documents

The public is encouraged to comment on draft documents for environmental review that will open for public comment for 30 days starting Tuesday, Oct. 28.

A community meeting is scheduled for 5:30 p.m. on Wednesday, Nov. 19, at the Zimmerman-Livonia Fire Hall and Event Center.

Review and comment | Community meeting

Elk River Landfill also will have to apply to the MPCA for a certificate of need (CON) to expand its MSW capacity. As part of its application, the landfill will have to show a need to take on more MSW in current county and regional solid waste management plans.

After submitting the CON application, the landfill will then have to apply for a new solid waste permit, which will go on public notice for 30 days during the EIS and CON processes. The solid waste permit and CON processes will take place after MPCA completes the EIS process.

Location

Elk River Landfill is located five miles north of Elk River, adjacent to U.S. Highway 169 in Sherburne County on a 550.24-acre portion of land owned by Waste Management. The proposed expansion will take the landfill north into Livonia Township. It will include the purchase of an additional 175.75 acres from Capital Land Group where sand and gravel mining operations by Martin Marietta are currently taking place. The landfill is located in a mix of industrial, agricultural, and residential areas.



Project information

Elk River Landfill currently accepts waste from 23 counties in central Minnesota and small quantities from Iowa and Wisconsin. The greatest volume of waste hauled to the landfill comes from Anoka and Hennepin counties.

The landfill will reach its permitted capacity in approximately three years. Without additional capacity, area businesses and residents won't have a local facility where they can send their waste. This proposed expansion will extend the operational life of the landfill.

The proposed project will consist of the construction of the expanded MSW disposal area with a special protective layer at the bottom designed to prevent liquids from leaching out and contaminating soil and groundwater. A system of basins and pumps will collect and remove the liquids to a treatment facility. The project will also include construction of a new road for trucks to deliver waste to the site and construction of stormwater ponds to collect and control rainwater runoff from the site. When the landfill is full, Elk River Landfill will cover it with a

durable, waterproof cap and vegetation such as grass to prevent erosion and stop water from getting into the waste.

The SEAW looks at items in the environmental assessment worksheet to determine the scope of the EIS. Some key findings include:

- The SEAW identified climate adaptation and resilience, permits, fish, wildlife, plant communities, sensitive ecological areas, and historic properties as important. The MPCA determined the information provided in the SEAW is adequate for use in the EIS with only minor updates.
- The SEAW identified land use, water resources, air quality, greenhouse gases, and noise as potentially significant issues. Information beyond what is in the SEAW will be included in the EIS.
- The DSDD provides a summary of the items to be reviewed in the EIS.

Next steps

The SEAW and DSDD will open for public comment for 30 days starting Tuesday, Oct. 28, 2025.



Public meeting

The MPCA will host a public meeting for community members starting at 5:30 p.m. on Wednesday, Nov. 19, at the Zimmerman-Livonia Fire Hall and Event Center to discuss the project in detail. There will be an open house and brief presentation on the SEAW and DSDD.

Meeting details

After the public comment period ends, the agency will review all comments and create a final scoping decision document that will be reviewed as part of the EIS. As the project progresses through the EIS process, the MPCA will offer multiple opportunities for public comment.

Elk River Landfill plans to develop the expanded landfill in phases following a typical landfill sequence with permitting followed by the construction, filling, and capping of individual cells. Construction activity will occur throughout the site's life as new cells become active or as completed cells are capped.

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Last revised: October 27, 2025

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EXHIBIT 2



Elk River Landfill

Elk River Landfill is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving Sherburne County and surrounding areas.

Waste Management's approximately 300 disposal facilities employ the latest advances in landfill technology. This facility is engineered with environmental protection systems that meet or exceed rigorous government regulations and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, and landfill gas collection and control.

Containment Design

Elk River Landfill utilizes a double-layer, 2-foot clay and a 60 mil geosynthetic liner system to ensure that waste and wastewater (leachate) are contained and isolated from soil and groundwater.

Leachate Collection & Treatment

Leachate is discharged to the local Publicly Owned Treatment Works (POTW).

Groundwater Monitoring

Groundwater is monitored at 31 wells, which are upgradient and downgradient of the waste disposal footprint. The groundwater monitoring network is sampled and analyzed in accordance with the procedures of the facility's groundwater sampling and analysis plan.

Landfill Gas Management

Elk River Landfill collects and manages landfill gas through an extensive flare system with 76 wells, which reduces emissions and minimizes odor. The Landfill-Gas-to-Energy plant produces about 3.2 MW of energy, and powers approximately 2,400 homes in Elk River, Minnesota.

Security

Site security is ensured by controlled, limited access to the facility through the gatehouse as well as perimeter fencing and natural barriers. During non-business hours the gate is locked and monitored by 24-hour electronic surveillance.

ELK RIVER LANDFILL

22460 U.S. 169
Elk River, MN 55330

800 963 4776

HOURS OF OPERATION

7:00 am - 4:30 pm
Monday - Friday

Closed Saturday & Sunday

YEAR OPENED

1972

PROJECTED LIFE REMAINING

49 years

FACILITY ACREAGE

510.5 acres

PERMITTED FOOTPRINT

191.4 acres

REMAINING PERMITTED CAPACITY

15M cubic yards

APPROXIMATE TONS PROCESSED ANNUALLY

300,000 tons

OWNERSHIP

Elk River Landfill, Inc. is owned by Waste Management of Minnesota, Inc.

PERMIT TYPE & PERMIT #

Waste Facility Permit No. SW-74

REGULATORY AGENCIES

City of Elk River; Minnesota Pollution Control Agency (MPCA); Occupational Safety and Health Administration (OSHA); Sherbourne County

EMPLOYEES

11

Acceptable Material

- Asbestos – Friable/Non Friable
- Construction & Demolition (C&D) Debris
- Drum Management – Solids
- Industrial & Special Wastes
- Municipal Solid Waste (MSW)
- Tires
- Yard Waste

Unacceptable Material

- Fluorescent Bulbs
- Gas Refrigerators
- Hazardous Waste
- Liquids
- Propane Tanks

Recycling Services Provided

- Appliances
- Batteries
- Electronic
- Metal
- Tires
- White Goods

Risk Mitigation

Waste Management provides the highest level of services, backed with state-of-the-art site design and management systems, to help minimize risks and reduce liabilities.

Community Partnerships and Involvement

Elk River Landfill is proud to be an active supporter of community events and programs that make Sherburne County and its surrounding cities a strong and healthy place to live, work and play.



CONTACT

Technical Support
TSC Midwest
800 963 4776
TSCMidwest@wm.com

COMMUNITY RELATIONS

Julie Ketchum
952 460 8606
jketchu@wm.com

COMMUNITIES SERVED

Sherburne County and surrounding cities

WASTE MANAGEMENT

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THINK GREEN®

EXHIBIT 3







January 2024

Metropolitan Solid Waste Management Policy Plan 2022-2042

A 20-year policy plan for solid waste management that sets goals and policy for the metropolitan solid waste system.

MINNESOTA POLLUTION CONTROL AGENCY

Legislative charge

Minn. Stat. § 473.149 - A metropolitan long range policy plan for solid waste management, prepared by the Pollution Control Agency, sets goals and policies for the metropolitan solid waste system. This plan includes goals and policies for solid waste management, including recycling consistent with section 115A.551 and household hazardous waste management consistent with section 115A.96, subdivision 6. The MPCA shall include specific and quantifiable metropolitan objectives for abating, to the greatest feasible and prudent extent, the need for and practice of land disposal of mixed municipal solid waste and specific components of the solid waste stream.

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This report is available in alternative formats upon request, and online at www.pca.state.mn.us.

Document number: w-sw7-22

Acronyms and initialisms

CII commercial, industrial, institutional

CON Certificate of Need

CSWMP County Solid Waste Management Plans

Demolition debris construction and demolition debris

EJ Environmental Justice

EPA U.S. Environmental Protection Agency

EPD Environmental Product Declaration

EPR Extended Producer Responsibility

GHGs Greenhouse gases

GHGe Greenhouse gas emissions

HERC Hennepin Energy Recovery Center

HHW household hazardous waste

ISW industrial solid waste

LRDG Local Recycling Development Grants

MLAA Metropolitan Landfill Abatement Account

MMSW mixed municipal solid waste

MN USGBC Minnesota U.S. Green Building Council

MPP Metro Policy Plan

MSW municipal solid waste

MnDOT Minnesota Department of Transportation

MPCA Minnesota Pollution Control Agency

MRF materials recovery facility

PFAS Per- and polyfluoroalkyl substances

PUC Minnesota Public Utilities Commission

RDF refuse derived fuel

RMD recycling market development

ROD restriction on disposal

SMM Sustainable Materials Management

SSO source separated organics

TCMA Twin Cities Metropolitan Area

WARM waste reduction model

WMA Waste Management Act

WTE waste-to-energy

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Part one: Introduction and background

In 1980, the Minnesota Legislature recognized the importance of waste management with the passage of the Waste Management Act (WMA) in Minn. Stat. § 115A. This statute's purpose is to protect the state's natural resources and public health by improving integrated solid waste management. The statute establishes the following hierarchy of preferred solid waste management practices, in order from most to least beneficial to the environment:

1. Waste reduction and reuse
2. Waste recycling
3. Composting of source-separated compostable materials, including but not limited to, yard waste and food waste
4. Resource recovery through mixed municipal solid waste (MMSW) composting or incineration
5. Land disposal which produces no measurable methane gas, or which involves the retrieval of methane gas as a fuel to produce energy to be used on-site or for sale
6. Land disposal which produces measurable methane, and which does not involve the retrieval of methane gas as a fuel to produce energy to be used on-site or for sale

The above hierarchy was established to achieve the following goals, as provided in Minn. Stat. § 115A.02(a):

1. Reduction in the amount and toxicity of waste generated
2. Separation and recovery of materials and energy from waste
3. Reduction in indiscriminate dependence on disposal of waste
4. Coordination of solid waste management among political subdivisions
5. Orderly and deliberate development and financial security of waste facilities including disposal facilities

To avoid confusion as to which types of plans are being discussed, this document will be referred to as the Metro Policy Plan (MPP); the plans the counties develop will be referred to as County Solid Waste Management Plans (CSWMP). The language in the statutes, where quoted, is not changed and is italicized for clarity.

Purpose of this Plan (MPP)

This MPP establishes the framework for managing the Twin Cities Metro Area's (TCMA) solid waste for the next 20 years (2023-2043). It was prepared in accordance with the requirements of Minn. Stat. § 473.149. It will guide the development and activities of solid waste management and must be followed by the counties in the TCMA. In addition to the counties, the MPCA, solid waste facilities, haulers, businesses, and residents all have a role in implementing the MPP. The MPP supports the goals of the WMA hierarchy, improving public health, reducing the reliance on landfills, conserving energy and natural resources, and reducing pollution and greenhouse gas emissions (GHGe).

The TCMA includes Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington counties. Excluded cities from the TCMA are Northfield, Hanover, Rockford, and New Prague.

Participants in the process

The MPCA staff held several meetings with stakeholders in advance of the release of the draft MPP. Several public meetings were also held after the release of the draft MPP to gather input from other MPP stakeholders, including members of the recycling and waste industry, counties, non-governmental organizations (NGOs), and members of the public.

Figure 1. TCMA County map



How the MPP will be used by stakeholders

The MPP will guide all stakeholders in their roles to ensure that waste is managed to the highest and best use.

The MPP will:

1. Inform waste generators (residents, businesses, public entities) about their roles and responsibilities in waste management.
2. Educate generators about solid waste issues and services (both public and private) available to them.
3. Identify and direct state agencies and county governments that provide assistance.

The MPP will outline the responsibility of the waste industry in providing future solid waste facilities and services. For the purposes of this MPP, the "waste industry" includes all entities, public and private, that collect and/or manage solid waste in some form, including recyclables, household hazardous waste (HHW), and problem materials.

The MPP will rely upon organizations that support the reuse industry, including repair organizations and non-government organizations, such as thrift stores.

The MPP will:

1. Provide guidance to counties and regional governmental entities in developing county solid waste ordinances, work plans, and budgets.
2. Direct the MPCA oversight responsibilities, including administration of the Metropolitan Landfill Abatement Account program, CSWMP reviews, and the MPCA's approval of solid waste facility permits and landfill certificates of need (CON).
3. Assist the MPCA in its regulatory, enforcement, and technical assistance functions that affect the TCMA.
4. Contribute to policy discussions regarding solid waste legislation affecting the TCMA.
5. Influence local jurisdictions in the planning and provision of services to residents and businesses.
6. Manage waste in a way that minimizes adverse impacts on the environment including, but not limited to, GHG reduction, resource conservation, and long-term legacy impacts as a result of land disposal.

Current system status

The TCMA solid waste system is the result of planning and development that began with the 1980 WMA. Since 1980, much has been accomplished.

- The TCMA recycles 45.2% of the MMSW generated. The recent improvement is largely due to advances in organics collection for food to people, food to livestock, source separated organics (SSO) management, and yard waste composting.
- Reuse and recycling activities contribute significantly to the economy of the region.
- Resource recovery facilities that serve the TCMA are now operating at full capacity.
- Resource recovery facilities manage 28% of the MMSW generated.
- Land disposal has decreased by 18% since 2008.
- Problem materials such as major appliances, mercury-containing products, and electronic waste are banned from the MMSW stream, and infectious wastes are separately managed.
- A system to collect and manage HHW is available to all residents, and all seven counties participate in an arrangement of shared reciprocity.
  As a region, we should be proud of the advances we have made because of the efforts from product producers, waste generators, waste industry, residents, and government.

A new name for this plan

The MPCA expects the fair treatment and meaningful involvement of communities of color, Indigenous communities, and low-income communities in agency actions and decisions that affect them. As the state takes initial steps to acknowledge its role in systemic racism, we recognize the power of language. Current Minnesota statute refers to the solid waste plans that metro counties develop as “master” plans. The term “master”, which is often defined as commanding control or being eminently skilled, has been identified as a word to remove in certain contexts due to its connection with the history of masters and slavery in the United States. While this statute remains unchanged as of the release of this plan, where possible, this plan uses the name “county solid waste plan” in place of “county master solid waste plan”. A noted exception is the use of “county master plan” in Appendix D, to remain consistent with current statute language. An additional benefit to using the term "county solid waste plan" is that it harmonizes the language with the term used for Greater Minnesota counties.

What challenges still exist?

The Minnesota solid waste system has faced several challenges over the past six years. A few large issues have indirectly affected the solid waste system in a negative way. These have slowed progress toward the objectives in the previous MPP. To meet our environmental goals, the following challenges will need to be further addressed.

The COVID-19 pandemic significantly disrupted all systems in Minnesota in 2020 and 2021. Transmission of the virus among solid waste workers was a safety concern, and outbreaks among staff at materials recovery facilities (MRFs) resulted in operational shutdowns. MRFs excelled at maintaining operations to the extent possible. However, requests for disposal allowances were yielded during this time.

The TCMA experienced social unrest following the murder of George Floyd. Some of the large Minneapolis MRFs shut down temporarily as a precautionary measure. Limited capacity exists in the region to absorb the material processed at that those facilities. This led to a request to dispose of recyclable material. Permission was granted for the one-time disposal of 59.7 tons of recyclables, which represents .000006% of the 1,000,000 tons of recyclables generated in the TCMA in 2020.

These events highlighted the lack of contingency plans the TCMA has for recyclable, reusable, and compostable materials. Maintaining and developing new end markets will continue to be important for

Minnesota's long-term success. A recent example of this is WestRock's unexpected closing of its corrugated cardboard line, resulting in a reduction of 600 tons of daily capacity, creating a major impact to local MRFs and haulers.

Success creates challenges, too. For example, an increase in organics collection programs throughout the TCMA point to the need for more planned programs in the coming years. Despite anticipated increases in feedstock, there is not a corresponding increase in organics processing capacity in the region. To meet our organics objectives, additional capacity to process organics will be necessary.

Minnesota's changing climate is creating stresses for the solid waste system, as severe weather events increase in frequency. Structural damage from flooding, tornados, and strong hail-producing thunderstorms generates large amounts of solid waste. Downed trees put pressure on the yard waste and composting facilities. The rise of EAB and other tree diseases compounds this issue as trees in Minnesota are dying at an increasing rate. The wood from the trees affected by EAB cannot be transported out of quarantine zones, leaving local entities to handle large volumes of wood waste without perpetuating the spread of the EAB. The TCMA will need to identify ways to manage the onslaught of wood waste over the coming years. Management solutions are needed to handle generated wood safely and efficiently.

Per- and polyfluoroalkyl substances (PFAS) are a significant challenge. Invented in the 1930s, PFAS are still commonly used for their water- and grease-resistant properties in many industrial applications and consumer products such as carpeting, waterproof clothing, upholstery, food paper wrappings, cookware, personal care products, fire-fighting foams, and metal plating. PFAS are persistent and can bioaccumulate, meaning the amount builds up in the body over time. When landfilled, PFAS migrates into the leachate, which is treated at a wastewater treatment facility. With no existing removal systems installed at landfills or wastewater plants to remove PFAS, the treated wastewater is discharged into surface water. It is not clear if waste-to-energy (WTE) facilities maintain the high temperatures required to destroy PFAS. The waste industry is in the process of identifying ways to address this unusual class of chemicals. As the solid waste system continues to evolve, adaptations are needed to safely manage new materials.

Establishing reuse and recycling markets for new additional materials is imperative to meet reuse and recycling goals and other objectives in the MPP. Market development is a complicated task requiring considerable lead time. New materials that can be recycled must be generated with enough volume to justify and sustain a business model.

Finally, the closure of the Great River Energy (GRE) processing and WTE facility has resulted in more than 250,000 tons of waste going to landfill. This closure directly increased landfill expansions in the TCMA. In many ways, the GRE closure was the result of an intersection of waste and energy policy. Minnesota needs to figure out how to manage the policy nexus for these facilities. The energy created at these facilities is not cost competitive with wind and solar and is not universally viewed as a clean energy source. However, the important role they serve in solid waste management should not be underscored. Left unresolved, other resource recovery facilities may follow suit. Without achieving greater waste diversion and reduction rates, that will result in an increased amount of waste being land-disposed.

Part two: Framework for change

This section of the MPP lays out a framework for a regional vision, key themes, goals, and policies. This framework will guide all decisions of the MPCA, regional governing entities, metropolitan counties, solid waste facilities, haulers, and other stakeholders with respect to the TCMA solid waste system.

Vision

This MPP is designed to help stakeholders exceed the benchmarks established in state law. The vision is that the TCMA will put more emphasis on the following:

- Pollution prevention
- Sustainable materials management (SMM)
- Conservation of natural resources and energy
- Reduced reliance on landfills and WTE
- Reduced toxicity of waste
- Equitable improvement in public health for all residents
- Supporting the economy
- Reducing GHGe and the impacts of climate change

The MPP sets forth a vision of sustainability for the TCMA solid waste management system. The TCMA is a sustainable community that minimizes waste, prevents pollution, promotes efficiency, reduces GHGe and the impacts of climate change, saves energy, reduces toxicity, and develops resources to revitalize local economies. The integrated waste management system is an essential component of the infrastructure of a sustainable community.

Solid waste is managed according to the principles of SMM that support sustainable communities and environments. The benefits of sustainable and healthy communities are shared equally throughout the region by all residents. The solid waste management hierarchy is central to attaining the twin objectives of sustainability and proper solid waste management because it emphasizes the higher end management methods.

Figure 2. Minnesota's solid waste management hierarchy of preferred methods



Key themes

The following key themes underlie all elements of the MPP.

SMM offers a systematic approach to using and reusing materials more productively over their entire life cycles. SMM considers the environmental impact of the entire life cycle, not just disposal. This holistic approach emphasizes management methods at the top of the waste hierarchy as well as reducing toxicity. These methods have greater environmental benefits. For example, preventing food waste is more impactful than increasing glass recycling rates.

GHGe reductions can be found throughout the solid waste management system. There are potential reductions in GHGe to be found throughout the life cycle of products and in the waste management system. This is particularly true at the top of the hierarchy and the design phase of a product when GHGe can be avoided altogether. Other system changes can affect GHGe in other sectors. For example, organized collection reduces the number of heavy truck miles and emissions.

The benefits and burdens of the solid waste management system must flow equally to everyone. The MPCA is committed to ensuring that pollution does not have a disproportionate impact on any group of people. This is a principle of environmental justice. Decisions about siting solid waste facilities should include all stakeholders. Translating educational materials into the languages spoken in the TCMA is important, as is including people who have not traditionally had a voice in decisions that affect them.

EPR presents great opportunities for shifting the burden of management from the counties and cities to the producers. Product stewardship and extended producer responsibility (EPR) is a policy approach to extend the producer's responsibility to include environmental impacts from all stages of the product's life cycle. This includes incentives for durability, reusability, toxicity reduction, and finding the highest and best use of materials and waste. In current practice, product stewardship requires manufacturers to share in the physical and financial responsibility of collecting and recycling products at the end of their useful life.

Minnesota has several product stewardship laws for paint and electronics and has been a leader in product stewardship efforts. Other states such as Maine, Colorado, Oregon, and California have adopted extensive EPR programs from which we can learn.

Goals and policies

The following goals and policies provide the basis for improving solid waste management in the TCMA. For the purposes of this section, "goal" is defined as a desired result; "policy" is defined as a course of action adopted by a government, party, business, or individual.

Goal 1: Protect and conserve. Manage materials in a manner that will protect the environment and public health, reduce GHGe, conserve energy and natural resources, and reduce toxicity and exposure to toxics.

The goal of the WMA is to protect Minnesota's land, air, water, and other natural resources, and public health by improving waste management to serve the following purposes: reduce the amount and toxicity of waste generated; increase the separation and recovery of materials and energy from waste; and coordinate the statewide management of solid waste and the development and financial security of waste management facilities, including disposal facilities. This goal recognizes a prevention-based approach to waste management to reduce, to the extent feasible, adverse effects on human health and the environment.

Policy 1: Challenge current waste management practices to identify materials with opportunities for management methods that fall higher on the waste hierarchy.

Policy 2: Focus on reuse and prevention. Apply SMM framework to decision making to decrease the environmental impact. Hold manufacturers responsible to design for repair, reuse, and recyclability.

Policy 3: Support and strengthen reuse and recycling markets to increase demand for reusables and recyclables.

Policy 4: Ensure systems are in place that foster the growth of organics recovery.

Policy 5: Promote recovery of energy when disposing of waste through WTE.

Policy 6: Strengthen compliance with cornerstone environmental statutes.

Policy 7: Increase public participation in decisions that impact them with special emphasis on Environmental Justice.

Policy 8: Account for all phases of a material's life cycle, including environmental and economic impacts.

Policy 9: Reduce toxicity by working with manufacturers to eliminate the use of hazardous components in packaging and products.

Goal 2: Whether public or private, hold all members of the solid waste system accountable for meeting the goals of this MPP.

To achieve the aggressive goals established in this MPP and by the Legislature, all parties in the solid waste system must be held accountable, and the MPCA must provide oversight of the system. Cities and counties must ensure the systems are in place for the proper management of waste, emphasizing managing it higher on the hierarchy. Generators must use the tools provided to properly manage the waste they create and to reduce the amount of waste created. Haulers and facility operators must ensure that waste is managed properly upon collection and look for opportunities to shift materials up the hierarchy.

Policy 10: Support the collection of reliable data to ensure that all parties in the solid waste system accurately measure progress toward achieving the objectives of this MPP.

Policy 11: Ensure that demolition debris and industrial wastes are categorized and are managed according to the applicable Statutes and Rules. Measure more accurately the composition of non-MMSW generated in the TCMA and being landfilled in Minnesota.

Policy 12: Increase opportunities for cities to implement organized collection for recycling and MMSW.

Policy 13: Cities and counties hold haulers and businesses in their communities accountable for managing waste according to the MPP via their licensing agreements.

Policy 14: The MPCA provides oversight of the system by holding counties and private businesses accountable. The Legislature holds the MPCA accountable for meeting waste management goals.

Policy 15: Hold producers responsible for the treatment or disposal of post-consumer products.

Policy 16: Set goals and performance standards following consultation with stakeholders on product stewardship.

Goal 3: Systematically and steadily promote more regional cohesiveness and collaboration to foster a synergistic, regional approach.

To achieve our goals of reducing the amount of solid waste generated and recycling/composting 75% of our solid waste by 2030, it is imperative that the counties work in concert and avoid duplication of efforts. This includes consistent uniform ordinances, greater collaboration between staff and leaders in each of the seven metro counties, and planning for facilities through a regional lens.

Policy 17: Develop model ordinances that could be enacted by all counties.

Policy 18: Local governments work together to develop a consistent ordinance structure that allows private entities to smoothly operate across the region.

Policy 19: Promote efficiencies and cost effectiveness and reduce environmental costs in the delivery of integrated solid waste management services.

Policy 20: Assure elected county officials understand the importance of supporting and maintaining WTE facilities.

Part three: MPP 2022-2042

The MPP provides guidance to all stakeholders responsible for TCMA solid waste management and was developed in accordance with the requirements of Minn. Stat. § 473.149, subd. 2d. for a land disposal abatement plan. It describes broad regional system objectives, a landfill diversion goal, and the strategies necessary for solid waste programs and services to meet the region's needs for the next 20 years. The MPP recognizes the inter-county complexity of the TCMA solid waste system and the value of and need for regional approaches. Specific details associated with implementing the MPP on a local level will be refined in the CSWMPs and any regional plan developed by the metropolitan counties. The MPP identifies where specific stakeholder actions are necessary to implement the objectives and strategies.

The MPP:

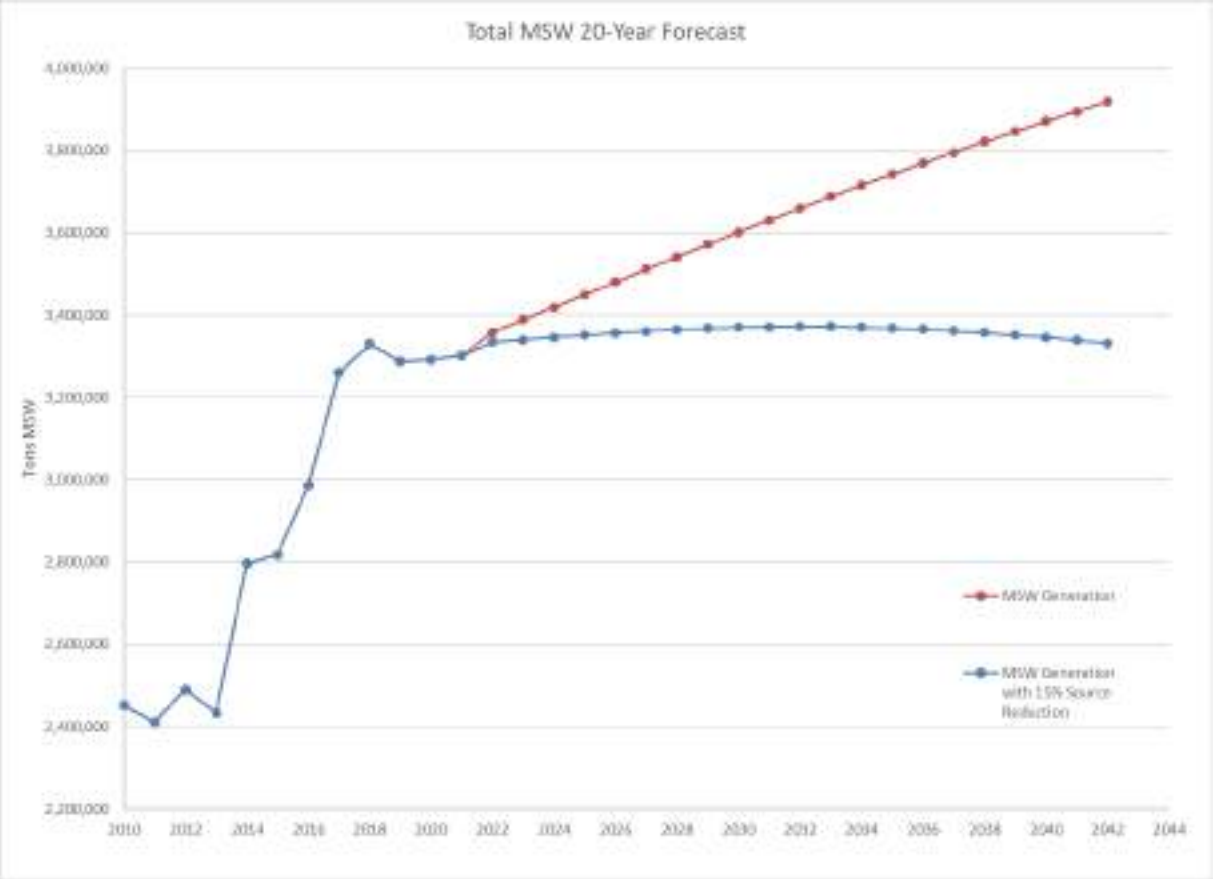
1. Places emphasis on the upper end of the hierarchy (waste reduction, reuse, recycling, and organics recovery).
2. Establishes objectives for each waste management method.
3. Achieves full use of resource recovery facility capacity and implements the Restriction on Disposal (ROD) of MMSW requirements.
4. Establishes a goal to minimize the amount of metro MMSW land disposal that will occur.

The MPP includes numerous strategies for reducing waste and increasing recycling and organics recovery. All stakeholders in the system have roles and responsibilities to ensure successful implementation of these strategies. A table that identifies each strategy is provided in Appendix G.

Regional waste generation forecast

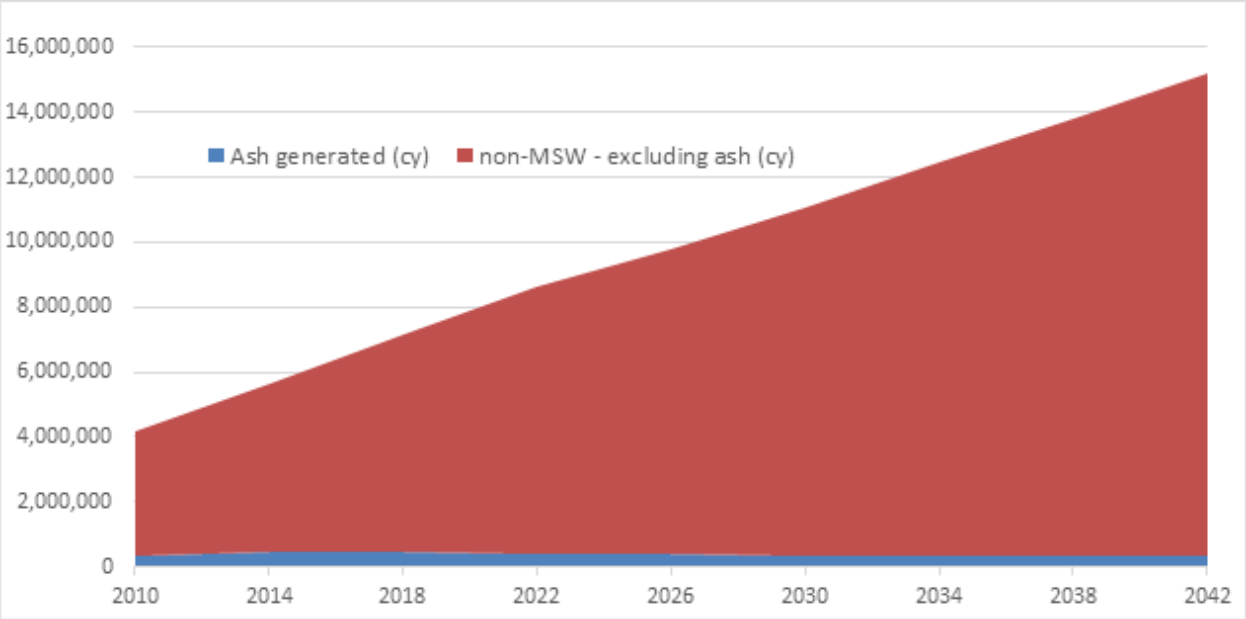
In 2021, the TCMA generated 3.3 million tons of MMSW. Metro MMSW generation is forecasted to grow to 3.92 million tons by 2042 (see Figure 3). The figure also includes the 15% reduction strategy to help visualize the intent of source reduction. Achieving a 15% reduction from the forecast amount will require waste generation to remain equal to the current generation going forward. This forecast does not include the non-MMSW waste stream (i.e., construction, demolition, and industrial wastes). The MMSW forecast was generated using waste generation amounts from 2010-2021. This period was chosen because the 2007-2009 recession created a new baseline.

Figure 3. Total MSW Generation Forecast with the 15% source reduction objective



Non-MSW like demolition debris, contaminated soil, and industrial waste continues to experience growth in generation of industrial and demolition debris (see Figure 4). It is forecasted that annual generation of non-MSW will increase by 6,000,000 cubic yards over the next 18 years. Reduction of non-MSW is vital to reach environmental goals in the future. Ash generation is forecasted to remain consistent over the next 20 years. Reducing or ceasing operations at Hennepin Energy Recovery Center could lower the amount of ash being land disposed but would greatly increase the need for MMSW disposal over the life of the plan.

Figure 4. Non-MSW and Ash Forecast



Sustainable Materials Management (SMM)

SMM overview

SMM identifies the best use and management of materials, considering the environmental impacts throughout the life cycle of materials. The major stages in a material's lifecycle are:

- Raw materials extraction
- Product manufacturing
- Product use
- Transportation
- End of life management

To protect the environment and human health, an understanding of “waste” must broaden. The impact of materials and waste include GHG emissions, pollution to land, air, and water, and resource depletion. These impacts happen throughout the entire life cycle of a product. All phases of that cycle must be considered, not simply end of life.

SMM includes traditional solid waste management. Management of the upstream impact of materials and the toxic chemicals used to manufacture those materials are also considered. The MPCA and EPA concede that an SMM approach seeks to:

- Use materials in the most productive way with an emphasis on using less.
- Reduce toxic chemicals and environmental impacts throughout the material life cycle.
- Ensure we have sufficient resources to meet today’s needs and those of the future.

An SMM approach invites more interested parties involved throughout the life cycle of a product to provide perspective and provide a broader scope of impact. These potential partners include, but are not limited to, primary chemical formulators, academic researchers, brand owners, retailers, product designers, and consumers.

Life Cycle Assessment

SMM uses Life Cycle Assessment (LCA) to inform decision-making. LCA is a way to model the environmental impacts associated with a material or process from resource extraction through end-of-life management. This yields information on environmental impact indicators, such as GHGe, toxicity, and acidification. These metrics help policymakers focus efforts on high leverage opportunities. At this time, the most widely used environmental indicator is GHGe. According to the EPA, materials can account for up to 42% of GHGe in the U.S. Most of that impact happens in the production lifecycle phase. In alignment with the waste hierarchy, the least environmentally impact action is to produce and use less.

Figure 5. LCA: a methodology for modeling the environmental impacts of a material or product from raw material extraction through end-of-life management



LCA modeling can compare environmental impacts associated with one material versus another. LCA modeling can also compare the impact of different management methods of the same material. Designers and manufacturers can use LCA modeling to determine the life cycle phase(s) in their products' lifecycle with the greatest specific impacts (e.g., water, air, and human health). For instance, electronics manufacturers may find that the use phase impacts are the energy usage by the consumer. The manufacturer can design the product to use less energy. They could also design the product to last longer and be reparable by producing replacement parts.

The ability to track and report on the environmental impacts of our materials management system is critical. Measuring repair activities as a waste reduction activity will be important to support this activity.

SMM for recycling

If Minnesotans recycled and composted all waste, GHGe would be reduced by only 3%. Recycling is important but recycling alone is insufficient. Moreover, material attributes like recyclability do not necessarily correlate with the greatest reduced environmental impacts. It is important to keep in mind that if something is marketed as "compostable" or "recyclable" that does not necessarily mean that it provides the best environmental outcome. For example, a steel coffee can is recyclable, so it may seem like the best packaging choice. LCA modeling comparing steel cans to other coffee packaging types shows that is not the case. Foil pouches result in fewer GHGe, despite having no material end market. That said, recycling plays an important role in the waste management system. If light weight packaging brings the greater environmental benefit, we should support developing recycling markets for packaging like foil pouches. Volatile recycling markets require innovative solutions to remain relevant.

SMM tends to favor prevention and reuse yet also reaffirms the importance of recycling. Recycling is commonly lauded for its ability to decrease demand for landfilling. However, there is a greater demonstrated environmental benefit in recycling when the byproduct alleviates the need to extract virgin materials by mining. The environmental degradation from extraction, energy use during processing, and transportation often tip the scales in favor of recycling. Identifying the highest and best use for each material is the primary consideration under this framework.

SMM and toxicity

Using an SMM approach also sheds new light on the use of toxic chemicals in manufactured materials. The policy and purpose of the Waste Management Act calls for a reduction in the toxicity of waste generated. Reducing toxics in the products we purchase reduces the overall toxicity of waste generated. In the past, the State of Minnesota Office of State Procurement prioritized recycled-content products on merit of recycled content alone. For example, a problem with the statewide flooring contract emerged when the vinyl flooring with recycled content was found to contain legacy heavy metals. The contract now restricts recycled content containing resilient flooring products unless they are third-party certified to conform with NSF/ANSI Standard 332: Sustainable Assessment of Resilient Floor Covering. This highlights the need to look at all material properties, not just recyclability.

Solid waste abatement objectives

Tables 1 and 2 set specific quantifiable objectives for abating the need for and practice of land disposal for the TCMA region over the next 20 years, pursuant to Minn. Stat. § 473.149, subd. 2d. Landfill abatement is best achieved through an integrated solid waste management and SMM approach. Therefore, the statute requires "objectives for waste reduction and measurable objectives for local abatement of solid waste through resource recovery, recycling, and source separation programs."

Table 1 defines the waste reduction objectives by percentage and tons reduced from forecast expectations. The forecasted trend in waste generation accounts for much of the reduction that

currently is occurring such as light weighting of materials. This plan calls for a 15% improvement on that trend-line following many comments that state that the waste reduction goal needs to be much more aggressive.

Table 2 defines the objectives by percentages of waste generated, and Table 3 defines the objectives in tons. Table 3 shows the objectives in tons based on the current waste forecast in this MPP and is subject to change if the forecast is updated. Several factors were considered when setting the objectives, including:

- Current statutory goals
- The regional waste forecast highlighted at the beginning of Section 3.
- Metro counties will achieve the 75% recycling rate as laid out in Minn. Stat. § 115A.551 by 2030.
- Total compliance with Restriction on Disposal (ROD) is assumed.
    - Additional capacity at any given WTE facility will be used regardless of originating county for MMSW.
- Landfilling is assumed to be a minimum of 5% given the need to manage non-processible waste, bulky items at WTE facilities, and residuals and rejects from recycling and composting facilities.
- Baseline is the last year of observable data (2021) since the latest year of data represent the best data available to the counties and their current education and diversion practices.

Currently, Hennepin County is the sole provider of MMSW to the Hennepin Energy Recovery Center (HERC) facility while Ramsey and Washington split the capacity of the Ramsey-Washington Energy Center. Each of these facilities is assumed to be at capacity due to ROD compliance. Dakota County will continue to send MMSW to the Red Wing processing facility, estimating 10,000 tons in 2020 and 13,000 tons in all subsequent years.

Meeting the objectives will reduce GHGe, conserve resources, reduce land disposal, and recover energy. The goals for recycling, organics, WTE, and landfilling do not change after 2030. The 75% recycling goal will be difficult to reach, so it will remain a relevant target beyond 2030. To continuing making progress, it is prudent to widen our regional focus to include waste reduction, given that the greatest environmental gains occur through reducing waste. Reduced upstream impacts contribute to a common goal with the recycling rate. The Hennepin County Board recently issued a resolution to create a plan for closing the Hennepin Energy Recovery Center sometime between 2028 and 2040. Due to the uncertain timeline, the MPCA is not revising the assumptions in the objective tables. However, history shows that the closure of a WTE facility leads to increased landfilling. MPCA expects that currently projected waste going to HERC would go to landfills if the facility closes. A robust plan to divert additional material and an influx of resources to improve programs and infrastructure may reduce the volume of waste that would be landfilled if HERC is closed. Without aggressive programs to replace HERC an additional 365,000 tons of material would be landfilled per year, which is equivalent to the largest landfill in Minnesota.

Table 1. Waste reduction system objectives in percentages and tons (2021-2042)

Management method	Current system (2021)	2025	2030	2036	2042
Waste Reduction	0%	2.9%	6.4%	10.7%	15.0%
Waste Reduction Tons	0	98,577	231,557	403,919	587,984

Table 2. MMSW management system objectives in percentages (2021-2042)

Management method	Current system (2021)	2025	2030	2036	2042
Recycling	28.6%	36.9%	47.4%	47.4%	47.4%
Organics	16.6%	21.5%	27.6%	27.6%	27.6%
WTE	21.4%	24.0%	20.0%	20.0%	20.0%
Landfill	33.4%	17.6%	5.0%	5.0%	5.0%

The table above shows the percentages of how waste is managed currently and projections for future years. The data under 2021 is from the latest SCORE report. Projections are based on the assumptions found in Appendix F.

Table 3. MMSW management system tonnages (Based on objectives in Table 2 in thousands of tons [2010-2030])

Management method	Current system (2021)	2025	2030	2036	2042
Recycling	944,968	1,237,436	1,598,496	1,596,691	1,580,830
Organics	547,931	719,166	929,331	927,801	918,102
WTE	707,268	828,000	674,087	673,198	666,382
Landfill	1,102,165	567,014	168,522	168,299	166,595
Total	3,302,332	3,351,615	3,370,437	3,368,899	3,331,909

The table above shows the same data and projections in thousands of tons to give context to the percentages in Table 3 and illustrates the amount of waste that needs to be managed in the TCMA.

Figure 6. TCMA MMSW management methods: past, present, and projection (SCORE and Certification Reports)



Evaluation of the system objectives

The MPCA will evaluate progress toward achieving all the system objectives through the annual SCORE Report submitted by the counties every April. The MPCA recognizes the challenges associated with measuring progress and measurement in general. Measuring waste reduction has posed challenges for years. See the Environmental impact target section for a discourse on a more robust way to measure environmental impact. Using data the counties currently provide, the MPCA has begun to calculate the environmental impact in the annual SCORE report. MPCA intends to continue to improve those efforts to better quantify the impacts of county programs on the environment. The environmental impact target does not require the counties to submit additional information to the MPCA. The MPCA will continue to work with local governments, haulers, and others to assure the data collected is necessary and relevant and will continue to collect data on a statewide and regional basis. The MPCA has historically used the SCORE Report as the method of tracking annual progress toward the objectives and has used the Solid Waste Policy Report to recommend needed policy changes to the legislature.

Emphasis on the upper end of the hierarchy

Handling materials using methods on the upper end of the hierarchy should be measured and reported. This includes an emphasis on waste reduction and reuse. There has been an emphasis on the legislative recycling goals, and while recycling plays an important role in the waste management system, measurement of success should be based on all impactful efforts. Reduction and prevention need to be organized and implemented through the TCMA.

Aggressive objectives for waste reduction and reuse, recycling, and organics recovery

All stakeholders, including the MPCA, will be held accountable for meeting these objectives. The MPCA believes the objectives are achievable, but to reach them, the TCMA will need new tools, enhanced infrastructure, and increases in funding. The current rate of increases in recycling and compost will not get the TCMA to the 75% recycling objective. New approaches to meeting the goal and other objectives in the MPP are needed for environmental protection.

Waste reduction and reuse

According to the EPA, waste prevention is the most environmentally preferred strategy to reduce impacts. Waste reduction and reuse methods are the most effective waste prevention strategies. Meeting waste reduction and reuse objectives will reduce the amount of MMSW that needs to be managed. Forecasting the projected MMSW generation for each county will deduct the tons of material reduced or reused.

Benefits of achieving success

In 2021, the TCMA achieved a 45.2% combined rate for traditional recycling and organics diversion. Minnesota would benefit from exploring additional methods to achieve the intended environmental and human health outcomes of the 75% recycling goal. Environmental and human health impacts of management methods should be considered. Minnesota needs to modernize data collection, measurement, and reporting. Other priorities should include identifying the highest return on investments in how staff time is allocated, introducing the most impactful policy changes, and investing in strategic infrastructure needs.

Oftentimes, waste reduction and reuse efforts can be cheaper than handling the same materials as waste. Incentivizing and tracking waste reduction and reuse separately ensures that county partners receive recognition for those efforts. Some counties have reported prevention and reuse in their CSWMPs and programming. Historically, reuse activities have counted towards the recycling rate via SCORE reporting.

An analysis of the 2018 SCORE report “recycling” data for accuracy revealed that, statewide, 79 of 87 counties reported reuse activities. This illustrates the need for counties to be recognized for investing in reuse. In response, the MPCA modified the 2021 SCORE reporting form to track reuse activities. Prevention and reuse programming result in fewer emissions. They are not and should not be treated as equal to recycling. The state should transition to a reporting structure that documents the increased climate and other pollution reductions from handling materials using methods higher on the waste management hierarchy.

Environmental impact target

To prioritize waste reduction and solid waste management with environmental and human health benefits, MPCA is setting an environmental impact target for TCMA counties based on full LCA. Under this environmental impact target, weight-based accounting for waste reduction, reuse, recycling, WTE, and landfill disposal is translated into GHGe generated or avoided. In this way, counties still report and work to meet their 75% recycling rate goal, but the environmental impact target documents overall changes in GHGe based on all county efforts and programming. By tracking progress with GHGe (currently the most accessible proxy for environmental impact), in addition to the recycling rate,

counties can invest in upstream activities, report on those efforts, and reach their environmental impact target through waste reduction and reuse programming as well.

The environmental impact target is defined by calculating the emissions avoided if the county were to reach the materials management goals set forth in the Metro Policy Plan by 2030. This means totaling the emissions associated with:

- Achieving a 15% waste reduction goal.
- Achieving a 75% recycling rate goal as established by the Minnesota Legislature.
- Achieving complete compliance with Restriction on Disposal, resulting in WTE facilities capturing most of the remaining materials.
- A minimum of 5% of material sent to landfill.

The value of setting a comprehensive environmental impact target that counts emissions reduction from the entire materials management system as all strategies become opportunities for meeting the target. This means a county can choose to do more waste reduction or reuse to reduce their GHGe more significantly and progress further on meeting their environmental impact, than solely focusing on recycling to achieve their 75% recycling rate. If a county is already meeting or exceeding their environmental target, the MPCA would recommend adjusting their target to be more ambitious and support continued work on reducing impacts from materials being handled. County-specific calculations will be made using 2021 SCORE data.

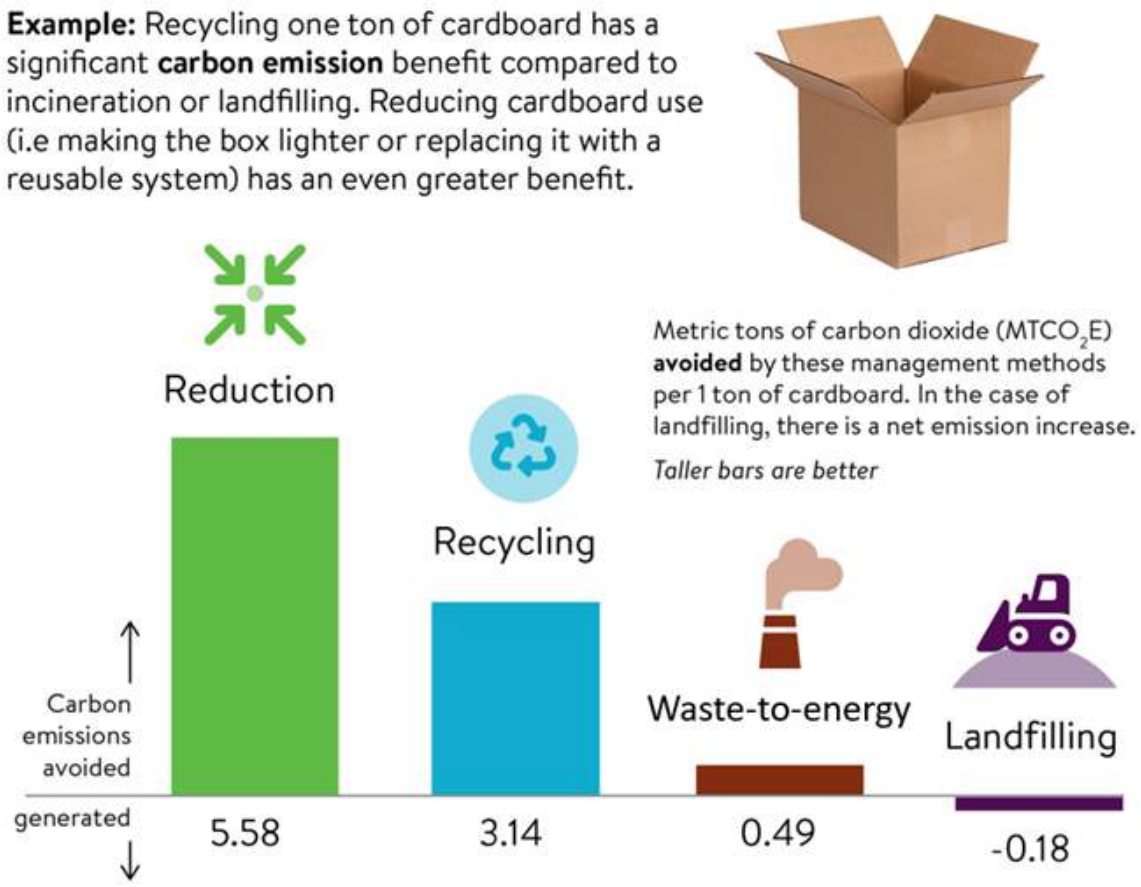
Each county will be able to work with their MPCA Planner to review their current progress and identify options for meeting their environmental impact target, determining which programs will have the greatest benefit. For example, counties will be able to see how the amount of emissions reduction achievable by focusing on food rescue versus composting. The target will not replace the 75% recycling goal already in statute.

The following example, using data from Scott County, illustrates how the environmental impact target will be implemented and shows two potential scenarios. In the first scenario, Scott County meets the 75% recycling rate goal by 2030 as required by the Minnesota Legislature. The rest of their materials are handled business-as-usual, meaning the county didn't implement additional waste reduction, reuse, or WTE strategies. The total GHGe savings is 234,037 metric tons of carbon dioxide equivalent ($mtCO_2e$).

In the second scenario Scott County maintains their current 55% recycling rate until 2030. However, they invest in waste reduction strategies and reduce materials by 10%. The county accomplished this by focusing on preventing food from going to waste, reducing paper use, and eliminating a small number of single-use items and replacing them with durable reusable systems. The total GHGe savings is 224,060 $mtCO_2e$. In the second scenario, only 10% of the waste is being source reduced. Yet, compared to a 20% increase in recycling in the first scenario, the amount of GHGe is very similar. How materials are managed makes a big difference. Scott County can achieve nearly twice the environmental and human health benefit by reducing materials than recycling in this scenario. This affirms the waste management hierarchy and emphasizes the importance of first reducing, then reusing, and then continuing to manage materials down the hierarchy as needed if the first two strategies are not feasible.

The MPCA staff will work with counties to assess their options for meeting the environmental impact target using an interactive tool based on EPA's WARM. The MPCA will be able to model county-specific scenarios for materials management using data that the counties currently provide. The MPCA will not be requesting additional information from the counties to track this new goal.

Figure 7. Carbon emissions impact of different management types



Strategies and best management practices to achieve the objectives of the MPP

There are various approaches to meet the system objectives of this MPP. The TCMA waste management system is governed by multiple public and private entities, and a variety of strategies provide the flexibility to meet the needs of each program or situation. The state, counties, cities, businesses, nonprofits, communities, and residents all have specific roles and responsibilities for improving solid waste management. To minimize conflicts and inefficiencies, it is important to select strategies that align public and private objectives, to work together to identify necessary changes to existing strategies, and to indicate where new strategies are needed. Counties can proposal alternative strategies if they see fit. Proposals must achieve comparable objectives and will be subject to agency approval. The point value of alternative optional strategies will be determined by the MPCA. Many of these strategies will require investment and additional funding. The MPCA will advocate for additional funding for the system when appropriate and asks the counties to do the same.

County solid waste plan evaluation point structure

Each topic below includes key strategies that will be instrumental to reaching the objectives of this MPP. Certain strategies are required to be incorporated into CSWMP. Optional strategies are assigned a point value. The counties will pick from any of the optional strategies to reach a minimum of 75 points.

The strategies are weighted by difficulty and by management strategy in accordance with the Waste Management Hierarchy. This places an incentive on environmental and human health outcomes while

allowing counties the flexibility to design and adapt their solid waste programs. The various optional strategies are worth 4-9 points. The optional strategy point total is 194 points, and the counties must have a minimum of 75 points for their CSWMP to be approved. Appendix G houses a strategy spreadsheet for counties to use in designing their solid waste plan.

Costs implications of strategies should be estimated by county staff when considering feasibility of implementation. The MPCA is committed to achieving the objectives established in this MPP and intends to assist with strategy implementation as noted below.

Improving the reliability of the data

The MPCA strategic plan calls for the Agency to "accelerate the availability of data and information in a self-service format." From a solid waste perspective, one of the best ways to accomplished this is to ensure that data is consistently collected through the most reliable sources and that all waste and waste reduction be tracked. The MPCA and the counties have historically focused on only MMSW. Little attention has been directed toward the measurement of demolition debris and industrial waste (ISW).

The SCORE program created a strong framework for tracking progress toward the goals and objectives of the WMA. Over the past 30 years, there have been some problems identified with traditional measurement methods. Like the MPCA and counties, SCORE historically focused on only MMSW, with no data on ISW reported or requested. In addition, the success of county programs has been measured through a weight-based system that treats all material tons equally.

Our improved ability to understand the environmental and human health impact of different material types has exposed the limitations of weight-based measures. Weight-based measures are important but have limitations. Data analysis can be enhanced by collecting additional data in addition to the weight-based measures. A moving target of what counts as recycling has added to inconsistencies. In recent years, yard waste and compost have been added to the recycling side of the ledger.

Ultimately, a large focus has been placed on recycling in county programs to the detriment of waste reduction and reuse. As discussed above, the greatest environmental and human health benefits are not realized through recycling. Improved reporting provides the information needed to understand how to achieve better environmental and human health outcomes. The added reuse component to the SCORE report captures the reuse activities within counties. The intended outcome is to fill a data gap that has existed since the inception of the program in the early 1990s. Hauler reporting requirements were added in 2016, but inconsistent compliance from the haulers, inconsistent support from counties, and staffing issues at the MPCA have led to lax enforcement and limited follow-up.

As previously mentioned, SCORE is only focused on MMSW, with no requirements to track other waste streams. Landfills report amounts of demolition debris and industrial waste annually. Yet, there is limited data regarding recycling rates of those two material streams. We also have limited data about non-MMSW landfill diversion such as recycling. To improve the management of non-MMSW materials, it is critical to have a better reporting for this waste sector. Despite these challenges, there are several strategies that can be pursued that will improve the management of data in the TCMA.

Required strategy:

The strategy listed below is required to be incorporated into the CSWMP because it is relatively simple or has significant environmental benefit.

1. **Increase compliance with hauler reporting per Minn. Stat. § 115A.93**. Compliance with hauler reporting in metro counties has been mediocre. In 2021, these compliance rates were between 45% and 68%, within the TCMA. There are several challenges regarding the compliance numbers. Some

haulers may be misreporting to counties. In these cases, counties should hold haulers accountable for completing their reporting accurately. Reliable hauler reporting provides a benchmark for the objectives of this MPP. Hauler reporting is a shared responsibility for the state and county. Cooperation from counties to maintain accurate license lists will allow the MPCA to trust the information collected. Both the state and counties benefit from the collection of this data. Sharing in the responsibility ensures accuracy and efficiency. Best practices in the promotion of compliance with hauler reporting include:

- Sending quarterly reminders to all licensed haulers
- Reviewing submitted data in ReTRAC
- Active communication and follow-up regarding incorrect or missing hauler data
- Requiring proof of data submittal prior to license renewal
- Cleaning up the regional license data to ensure that haulers are truly operating in the counties

Improved compliance and data integrity would facilitate the mapping of waste flow in the TCMA from origin point to end destination. We need to understand the breakdown of residential and commercial tonnage and the scope of material exports. Dakota County demonstrates that improving compliance with the haulers is possible when county staff are persistent. Compliance rates for haulers in Dakota County is 68%, compared to 45-55% in other counties in the metro.

2. **Provide required county reporting.** Ensure the MPCA receives all data in the state-issued format. Counties should collaborate on creating best data practices for soliciting data from organizations. The MPCA and counties shall standardize waste composition sorts for consistency. SCORE, certification, and the metro county annual reports are also targeted in this strategy.
3. **Require waste composition study at least once every 5 years at all landfills that are located within your county.** Waste composition study data helps identify important trends on waste types and quantities. Landfill information will help policy, planning, and implementation, such as assessing capture rates. Counties with landfills receiving TCMA waste should introduce an ordinance to reinforce this requirement. Waste composition studies shall include MMSW, ISW, and demolition debris disposal streams. The MPCA seeks to assure all landfills receiving metro waste operate with equal requirements. Dakota County ordinance no. 110 establishes a requirement for waste composition studies to be performed every five years at all land disposal solid waste facilities. Performing waste composition studies on a regular schedule will help determine generation rates, aid in capture rates, and provide material type breakdown.

Optional strategy:

The following strategy is optional and may be incorporated into a CSWMP. Each strategy has been assigned a point value, which is added to the total amount of points the county must achieve for approval of their CSWMP by the MPCA.

4. **Improve recycling data collection at businesses within the county.**

   Point Value: 7

   Commercial buildings required to recycle in Minn. Stat. § 115A.151 should report their recycling tonnages to the county in which business is conducted. Exempted businesses can provide documentation of their licensed hauler's reports to the MPCA. Develop an ordinance that requires businesses to assign a recycling manager. The recycling manager shall report weight, material type, and management method for self-hauling. Self-hauling shall include contracted services outside of licensed haulers. Alternative to development of an ordinance would be developing a surveying approach. Create a survey method resulting in a statistically significant number of annual responses.

Review and analyze to assure reliable commercial data are being collected. Carver County conducts an annual survey of businesses to collect data from generators who self-haul. Replicating this approach would fulfill this strategy.

State-led strategies:

The following strategies are the responsibility of the MPCA and will support the efforts by the counties.

5. **Require waste composition study at all landfills.** Understanding the composition of MMSW, demolition debris, and ISW streams is critical to perform GHG calculations and to quantify other environmental impacts. Resource recovery facilities are currently required to conduct waste composition studies every five years. This requirement should be extended to all disposal facilities for consistency and equal treatment, and to have comparable information from the data. Waste composition study data provides important trend information on waste types and quantities. The addition of landfill information will help policy, planning, and implementation efforts, such as assessing capture rates. The State will work to require waste compositions across the state with the express purpose of obtaining better data.
6. **Develop appropriate and consistent waste reporting systems to measure all waste.** Measuring and reporting all waste (including MMSW, demolition debris, and ISW) through annual reporting is necessary for the state and counties to effectively manage waste to its highest and best use. Alternative measures to weight-based reporting that encompass the environmental impacts of a material should be researched and considered. This could include using SMM tools such as capture rates and human health impact data that focus more on the impact of a material throughout its life cycle. The MPCA will continue to build on initial efforts to report on the environmental and human health impacts utilizing the data that counties currently submit. High quality data will result in the development of strong statewide policy. Developing a system will support evidence-based decision making for future laws, policies, rules, and program planning. Commonly recovered materials from demolition sites are concrete, shingles, wallboard, carpet, and lumber. A robust system for evaluating these materials will help counties and the state prioritize our efforts.
7. **Continue to explore options for growing the agency's LCA data, modeling, and resources to better support counties in measuring and tracking environmental and human health impacts.** This includes translating county solid waste measures from weight-based measures to GHGe and other environmental and human health impacts and periodically updating the state's consumption-based emissions inventory to complement the current in-boundary emissions inventory. It also includes incorporating environmental impact data across agency materials management and solid waste management programs to identify priority materials and strategies to target the highest-impact categories.
8. **Continue to engage with counties in the development of an environmental target that better accounts for and incentivizes programming and actions higher on the hierarchy.** The recycling rate serves a specific purpose and there is an opportunity for the MPCA to evaluate and develop an approach to represent county SMM efforts more holistically.

Regional solutions

The TCMA counties do not have a formal regional waste management district. Yet, it is practical to implement certain strategies at the regional level. Collaboratively designing and modernizing a materials management system will benefit all TCMA counties.

Required strategies:

The strategies listed below are required to be incorporated into the CSWMP because they are relatively simple or have significant environmental benefit.

9. **Participate in an annual joint commissioner/staff meeting on solid waste.** This annual or semi-annual meeting will provide an opportunity to get a county commissioner and lead staff from all seven counties together to discuss relevant waste topics. The purpose of this strategy is to help ensure that all seven county boards understand the challenges that each county faces, learn from the CSWMP of other counties, and examine places to collaborate to meet the regions solid waste goals. MPCA will take the lead in organizing this meeting at the inception.
10. **Commit to standardized outreach and education.** The seven counties in the TCMA must coordinate on their recycling messaging to avoid confusion among residents. To coordinate, each county should attend the Recycling Education Committee (REC) meetings and use REC communications calendars. If a deviation is made from the REC materials, the TCMA counties all must agree. Counties should utilize or adapt the MPCA-designed library exhibits on food storage tips and the impacts of food choices to educate residents on preventing food waste. To create regional consistency, counties should acknowledge organics recycling and food scraps are both in use in different areas of the TCMA. Counties should coordinate to reduce confusion associated with the use of different terminology within the region. Outreach and education efforts should include how to handle materials not accepted in curbside collection bins. These materials should include lithium-ion batteries, scrap metal, and other materials accepted by environmental centers and household hazardous waste drop-off sites.
11. **Engage in efficient and value-added infrastructure planning.** TCMA counties should seek to eliminate system redundancy by sharing and co-developing CSWMP for managing all material types. This collaboration includes the use of emerging technologies that have the potential to reduce or manage waste higher on the waste hierarchy and that have the potential to impact materials and processes that have a greater environmental impact. TCMA counties should foster a space for counties and private partners to work cooperatively and not competitively to build system resiliency. More processing capacity to assure materials with useful life are routed appropriately is imperative. Food-derived composting and food rescue are high priorities for infrastructure planning. MRFs face pressing issues such as overflow of materials and a need for fire suppression.
12. **Develop plans for large facility closures to reduce landfill reliance.** The plans must include:
    - Develop a plan that identifies alternatives that can manage the waste currently managed at the facility. This plan must include landfills, transfer station infrastructure, recycling and composting infrastructure and other logistical solutions to manage MMSW.
    - Identify a plan to push waste up the hierarchy including an effort to prioritize reduction.
    - Issue a letter assuring waste to one or more of the alternative locations suitable as part of the CON process for landfill expansions when necessary.
    - Include in the plan acknowledgement of liability associated with increased landfilling including the understanding that at some point in the future the county may be identified as a responsible party for a superfund clean-up investigation.
    - Identify and evaluate potential locations within the county or region for a disposal facility that can be developed within the timeline of the facility closure.
        - Any new facilities that are sited should take clear and effective measure to ensure that they are not located in environmental justice areas.
    - A list of policy, program, infrastructure changes needed to eliminate reliance on WTE and/or landfilling.
    - Consideration of where money saved by closing the facility could be reinvested to benefit the region.

Waste reduction

In accordance with Rule 9215.0580 and Minn. Stat. § 115A.02, counties are responsible for advancing prevention and reuse along with other solid waste management strategies. Waste reduction means not generating any materials that require further recycling, composting, disposal, or other management. Waste reduction includes reducing the amount and toxicity of materials generated. It is at the top of the hierarchy, because it is the best option for the environment. Using an SMM framework, counties can design programs that direct limited resources toward waste reduction programming and infrastructure to have the greatest impact on their communities. To quantify this impact, counties can now report their waste reduction activities by material type to the MPCA. Related GHGe savings can be found in the SCORE report.

Waste reduction is the most effective way to lessen the need for resource extraction, reducing pollution at the source and conserving materials for future generations. Measuring waste reduction requires setting a baseline of consumption and comparing all future consumption to that baseline. One example of doing this on a broad scale is represented in the SCORE report.

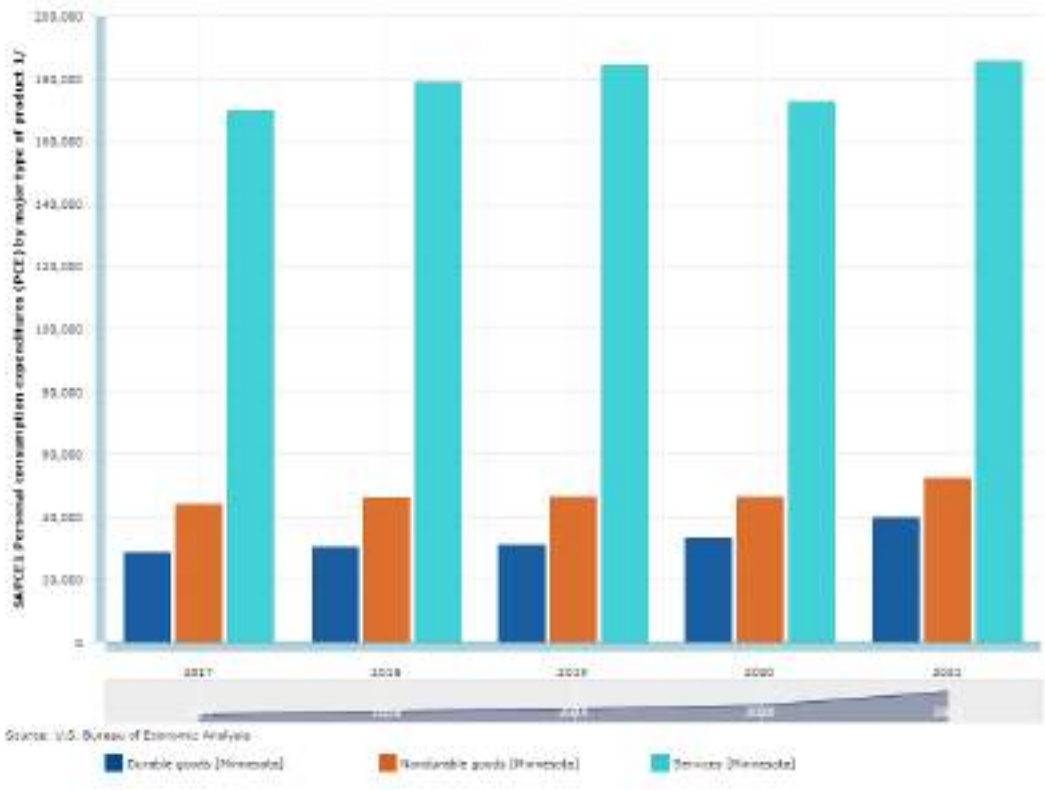
Based on statewide waste generation data, starting in 2008, Minnesotans are generating less waste than expected based on projections using the 1997 rate. There was a dip in the actual waste generated during the national 2008 recession that extends into 2010, mirroring the economic recovery period. There has since been a steady upward trend in waste generation. In 2020, however, expected waste generation sharply declined while actual waste generation continued to increase. This anomaly in expected waste generation is primarily due to a large drop in per capita expenditures in the "Services" consumption category, including food services and accommodations, recreation services, and transportation services. Spending in both the consumption categories of "Durable Goods" and "Nondurable Goods" remained consistent with the trends from previous years. This can be explained by changes in purchasing due to the COVID-19 pandemic, in which the service industry was most affected by periods of lockdown and residents spent more time at home. However, because "Durable Goods" and "Nondurable Goods" did not see the same decline, resulting waste generation will continue to increase in future years as those purchased items in 2020 are disposed of at the end of their useful life.

Waste reduction in real life



MN Waste Wise utilizes the Leanpath Food Waste Prevention Platform. This an online software helps staff identify and dramatically reduce food waste and operate a more sustainable facility. The results were determined by measuring and tracking purchasing of food items throughout several months. Overall, three restaurants reduced their food waste by 29% in value, totaling $40,110. Additionally, the offered solutions allowed the participating restaurants to decrease their waste bills.

Figure 8. Personal consumption expenditures



Increase and document prevention of wasted food and food rescue

Up to 40% of the food in the United States goes uneaten, according to a Natural Resources Defense Council (NRDC) report. At the same time, one in thirteen Minnesotans face hunger. The greatest environmental benefit—in terms of reductions in energy use and GHGe—is made when we can prevent food from being wasted rather than managing or disposing food waste.

The MPCA recently conducted a sort of food in the MMSW stream. The waste sort uncovered that almost half of the food Minnesotans threw in the trash could have been eaten. There is a significant opportunity for counties to work with residents and businesses on systems improvements and behavior changes that promote the prevention of wasted food.

Wasted food wastes the resources used to produce it, such as agricultural land, water, and energy, and generates significant environmental impacts, such as GHGe contributing to climate change, consumption and degradation of freshwater, degradation of soil quality, and degradation of air quality. According to EPA's 2021 report, "From Farm to Kitchen: The Environmental Impacts of U.S. Food Waste," uneaten food in the United States annually embodies:

- 140 million acres of agricultural land – an area the size of California and New York combined
- 5.9 trillion gallons of fresh water – equal to annual water use of 50 million American homes
- 778 million pounds of pesticides
- 14 billion pounds of fertilizer – enough to grow all the plant-based foods produced each year in the United States for domestic consumption
- 664 billion kWh of energy – enough to power more than 50 million U.S. homes for a year
- 170 million $MTCO_2e$ GHG emissions (excluding landfill emissions) – equal to the annual CO_2 emissions of 42 coal-fired power plants

Reducing one ton of food saves about twenty times more GHGe than composting that same amount of food waste. Households are the biggest contributor to this waste. Preventing wasted food is one of the more impactful ways that everyday Minnesotans can mitigate climate change. Addressing this issue would impact not only the environment but has the potential to support the needs of TCMA residents experiencing food insecurity. According to the NRDC, redirecting one-third of the food currently being thrown out would be more than enough to cover unmet food needs across the country. Nearly 1 in 10 households in Minnesota experience food insecurity, as reported by the Minnesota Department of Health.

Purchasing

Minnesota's Sustainable Procurement Program is a partnership between the MPCA and the Department of Administration. The Sustainable Purchasing Program currently prioritizes 19 state contracts for the inclusion of sustainability requirements. As of fiscal year 2020, 53% of priority contracts are considered "100% sustainable." Allocating funds toward sustainable materials is key to ensuring support for sustainable, non-toxic, and closed-loop markets. Sustainable purchasing considers environmental, social, and economic factors by considering the lifecycle impacts of a product — from raw material extraction through end-of-life management. This approach allows buyers to decrease the impact of their purchases more strategically and effectively. Local governments can save money and identify where the greatest reductions in impacts. Purchasing from the 19 priority state contracts available through the Cooperative Purchasing Venture (CPV) program allows counties to easily expand the impact of the state's sustainability efforts.

Environmental product declarations (EPDs) are another tool to influence purchasing power at the state level. An EPD provides transparency about the environmental life cycle impacts of a product. EPDs are increasingly being used to account for the full scope of impact for building materials.

Required strategies:

The strategy listed below is required to be incorporated into the CSWMPs. It is required because it is relatively simple or has significant environmental benefit.

13. **Provide grants for or access to software that can track food waste.** By 2025, implement county programs that prevent wasted food to businesses and institutions that produce food waste. According to the EPA, one-third of all food in the United States goes uneaten, of which a majority ends up in landfills or WTE facilities. Food waste tracking software can aggregate data that can be easily reported as a reduction in SCORE. Most software can also provide environmental metrics, which could be used to further determine impacts. These metrics can be shared with customers and users to educate them based on real-time results, which can have impacts on the users' behavior outside of these facilities. Hennepin County has previously provided some limited grant funding for businesses to utilize software for preventing food waste. Additionally, Minnesota Waste Wise has assisted businesses with implementing programs that rely on food waste tracking software.
14. **Establish partnerships between food rescue organizations and restaurants/stores to increase food rescue.** Developing reliable networks between institutions with excess food and institutions that can rescue the food is imperative to the success of these programs. Established organizations such as Second Harvest Heartland can assist with food rescue efforts. This could be accomplished by assigning county staff or a GreenCorps member to build these networks. MPCA can be contacted to learn more about how to host a GreenCorps member to help with these types of efforts.
15. **Launch bi-annual sustainable consumption challenges for residents.** These challenges should focus on reducing waste produced by residents. Organize and run these challenges for residents that encourage them to reduce their own waste in various areas. Examples include Zero Waste

Challenge, EPA Get Smart Challenge, and Track Food Waste at Home – Hennepin County. The campaigns should also incorporate messages that encourage buying more durable products and repairing these items to extend their useful life (including textiles, electronics, and furniture.). These products may cost more, so it is important to frame these campaigns in a way that acknowledges how the cost can be a barrier.

16. **Implement a formal county sustainable purchasing policy using** MPCA guidance. Sustainable purchasing policies shows a commitment to reducing environmental, social, and economic impacts. The policy should increase county purchases of goods that are reused, remanufactured, and designed for durability and repairability. Identify purchases that are not necessary and eliminate them. County-wide spending should be analyzed for redundancies. Those redundancies should be eliminated. Procurement professionals should collaborate and forecast purchases whenever possible.
17. **Participate in Responsible Public Purchasing Council meetings.** This bi-annual meeting connects county, city, township, and other Cooperative Purchasing Venture member organization purchasers. The purpose of this group is to support purchasing leaders to be good stewards of public dollars and to share information about sustainable criteria developments throughout purchasing sectors. Each county shall plan and host two Responsible Public Purchasing Council meetings by 2030 and send a representative to attend each meeting.

Optional strategy:

The following strategy is optional and may be incorporated into a CSWMP. Each strategy has been assigned a point value, which is added to the total amount of points the county must achieve for approval of their CSWMP by the MPCA.

18. **Work with health inspectors to educate restaurants and other establishments that have excess prepared food to donate.**

    Point Value: 7

    There is widespread concern over the liability of donating prepared food. Enlisting county and city health inspectors to help willing restaurant operators navigate the laws, statutes, and ordinances for food donation can help to support the growth of additional sources for donations. This strategy prevents wasted food and proposes a solution to food insecurity, which is something 1 in 17 Minnesotans face (according to Feeding America). Partner with the health inspectors in your county to distribute information on food donation and food waste avoidance.

Reuse

Reuse is a waste reduction strategy as it extends the useful life of items or materials. This keeps materials in use and decreases the demand for new production. Compared to recycling, reuse further reduces environmental harms. It accounts for embodied emissions and impacts from the upstream manufacturing of materials and products. Recycling still requires energy and resource inputs to convert an existing product into a material stock. Only then can it be incorporated into new production. This generates additional environmental impacts and wastes that are not created when a product is reused.

The state of Minnesota also benefits economically and socially from reuse. According to a report published by Reuse Minnesota, the reuse economy generates between $3.1 and $4.7 billion in revenue each year. At the time of the report publication, there were more than 13,000 reuse businesses, accounting for more than 45,000 jobs. Reuse jobs are usually not outsourced because they handle existing products within a community or region, making reuse inherently local. The report estimates that reuse contributes $2.4 billion in social value (i.e., benefits such as taxes, wages, and shareholder profits). Resale, rental, repair, and sharing also expand access to items that may otherwise be unaffordable or

impractical to individually own. Reuse training, skills development, and local events contribute to a strong sense of community. A thriving reuse economy often depends on established networks. It subsequently bolsters collaboration between businesses, educational institutions, organizations, and residents.

For these reasons, it is critical that reuse strategies and programming be a higher priority and receive significant investment at the state and local levels. Recycling and composting strategies are more familiar and comfortable in most systems. Without distinct reuse targets, guidance, and goals, it is often the default to fall back on end-of-life management and primarily direct resources and infrastructure investment towards recycling and composting.

Some of the most successful and impactful reuse strategies are not new, innovative, or expensive technologies. Revitalizing these strategies, determining the requirements or incentives that best support them, and raising awareness or comfort with them is an important path forward for TCMA counties. When proposing these strategies, take the time to engage across the community. This ensures they are developed in an inclusive way so that implementation does not disproportionately impact certain businesses or neighborhoods and participation increases. Particularly when passing policies that require new actions or fees for specific entities, allow time for outreach and create support systems that aid in that transition.

Required strategy:

The strategy listed below is required to be incorporated into the CSWMP because it is relatively simple or has significant environmental benefit.

19. **Offer grants or rebates for organizations to transition to reusable food and beverage service ware.** Reusable service ware is any product designed to be used for serving, consuming, or transporting prepared food and raw food, including but not limited to reusable plates, bowls, trays, wrappers or wrapping, platters, cartons, condiment containers, cups or drink ware, or any container in or on which prepared foods and raw foods are placed or packaged for consumption. Reducing or removing the barrier of the cost of investment for reusable service ware can help institutions to make this change. Assistance should cover both the cost of materials and building modifications to support the cleaning, storage and maintenance of reusable food and beverage service ware.
20. **Offer grants for waste reduction, reuse, and repair.** Shifting more funding into this focus area can support the goal to minimize the need for disposal or recycling. Consider broad eligibility including public, private, and non-profit entities. Do not specifying that projects need to be innovative as organizations may already be contributing positively with their current reuse and repair offerings and simply need the additional funding to support or expand their existing operations. Consider expanding support offerings for grant applications and documentation as many reuse and repair organizations may be smaller operations that have limited capacity and staffing for grant administration.
21. **Implement a green meeting policy.** A "green" meeting is one that is organized and implemented in such a way as to minimize negative impacts on the environment and promote a positive social impact for the host community.

Optional strategies:

The following strategies are optional and may be incorporated into a CSWMP. Each strategy has been assigned a point value which is added to the total amount of points the county must achieve for approval of their CSWMP by the MPCA.

22. **Implement a county policy encouraging the use of reusable food and beverage service ware.**

    Point Value: 6
    This can be done as a "green event policy" or as a part of a sustainable government purchasing requirement. This policy should include tracking and reporting to ensure it is being implemented. This should be required of all county events and meetings.

23. **Adopt an ordinance with a mandatory consumer charge or ban for single-use items.**

    Point Value: 9
    The "Bring Your Own Bag" ordinance in Minneapolis can serve as an example of how to roll out an ordinance to set a fee for single-use items. A set fee for each container type should be determined by the ordinance. The ordinance may allow BPI-certified compostable and recyclable take-out service ware. The fee will serve as an incentive for customers to participate in reuse behavior. Alternatively, the ordinance can ban certain single-use items.

24. **Join and/or actively participate in a reuse network, like Reuse Minnesota, to provide county and city staff with learning opportunities to broaden their reuse expertise.**

    Point Value: 6
    The most effective way to reduce waste is to not create it in the first place. As a result, reduction and reuse are the most effective ways you can save natural resources, protect the environment, and save money. County staff participation in this type of network also supports the development of statewide resources, helps develop county programs, improves advocacy, and strengthens connections for reuse organizations.

25. **Establish a Repair Ambassador program, like the Recycler/Composters (RCAs) Ambassador programs.**

    Point Value: 7
    Programs exist in several counties and can be a collection of connections between skilled individuals, for-profit and non-profit organizations, and a volunteer coordinator. Fix-It Clinics offer free, guided assistance from volunteers with repair skills to disassemble, troubleshoot, and potentially fix small household appliances, clothing, electronics, mobile devices, and more. Fix-It Clinics teach valuable troubleshooting and basic repair skills, build community connections, and reduce the number of repairable items that are thrown in the trash. These groups should have goals to grow the volunteer base and offer regular fixer trainings to support Fix-It Clinics or Repair Cafes.

26. **Establish a reuse location for residential drop-off and pick-up.**

    Point Value: 7
    Some items are not accepted by reuse businesses in the region because they don't have significant resell value. Those items not desired by the reuse businesses in the region could be made available to the public for free (reuse warehouse at the drop-off/transfer locations) or donated to other non-profit thrift operations in the area. Items in poor condition would be managed through the existing county solid waste and recycling channels.

27. **Establish a curbside set-out day to allow residents to set out used items for reuse.**

    Point Value: 7
    Coordinate this day to occur 1-2 days prior to curbside, large item pick-up by haulers and with reuse businesses to pick-up unclaimed items. In 2021, the Bloomington City Council passed a plan to partner with Better Futures Minnesota for collection of reusables from curbside. The pilot program has been in place since November 2022.

State-led strategies:

During information-gathering sessions with MPCA staff, metro counties noted that two of the main barriers to working on waste reduction and reuse are lack of statewide legislation that support or

advance these strategies and lack of consistent and clear measurement, including both standardized methodology and access to environmental data. The following strategies address this input and are the responsibility of the MPCA.

28. **Develop standardized guidance and methodology for tracking waste reduction and reuse activities and their resulting benefits.** With the 2021 SCORE reporting, the MPCA added a reuse table for counties to enter data for material and product reuse by the county or by organizations/businesses in the county. These additional resources can be developed to further support and better acknowledge reuse programming that counties implement going forward.
29. **Research and pursue financial strategies to best incentivize waste reduction and reuse, such as grants and loans.** In the shorter term, the MPCA continues to explore opportunities for ongoing funding for reuse by expanding eligibility with current grant programs and pursuing the development of a reuse-specific program.

Collection best practices

A variety of methods are used to collect recyclables, organics, and trash. There is some room for diversity in methods used from one community to the next. However, implementing best management practices will increase the recycling rates in the region.

Required strategies:

The strategies listed below are required to be incorporated into the CSWMPs because they are relatively simple or have significant environmental benefit.

30. **Collect recyclables, organics, and trash on the same day.** Same day collection of recycling and trash makes it easier for residents to remember. Tracking different collection schedules can be challenging, especially if change occurs often. Implementing same-day collection for recycling and trash helps residents increase waste diversion. Counties should work with their cities to implement same day collection for recyclables and trash. Counties or cities can implement this through licensing or ordinance provisions.

Optional strategies:

The following strategies are optional and may be incorporated into a CSWMP. Each strategy has been assigned a point value, which is added to the total amount of points the county must achieve for approval of their CSWMP by the MPCA.

31. **Collect recycling weekly by 2030.**

    Point value: 7

    Recycling is collected bi-weekly in most cities with single stream recycling programs. Since recycling carts often reach capacity during the two-week interval between collections, some residents throw the extra recyclables into their garbage container. By offering weekly collection, the recycling carts are less likely to exceed capacity. Residents who miss a bi-weekly recycling collection find themselves with a month's worth of recyclable material to fit into a cart that many times is completely full after two weeks. If current driver shortages are affecting the ability to meet this practice, the county should collaborate with haulers to develop a solution until the driver shortage is resolved. Counties should work with their cities to implement weekly collection for recyclables. The county can require weekly collection, or make sure that cities require it in their respective ordinances or license provisions. Establishing a system that allows for free additional recycling bins could also fulfill the objective of this strategy if residents are likely to have space for additional containers and/or other local circumstances make weekly collection untenable.

32. **Pair the option of bi-weekly trash collection with weekly recycling and organics collection.**

Point value: 7

By pairing weekly recycling and organics collection with bi-weekly trash collection, communities can achieve greater recovery rates. Since most residential waste is recyclable or compostable, very little waste remains in the trash when curbside recycling and organics programs are provided. Organics collection removes the portion of the waste stream likely to decay, which causes bad trash odor, so trash does not need to be collected as frequently. Offering recycling and organics collection weekly allows for a transition to bi-weekly trash collection for residents that may want to, leading to potential cost savings for haulers and residents. Bi-weekly trash collection incentivizes residents to place all recyclable and compostable materials in the weekly containers and can result in greater recovery rates. Counties should work with their cities to have the option to pair bi-weekly trash collection with weekly recycling and organics collection.

33. **Contract for residential recycling and organics by 2030.**

Point Value: 7

Research has shown that organized recycling collection programs yield a higher recycling rate when compared to non-organized recycling programs (The Benefits of Organized Collection, MPCA, February 2012). Roughly 60% of communities in the TCMA offer organized recycling collection. However, many cities still rely on subscription service provided by licensed haulers. While some of these non-organized programs have been successful, the results from communities with organized recycling are consistently stronger. By 2030, cities in the TCMA should provide organized recycling collection for residents. To implement this strategy, counties may:

- Require that cities offer organized residential recycling collection to receive funding for recycling programs.
- Provide technical assistance to cities developing and implementing an organized recycling program.

The MPCA also plays a role in implementing this strategy and may provide technical assistance to cities developing and implementing a new, organized recycling program.

34. **Contract for residential MMSW collection by 2030.**

Point Value: 7

In the TCMA, 37% of cities currently contract for residential MMSW collection, compared with approximately 70% of cities nationwide. However, over the last few years, several communities followed the process required by Minn. Stat. § 115A.94 and successfully implemented organized MMSW collection programs for their residents. Although transitioning from an open MMSW collection system to an organized MMSW collection system is not simple, there are many environmental benefits of organized collection, and counties should work with cities to make this transition.

In addition to the environmental benefits associated with increasing recycling, creating efficiencies in waste collection can reduce both fuel consumption and emissions. Fuel consumption during collection activities in cities with open collection systems is typically much higher than that of cities with organized systems. The number of haulers and their market share can affect overall fuel consumption and emissions. In an open system, trucks from many haulers travel the same alleys or streets. In an organized system, there may be the same number of haulers, but only one truck travels down each alley or street, resulting in lower fuel use because fewer miles are traveled to collect the same amount of material. Simplifying the hauler routes leads to efficiencies that would lighten the driver shortage. Open cities with one hauler assigned to more than 60% of the market share (e.g., Eagan) would see a significant reduction in fuel use by switching to an organized system. A city with many haulers, each having a smaller market share, (for example, St. Paul) would realize

even greater savings. Fewer vehicle miles traveled also results in less air pollutant emissions from heavy duty waste/recycling collection vehicles. Public concern has increased regarding human health and environmental impacts of particulate matter and nitrogen oxides, which are emitted in large amounts from heavy duty vehicles. (Source: The Benefits of Organized Collection, MPCA, February 2012).

Organized MMSW collection programs are also often more cost-effective when compared to subscription programs. Data in Table 4 was derived from the City of Richfield which was the most recent city to organize trash collection. During its process, the city received bills from residents to be able to assess the cost of collection prior to implementation. The monthly cost for residential MMSW collection varies by container size. Although the cost for a 90-gallon cart is similar in both systems, the cost in organized collection systems is lower on average.

Table 4. Monthly cost of residential MMSW service in the Richfield before and after organized collection

Container size	35 gallon	65 gallon	95 gallon
Subscription average	$16.33	$17.99	$18.85
Organized average	$11.90	$15.03	$18.16

Recycling management

Regionally, it is important to apply SMM concepts to prioritize targeted materials that are the most recyclable materials over those with a more energy-intensive recovery process. It is also important to identify and focus efforts on larger generators of recyclables. A regional plan for temporary storage of recyclables will assure diverted materials are not managed at the lowest levels of the hierarchy. Additional space for recyclables as a contingency plan if interruptions in the system occur can avoid those materials potentially being landfilled or incinerated at WTE facilities. Preprocessing at WTE facilities and landfills will increase recycling rates.

Required strategies:

The strategies listed below are required to be incorporated into the CSWMP because they are relatively simple or have significant environmental benefit.

35. **Recruit a minimum of 12 commercial businesses a year to recycle at least three materials from their operations and promote the environmental and resource benefits.** The commercial recycling statute Minn. Stat. § 115A.151 requires businesses in the TCMA that contract for four cubic yards or more per week of solid waste to recycle at least three materials. The commercial recycling law is an opportunity for businesses to decrease their waste, reduce their taxes by increasing recycling, and support Minnesota's recycling industry, which creates approximately 37,000 jobs in the state. There is no tax on recyclables or organics in Minnesota, but there is a 17% state solid waste management tax charged on all commercial trash. Many counties charge additional taxes or fees as high as 53% on trash, but not on recyclables or organics.
36. **Establish mandatory pre-processing of waste at resource recovery facilities and landfills by 2030.** Achievement of the 75% recycling goal will require major system changes. Upfront processing of waste to recover recyclables at transfer stations, resource recovery facilities, and landfills may help achieve that. Steel and aluminum are the easiest to recover from MSW, but other materials should be considered if possible. Processing methods should be evaluated prior to implementation to ensure optimal effectiveness.

37. **Provide assistance to multi-family properties to improve recycling (4 or more units with shared walls).** Some examples of activities that would achieve this strategy include:
    - Education to residents and property managers on how to handle and route materials to their proper bins and how to recycle items not accepted in building provided collection
    - Financial and/or technical assistance for infrastructure improvements and implementation of improvements
    - Assure property manager plans and provides sufficient space for collecting recycling based on the number of residents
    - Collaborate with cities to promote assistance resources, on-site education, and implementation of recycling improvements
    - Conduct outreach to multi-family association networks (e.g., Minnesota Multi Housing Association) to promote resources

State-led strategies:

The following strategies are the responsibility of the MPCA to support the efforts of counties.

38. **Assist with tracking commercial recycling self-hauling activities.** In addition to establishing a baseline, identifying the large volume generators of recyclables is necessary to developing a targeted, effective commercial recycling program. The MPCA should review existing data from other states and the EPA on typical generators of large quantities of recyclables and work with counties to interpret this data for use in program implementation. If appropriate data is unavailable, the MPCA will work with the counties to develop a list of large volume generators, as well as a list of generators of the most impactful materials.

Recycling market development

Traditional recycling markets

Without end markets to use recyclable material, there is no recycling. Recycling market development (RMD) creates and maintains demand for recyclable materials. End markets buy these materials for further processing or to produce products. RMD looks at the highest and best use of post-consumer discards from the waste stream. Recycled material used as a commodity in a manufacturing process generates economic activity.

MRFs and haulers have invested in artificial intelligence technologies and sorting equipment. Domestic end markets have expanded in response to surplus of material. The COVID-19 pandemic and rise of online shopping has shifted the market for OCC and paper. Market demand for other materials has increased in the last 18 months.

Capacity in Minnesota's recycling economy is expanding. MyPlas, capable of processing 90 million pounds of film plastic annually, will soon open in Rogers. Minnesota is home to manufacturing plants in Paynesville, Worthington, and Garfield that produce plastic lumber from post-consumer materials. Plastic lumber is made into furniture in Duluth and Jordan. Minnesota’s plastic lumber markets include marine, landscaping, and parks and recreation.

However, there have been worrisome losses of markets since 2018 with capacity also shrinking. WestRock in St. Paul processes 600 tons of mixed paper and cardboard per day, a reduction from the former daily capacity of 1,200 tons after the closure of the corrugated medium manufacturing operations in October 2022. Major closures in the TCMA since 2018 include:

- Gerdau Ameristeel Recycling Plant– recycled 560,000 tons of scrap steel annually
- Ball/Rexam– made 2 billion aluminum cans/year

- Brotex – no longer recycles 6,000 tons/year of carpet from Minnesota
- WestRock– recycled OCC (corrugated cardboard) 200,000 tons/year (portion of their plant) in addition to the reduced mixed paper capacity
- Verso Paper Mill in Duluth –recycled mostly industrial paper trimmings

Capacity is under attack in other ways. Overseas markets have forced MRFs and haulers to make expensive investments in infrastructure. Minnesota has one of the lowest residual rates in the country. Residuals are the fraction left over from processing recyclable materials. Yet with supply high and demand low, buyers can be picky. Cleaner material is of higher value and sells more easily.

Markets are cyclical. We must maintain investment in new technologies for sorting equipment to remain competitive. We need to focus on supporting our local businesses and economies and keeping jobs and tax dollars in Minnesota. We need to invest in new products produced with recycled materials. Investments in technology at MRFs helps make that possible.

State-led strategies:

The following strategies are the responsibility of the MPCA and will support counties.

39. **Support and invest in new facilities and retain processors of recycled material for end markets.** Establish a directory of processors throughout the state. Dedicate staff resources to assisting and connecting local processors that prepare collected material for end markets to manufacturers. Processors need to maintain and upgrade equipment to be competitive. Investing in new and upgraded facilities is a benefit to the local recycling market and supports the economy.

Organics management

Organic materials account for approximately 25% of the waste thrown away by Minnesotans. Preventing wasted food and rescuing edible food are strategies that offer the greatest environmental benefit for managing organic materials. Based on EPA's WARM calculations, preventing one ton of food waste results in 20 times fewer GHGe than composting one ton of food waste. Policies oriented to enhance those efforts are included in the waste reduction and reuse section of this MPP. However, composting and feeding food to livestock or backyard chickens are also important strategies for situations where prevention and rescue were unsuccessful. Counties are encouraged to collaborate with partners to develop and implement best practices to expand organics collections. Partnerships with organizations like the Minnesota Composting Council (MNCC), Food Rescue non-profits, waste haulers, Minnesota Waste Wise and others could lead to better program development and faster progress towards recovery goals.

Anaerobic digestion is covered in the emerging technology section of this MPP.

Anoka County Rice Creek Compost Site Organics Pilot Project



The Anoka County Rice Creek Compost Site, located in Lino Lakes, serves the eastern half of Anoka County. Accepted materials are yard and tree waste, as well as organics recycling. Visitors reported the site as difficult to navigate due to wet and muddy road conditions. Demand often exceeded capacity.

To address the issues, Anoka County acquired an adjacent property on higher ground in 2015 to make improvements. Site design, building removal, building construction, road construction, and surface improvements were completed in 2021 to improve site access, improve traffic flow and safety, expand capacity for processing of organics in the north metro, and allow for a greater number of visitors. Over the last three years, an average of nearly 7,000 vehicles visited annually.

Early in the planning process, one of the existing buildings on the new property was identified as a possible solution for processing organics collected at the organics transfer station. Anoka County and its site contractor, OTI, Inc. approached the MPCA with the possibility of composting organics within the covered enclosed barn as an adjacent facility to the yard waste facility. The county discussed the operation with the MPCA and then began operating a small-scale composting site. The site is managed in a manner consistent with MPCA rules that govern small compost sites. This resulted in the first-of-its-kind small-scale composting facility adjacent to a yard waste facility.

Organics are collected from the public at the organics drop-off on site, then brought into the barn and combined with tree and leaf waste from the yard waste site to be processed into compost. The pilot has completed, and the site is considered fully operational. The finished compost is available for purchase to residents during spring through mid-fall.

Required strategies:

The strategies listed below are required to be incorporated into the CSWMP because they are relatively simple or have significant environmental benefit.

40. **Make residential curbside organics collection available in cities with a population greater than 5,000 by 2030.** Drop sites collecting organics have been well received in the region. However, they appear to only be reaching the most enthusiastic residents. Like curbside recycling services, programs should be offered to all single-family dwellings, duplexes, and small multifamily properties. Programs that charge all eligible households must comply with Minn. Stat. § 115A.93, subd 3 (c). This means all haulers must charge and offer organics to everyone. If offered as a subscription service, the licensing authority must make sure that haulers are compliant with 115A.93 subd 3(c). Programs that charge all eligible households, comply with the statute, are cheaper per household and reduce barriers to participation. Additionally, programs with the lowest contamination are supported by robust education. Curbside collection requires proper and frequent education to be successful. It ensures programs are accessible and maximizes participation.
41. **Expand backyard composting outreach and resources for residents.** Provide resources needed to set up a simple yard waste compost pile and education to assure implementation is sustained. Establish a webpage with an explanation all available resources. Promote the program at least twice per year to residents. This will be especially important in areas experiencing hauler shortages for yard waste.
42. **Require management of organics from large commercial food generators by 2033.**

    Commercial and industrial entities that generate large volumes of organics (e.g., restaurants, grocery stores, and food processors) must have an opportunity to reduce their environmental impacts. They often reduce their disposal costs by first preventing food from going to waste. They also rescue food and recycle food waste. As noted in the SMM section, the most impactful action is to reduce the amount of food waste created. Only then should focus shift to rescue of remaining edible food. Local policies should first require adoption of policies that support the prevention and rescue initiatives at large generators.

    After the adoption of prevention and rescue initiatives, large generators must implement organics recycling programs. This serves to capture the remaining organic material they would otherwise discard. Many communities like Hennepin County and Western Lake Superior Sanitary District (WLSSD) have already adopted policies requiring large generators like grocers and restaurants to implement these types of programs. Large volumes of material are being captured and used to create compost or feed livestock.

Optional strategy:

The following strategy is optional and may be incorporated into a county CSWMP. Each strategy has been assigned a point value, which is added to the total amount of points the county must achieve for approval of their CSWMP by the MPCA.

43. **Establish additional organics recycling drop-off sites.**

    Point Value: 7

    Many counties offer organics drop-off sites, which have been successful at capturing food waste for households without curbside collection. Site selection should be in convenient, well-lit places. This strategy can be paired with multi-family recycling strategies to provide opt-in access to residents without curbside collection of organics recycling.

State-led strategies:

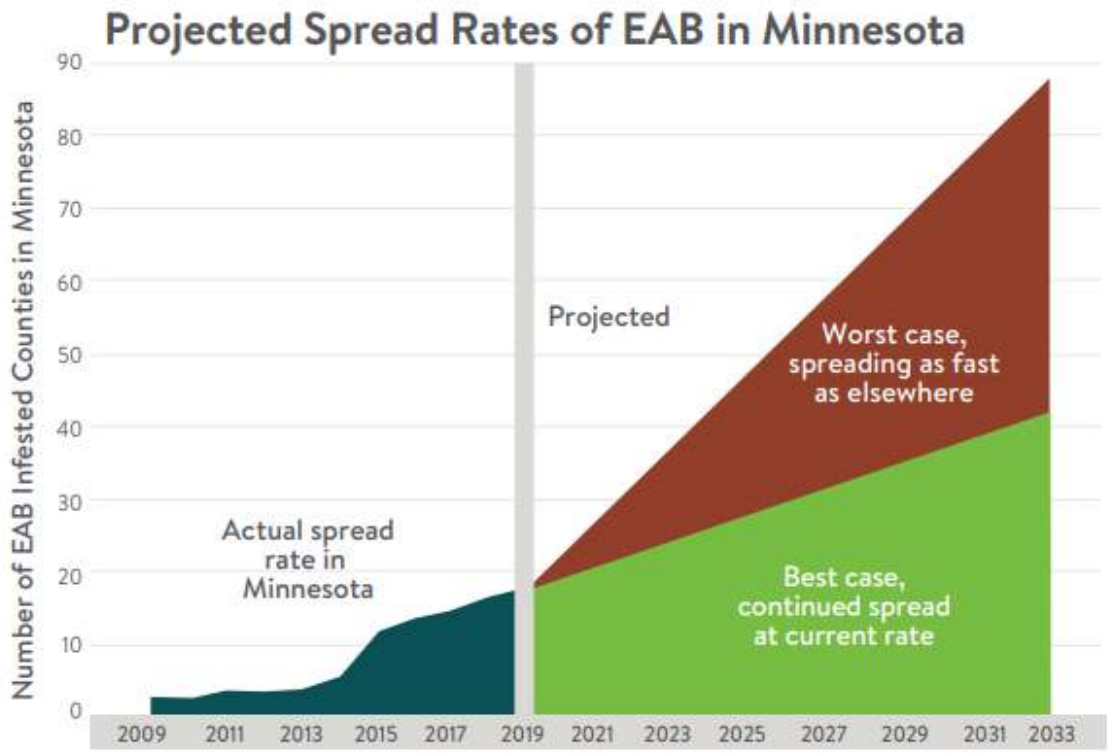
The following strategies are the responsibility of the MPCA to support counties.

44. **Standardize the role of compostable products in organics recycling programs by 2025.** Most of Minnesota's composting programs have included compostable products as acceptable materials. Some metro cities have adopted ordinances requiring the use of compostable take-out containers. Compostable product advocates suggest they capture more food scraps and increase recycling rates; however, MPCA is not aware of any research that confirms this claim. A study from Oregon using life cycle analysis of compostable products has shown unfavorable results, even when compared to single use disposable items. Standardization of compostable materials will reduce resident confusion and reduce contamination for compost facilities.

Wood waste & EAB

The TCMA is heavily impacted by EAB, with an estimated 20% of community trees being ash. All seven metro counties are included in the Minnesota Department of Agriculture's (MDA) EAB quarantine area, with infestation observed throughout the area. Additionally, climate change has increased the severity and frequency of storms that knock down trees and branches that must be quickly removed to preserve access to sidewalks and roads and to restore power. These factors have led to large volumes of wood waste. The trajectory of the EAB infestation suggests we are still five to ten years from peak volumes of wood waste in the TCMA (see Figure 9).

Figure 9. Projected county infestation impact in Minnesota due to EAB



Past and projected spread rates of EAB have been slower in Minnesota than the national average. In the worst-case scenario, all 87 counties will have EAB infestations by 2031, as calculated with the national average rate of spread. Under a best-case scenario, with EAB spreading no faster than it has in Minnesota to date, EAB will be present in 39 counties by the same date. Source: MDA

Currently, the St Paul Cogeneration (SPC) District Energy plant in St Paul manages approximately 250,000 tons of wood waste annually. The District Energy facility is a combined heat and power plant fueled by biomass. In recent years, the facility has accepted wood waste at no charge and relied upon the energy fees collected from its district heating customers and revenues from electricity sold to Xcel Energy to finance the plant. The Public Utilities Commission has indicated it no longer supports relying on just energy fees and electricity sale revenues to operate the facility and other revenue sources are needed, such as a tip fee for wood waste delivered to the plant. Other solid waste streams rely on tip fees to operate facilities to process the materials they receive. As such, it is a reasonable and credible path forward for wood waste generators to pay a tip fee to bring wood waste to the facility in order assist with a portion of the facility's expenses. It is also possible that the facility will cease operations if the facility is unable to fill the revenue shortfall.

With the District Energy facility, capacity for managing wood waste is already strained and being used to the maximum that the current contract allows. If the facility ceases operations, capacity to handle wood waste will be drastically reduced, likely triggering a massive increase in open burning piles. Open burning creates a large amount of small particulate matter that can cause problems for people with asthma. Even if District Energy operations continue, it is certain that additional markets are needed to ensure we direct wood waste to its highest and best use and have capacity to manage the anticipated rising tonnage of material.

Hierarchy of ash tree material management:

The MPCA partnered with the Environmental Quality Board (EQB), the Department of Natural Resources (DNR) and the Department of Agriculture (MDA) to release a report on EAB in 2019. The report details the scope of the problems caused by EAB and suggests strategies for meeting the challenges. The report also includes a hierarchy of ash tree materials management that seeks to prevent wood waste and to utilize wood for its highest and best use. The hierarchy should guide county planning efforts to minimize the environmental impact of managing wood in their communities. Other tree species are facing similar infestations and diseases. Counties are encouraged to address emerging tree diseases and pests with prevention efforts, when possible, to avoid the generation of wood waste.

The following strategies are needed to meet the challenges of managing wood waste throughout the TCMA during the upcoming planning cycle. The strategies will flatten the curve of waste trees generated, support existing markets for wood waste, and develop new markets to help relieve the pressure on current markets to handle the material.

Required strategies:

The strategies listed below are required to be incorporated into the CSWMP because they are relatively simple or have significant environmental benefit.

45. **Develop plans to prevent and manage wood waste in each county and throughout the region.** Plans should assume that biomass plants, including SPC's District Energy, will have tip fees to ensure long-term economic viability. Plans should also not assume the Legislature will provide appropriate funds to biomass plants to allow for their continued operations without a tip fee. Plans should be modified to collect data to improve understanding of the wood waste challenges—at a minimum the amount of wood waste being generated and processed at wood yards. This means that plans should include an ordinance requiring wood yards to register with the county and report volumes of wood waste collected, managed, stored, and disposed. Additional data should be collected on tree inventories and on facilities and industries (biomass, compost sites, mulch producers, tree care companies, etc.) that can participate in discussions about wood waste management. Plans should consider setting goals, especially for wood waste management options that offer the greatest

environmental benefits. Plans should include strategies to educate the public about EAB, tree treatment and preservation, and responsible wood waste management.

46. **Promote existing programs that use EAB-affected wood for furniture, home goods, flooring, and other purposes.** While the volume of wood waste managed via these industries in these areas is not enormous, these industries do play an important role in the system by using wood to produce products, thus preventing waste. Additionally, these industries frequently educate the public about EAB, and they provide important economic benefits through the jobs they create and support. Ensure that these organizations are successful and continue to be available. Develop county purchasing requirements to utilize urban wood when available and encourage residents to purchase products made from urban trees. Consider financial support when appropriate.
47. **Composting and mulching operations must continue to be supported.** These industries provide an important outlet for wood waste management. Additionally, they serve as important infrastructure to help manage additional types of organic waste (i.e., yard waste and food scraps). Support that would meet this requirement could include grants or financial assistance to compost facilities, contracts that commit certain volumes of material to sites over a multi-year term, assistance with siting and/or meeting local permitting or land use requirements and promoting the use of the sites to the public and/or alternate strategies that ensure the long-term viability of composting capacity in the region.

Optional strategies:

The following strategies are optional and may be incorporated into a CSWMP. Each strategy has been assigned a point value, which is added to the total amount of points the county must achieve for approval of their CSWMP by the MPCA.

48. **Update ordinances that address wood burning**.

    Point Value: 4

    Update ordinances defining rules for burning wood, including restrictions on commercial and municipal burning. Establish requirements that minimize the environmental and human health impact. Open burning is the least preferable management method. Expanding other management methods is the best way to avoid open burning.

49. **Develop and distribute EAB tree care education programs for privately owned land.**

    Point Value: 8

    Education through digital marketing and paper mailers should include an explanation of the risks to ash trees, why a mature tree canopy is important, and focus on the benefits and cost savings of treatment versus removal.

50. **Incentivize tree treatment as a cost-effective strategy to extend the life of ash trees and to reduce the volume of wood waste generated over the next 20 years.**

    Point Value: 8

    Counties are encouraged to incentivize treatment of private and public trees and to develop financial incentives and/or provide support for treatment and tree preservation. It is much less expensive to treat trees and keep them living than to remove and replace them.

51. **Allow assessments on property taxes to spread the cost of tree care over a multi-year timeframe.**

    Point Value: 9

    Some communities have used tax assessments to fund tree care services even on private property. This would allow homeowners to defer costs to make tree care services available and affordable.

52. **Expand composting and mulching capacity beyond existing markets.**

    Point Value: 5

    Counties and/or cities can contribute to expanded capacity by offering commitments to deliver organics or wood waste at stable tip fees, purchasing compost and mulch, assisting sites in coming online and/or offering other financial, policy or technical support. This could be accomplished by developing the capacity for biochar or other new technologies. Biochar is a carbon-rich soil amendment and agricultural byproduct. It generates energy from biomass in the absence of oxygen. Biochar operations are in early stages in the TCMA but may use wood waste in a beneficial way. The City of Minneapolis collaborated with Hennepin County to begin using biochar for landscaping in 2019. Counties and cities can develop additional capacity by providing financial support and siting assistance and adopting policies that support capacity development.

53. **Support development of systems that use wood fuel.**

    Point Value: 4

    Incentivize retrofits through financial or policy initiatives for heating with efficient, low-emissions wood burning appliances. Encourage use of Environmental Initiative's Project Stove Swap. Burning wood in retrofitted stoves is preferable to open burning. This strategy also reduces reliance on fossil fuels for home heating.

State-led strategies:

The following strategies are the responsibility of the MPCA to support counties.

54. **MPCA will continue state agency coordination to address wood waste.** MPCA works with Minnesota Department of Natural Resources and Minnesota Department of Agriculture on wood waste issues. Some of the topics needing state level coordination include, but are not limited to, open burning permits, grants for tree management to local governments, and developing educational resources for local government and residents.

Organics market development

The MPCA, along with many municipalities in the TCMA, is working to bring organics collections to curbside containers, drop off sites, sports facilities, and commercial businesses. Opportunities to reduce wasted food and rescue food are most impactful. Food waste that cannot first be prevented or donated should be composted, fed to livestock, or rendered. There are well-identified market expansions for compost.

Use of compost in roadside and other construction projects has many benefits. Compost helps amend soils, so they are better equipped to support plant growth, aerate compacted soils, prevent erosion, and infiltrate runoff to prevent pollutants from entering lakes and streams.

Required strategy:

The strategy listed below is required to be incorporated into the CSWMP because it is relatively simple or has significant environmental benefit.

55. **Require food-derived compost in county construction and landscaping projects.**

    Several communities have established practices to incorporate the use of compost into routine operations. Implementing compost specifications into Minnesota's county construction efforts would help expand markets for compost and ensure that those projects are conducted in a way that better protects Minnesota's lakes, rivers, and streams. In revising their specifications for compost, MnDOT updated the 3890 specifications to include compost products that are derived from food scraps in Grade 2 compost. Counties should specify in ordinances the use of a percentage of Grade 2 compost in roadside construction and landscaping projects, in keeping with the MPCA stormwater

manual. Several communities are establishing such requirements. For example, Denver Colorado has a Soil Amendment Program that requires new residential, commercial, industrial, and government properties to use compost. Eagan also has an ordinance requiring organic matter (Grade 2 compost) be used at no less than 5% at sites with greater than 10,000 square feet of land disturbance. Counties should partner with their public works departments to develop an ordinance that makes incorporating food-derived compost a default purchase.

Optional strategy:

The following strategy is optional and may be incorporated into a CSWMP. Each strategy has been assigned a point value, which is added to the total amount of points the county must achieve for approval of their CSWMP by the MPCA.

56. **Find new outlets to increase food to animal operations.**

    Point Value: 7

    For food that cannot be prevented or donated, counties may work with the Board of Animal Health (BAH) to promote and expand food-to-animals programs. A county may solicit new partners to receive a garbage feeder permit, which must be obtained from BAH. An existing list of approved food-to-animal garbage feeders can be found on BAH's website: https://www.bah.state.mn.us/swine/. Support for the new outlets will help assure their long-term viability. The CSWMP must include a plan for addressing food to animal opportunities within the county.

Emerging technology

The solid waste system is evolving. Waste materials change and the technology to separate materials continues to improve. These changes improve our ability to divert more material from land disposal. Yet, the environmental impacts of some of these new technologies are not well known, creating challenges because the new technologies do not fit neatly into current rules and the Solid Waste Management hierarchy. As a result, MPCA and others need more time to understand the new technologies to determine what permits they may need and how they may fit into the Solid Waste Management hierarchy. An example is whether new technologies meet the technical requirements for recycling. If they do, this brings the benefit of tax-exemption status for facilities. Processed materials could also count toward county recycling goals. If they do not, waste is being handled lower on the waste hierarchy.

Anaerobic digestion of food has been a focus of several metro counties, to keep food out of landfills. Stakeholders note the need for more clarity surrounding anaerobic digestion. In response, a review of the solid waste management hierarchy and definitions under Chapter 115A was conducted to provide direction as to when anaerobic digestion could count towards county recycling goals. It was determined that organic materials going to an anaerobic digestion facility do not automatically count toward county recycling goals.

The MPCA must consider on a case-by-case basis whether activities at an anaerobic digestion facility meet existing definitions of recycling, for purposes of meeting the recycling goals found in Minn. Stat. § 115A.551 and/or the definition of recycling in Minn. Stat. § 115A.03, subd. 25b. Please note:

- Anaerobic digestion facilities that accept source-separated compostable materials (SSCM) and then compost the digestate can count this material towards a county recycling goal if they

demonstrate the process used aligns with the requirements included in Minn. Stat. § 115A.03 subd. 32a[1][3].

- Other types of organic materials may also count towards a county recycling goal if a county can demonstrate that digestate from the anaerobic digestion process is used "in manufacturing processes that do not cause the destruction of recyclable materials in a manner that precludes further use.[2][3][4][5]"
- Use of digestate for alternative daily landfill cover is not considered recycling because this application precludes further use and because landfilling is not recycling. The MPCA holds a long-established position that alternative daily landfill cover is not recycling[4][6].
- Anaerobic digestion processes that capture biogas but do not produce a useable digestate may be considered resource recovery, but not recycling.

A hypothetical example of an anaerobic digestion facility that would potentially satisfy existing definitions is one that receives source-separated organic materials, uses the anaerobic digestion process to capture biogas to create energy for use, and produces a digestate that is composted and produces a class I or class II compost. In view of the variety of materials and designs for anaerobic digestion facilities, the MPCA looks forward to discussing proposals with stakeholders for purposes of meeting recycling goals and solid waste planning. Stakeholders are encouraged to reach out to agency staff to initiate conversations about specific scenarios for further clarity on classification of materials sent to anaerobic digesters.

Additionally, it is important to note that the EPA's food hierarchy describes anaerobic digestion as a process that produces both biogas and a soil amendment[5]. The MPCA is continuously engaging with EPA on this topic to ensure consistency and accounting for the best available information. The agency is also pursuing LCA research to provide Minnesota-based environmental analysis for the anaerobic digestion of food waste.

Gasification and plastics-to-oil technology have been proposed and even temporarily in business in the state. The long-term viability of these technologies is unknown as Rational Energies in Plymouth went out of business when it was unable to sell its fuel. The MPCA views them as similar to WTE operations rather than recycling. As such, the MPCA does not allow for these types of facilities to take source separated plastics or other recyclables in their operations.

State-led strategies:

The following strategies are the responsibility of the MPCA to support counties.

57. **Develop a process for gathering the information necessary to make timelier and consistent policy decisions.** The MPCA should evaluate the various levels of the hierarchy using a life cycle perspective to determine future policy decisions around new technologies. The evaluation should include:
    - Use of existing life cycle analysis, such as the Municipal Solid Waste Decision Support Tool

[1] https://www.revisor.mn.gov/statutes/cite/115A.03#stat.115A.03.32a

[2] https://www.revisor.mn.gov/statutes/cite/115A.551#stat.115A.551.1

[3] https://www.revisor.mn.gov/statutes/cite/115A.03#stat.115A.03.25a

[4] https://www.pca.state.mn.us/sites/default/files/w-sw-1-31.pdf

[5] Per EPA's Anaerobic Digestion section of their Food Recovery Hierarchy: https://www.epa.gov/sustainable-management-food/industrial-uses-wasted-food

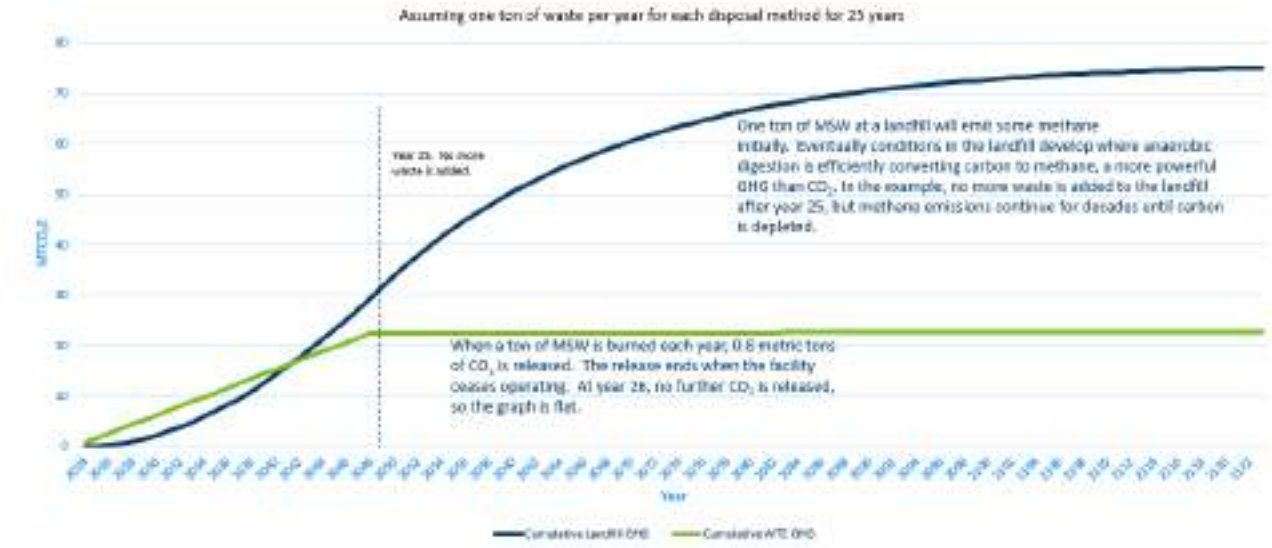
- Research waste management methods including, but not limited to, land disposal, resource recovery, composting, anaerobic digestion, plastics to oil, recycling, and food to livestock
- Identification of gaps in life cycle analysis data and research funds needed to fill those gaps
- Development of solid waste life-cycle policy recommendations
- When needed update state rules for new technology such as anaerobic digestion once sufficient data is in place to inform the process
- Develop a framework for preferred technology

Waste-to-energy

The Waste Management Act identifies a hierarchy that the MPCA is bound by statute to follow, which outlines WTE is preferred over landfills. The following items support this preference for WTE over landfills as a method for waste disposal.

WTE has a significantly smaller climate impact. Landfills produce over three times the amount of GHGe compared to WTE. While operational, the GHGe are similar from WTE and landfills. There is a stark difference at end-of-life. Landfills continue to generate GHGe for decades after closure, while WTE facilities only emit GHGe while operational.

Figure 10. Total GHG generated by landfill and WTE from start of disposal through closure and beyond



After closure, landfills continue to create pollution. Beyond the creation of GHGe, landfills continue to create leachate with contaminants in it. Unless properly managed, leachate can seep into groundwater. Leachate that goes to wastewater treatment plant in part ends up in surface waters due to lack of treatment technologies for many of the contaminants.

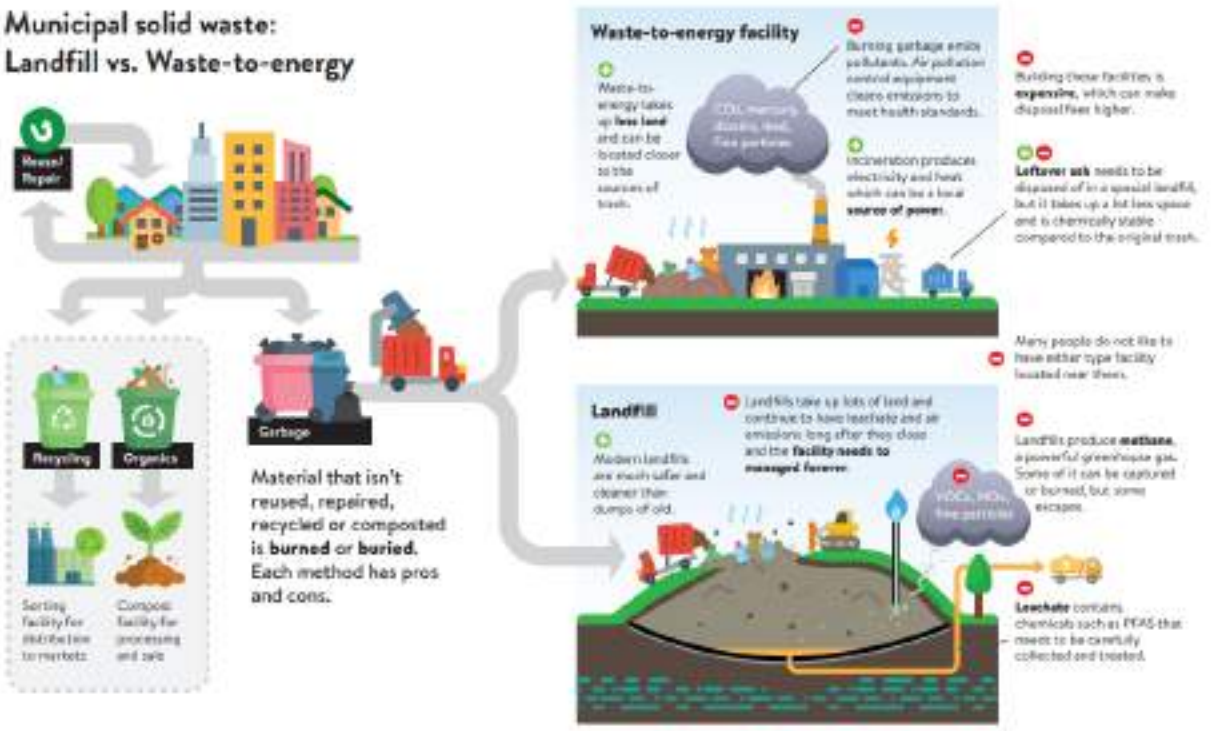
WTE recovers more materials and energy compared to landfills. A portion of the MMSW delivered to resource recovery facilities is diverted to be recycled or recovered for organics management, which is counted as recycled in the objectives in Table 2 and Table 3 (see table footnotes). WTE generates heat and power that contributes to the power grid across the state. Without WTE facilities, additional heat and power must be generated through other methods, which can include burning natural gas or coal to make up the difference.

WTE provides other useful services. WTE facilities are used to destroy pharmaceuticals and drugs for law enforcement departments. Disposal of pharmaceuticals in landfills leads to additional contaminants in leachate, that are not treated.

While WTE has benefits compared to landfilling, the waste hierarchy prioritizes waste reduction, reuse, recycling, and composting over WTE.

Air emissions from WTE and landfills, while meeting state and federal standards, contribute to the overall impacts experienced by neighboring communities. Landfills and WTE facilities located in or near environmental justice areas have a negative impact on communities already overburdened by pollution. WTE facilities in general produce more dioxins, furans, lead, and NOx (nitric oxide), while landfills create more fine particulate matter (PM_{10} and $PM_{2.5}$), CO (carbon monoxide), methane, and VOCs (volatile organic compounds).

Figure 11. Municipal Solid Waste: Landfill vs. WTE



The MPCA acknowledges the impacts to residents near WTE facilities and landfills that the past siting of facilities disproportionally impacted disadvantaged communities. Reducing our reliance on WTE facilities and landfills through waste reduction and increased reuse, recycling, and organics recovery is the best way to avoid shifting pollution from one environmental justice area to another. Only then would it be appropriate to set a timeline for taking facilities off-line.

The MPCA supports managing waste as high on the waste hierarchy as possible, as is evident from the strategies in this plan. The solid waste system of the TCMA is not prepared for closing WTE facilities without development of needed infrastructure, programing, and education. The closure of the Elk River WTE facility resulted in increased landfilling, rather than increasing recycling and composting.

On October 24, 2023, the Hennepin County Board passed a board action resolution that instructs county staff to develop a plan for the closure of HERC between 2028 and 2040. Considering the Board's

decision, MPCA expects Hennepin County to develop a contingency plan consistent with the expectations under strategy 12. Ensure there are contingency plans in place if for large facility closures in order to reduce the likelihood of landfill reliance. Changes in management strategies involving large volumes of waste will have regional and potentially statewide impacts. Planning and resource investments are needed to ensure subsequent waste management systems minimize environmental impacts, are cost effective and do not result in increased burdens in communities already experiencing environmental justice concerns.

Table 5. Existing resource recovery facility capacity serving the TCMA

MMSW processing facility	Permitted capacity	Greater Minnesota-forecast tons per year	TCMA- forecast tons per year	Total - forecast tons per year
HERC	365,000	0	365,000	365,000
REC	450,000	0	450,000	450,000
City of Red Wing	36,000	23,000	13,000	36,000

Interested parties in the public and private sector need to work collaboratively to improve processing of collected materials in a way that will capture more recyclables and assess the efficacy of policies.

The MPCA has regulatory authority to ensure implementation of ROD (Minn. Stat. § 473.848) and public entity requirements (Minn. Stat. § 115A.471), both of which require processing of MMSW. Hennepin County and jointly Ramsey and Washington counties have successfully directed waste to their own processing facilities. Designation in Goodhue County has stabilized the base amount that Red Wing receives with tonnage being supplemented with contract waste from two cities in Dakota County. These efforts have allowed the three facilities to operate at full capacity. If there are delivery shortages of waste at the resource recovery facilities listed above, the landfills are obligated to fill the shortage or stop accepting waste. The MPCA expects that operational WTE facilities will continue to run at full capacity going forward.

Required strategy:

The strategy listed below is required to be incorporated into the CSWMP because it is relatively simple or has significant environmental benefit.

58. **Counties must continue to support the implementation of Minn. Stat. § 473.848 Restriction on Disposal.** Operating resource recovery facilities at full capacity is important. Continue to require delivery of county waste to WTE facilities, if available. Submit timely ROD reports. Continue to actively participate in the quarterly certification process. Facilitate communication between facilities.

Landfilling

The system objectives strive to reduce land disposal to 5% of MMSW generation within the next ten years, recognizing that some MMSW is not processible. Some disposal options will always be necessary. If the MMSW cannot be prevented, reduced, reused, recycled, or composted, it should first go to a resource recovery facility. Only then, if the waste is not processible, should it be landfilled.

Optional strategies:

The following strategies are optional and may be incorporated into a CSWMP. Each strategy has been assigned a point value, which is added to the total amount of points the county must achieve for approval of their CSWMP by the MPCA.

59. **Implement additional fees to better account for the externalities of land disposal.**

    Point Value: 4

    Landfilling is the least expensive option at the point of disposal, but the externalities like operating the closed landfill program, groundwater monitoring, and managing vapor intrusion, make it more expensive in the long run. Closed landfills must be monitored and managed in perpetuity to protect the environment and human health. They produce contaminated fluids (leachate) and gases that must be managed properly to avoid polluting groundwater or affecting nearby structures. Finding solutions to minimize land disposal and move waste up the hierarchy will save taxpayers money in the long term. Ramsey County's environmental charge on MMSW is a good example of a possible strategy to better reflect the true costs associated with disposal. Placing a county fee on every ton of MMSW delivered to landfills can provide revenue for preferable waste management programs and can contribute to prices for residents and businesses that reflect actual, long term disposal costs.

Product stewardship

Managing waste in Minnesota is a challenge that requires consistent innovation. One evolving concept pertains to who should be responsible for managing waste. The beverage industry's shift from reusable containers to disposable resulted in an increased amount of waste. In the 1970s, other states began to introduce "bottle bills." also known as container deposit return laws, to address these concerns. This introduced the concept of industry managed product return programs.

Product stewardship was introduced in the 1990s. Product stewardship aims to shift responsibility for negative impacts to the economy, environment, public health, and worker safety to designers, manufacturers, retailers, and users of consumer products. Product stewardship should focus on the impacts of a product and its packaging throughout all lifecycle stages. This includes the material type, toxicity, raw materials, design, and recyclability.

Minnesota was a product stewardship leader in the early 1990s. Lawmakers introduced Minn. Stat. § 325E.125, subd. 3, requiring manufacturers to collect and recycle rechargeable batteries. Since then, more than 30 states have adopted product stewardship laws, including 25 states with e-waste laws. The manufacturer takes responsibility by paying to collect and recycle the products covered under law, with the products covered varying widely from state to state.

Manufacturers have continued to produce without planning for the end-of-life (EOL) management of products and by-products. Updates to the law are needed to address the full scope of the lithium battery issue. When manufacturers are responsible for end-of-life costs, it incentivizes toxicity reduction, consideration of processing costs, and recovery yields. First Solar's take-back program is a great example of EPR. The company recovers materials from retired solar panels to create new panels. The cost of this service is passed on to the owners of the solar panels.

States have been introducing product stewardship laws that focus on materials such as solar panels, carpet, mattresses, and packaging. Studying the development of product stewardship adaptation in other areas of the country provides many benefits. It gives Minnesota an opportunity to avoid pitfalls and focus on proven strategies.

Required strategy:

The strategy listed below is required to be incorporated into the CSWMP because it is relatively simple or has significant environmental benefit.

60. **Participate with the Product Stewardship Committee under the Solid Waste Administrators Association (SWAA).** SWAA provides peer-to-peer networking opportunities, and the Product Stewardship Committee allows for targeted information sharing. Consistency in product stewardship goals between the metro counties is imperative for planning how to handle post-consumer materials. Strong county coordination and support of product stewardship approaches by the counties can help enact legislation and programs at the state level to move the state forward. State policy and actions can help lead to regional and national initiatives.

Household Hazardous Waste (HHW)

HHW facilities play an important role in capturing products or wastes that are not amenable to management at other waste facilities. They reduce the toxicity of the solid waste stream by providing households with an opportunity to bring pesticides, drain cleaners, mercury thermometers, stains, or varnishes, and other such products to drop-off sites. This prevents exposure and operational problems at other solid waste facilities from common HHW.

HHW collection programs are statutorily mandated to remove hazardous materials from the solid waste stream. Each of the metropolitan counties has at least one year-round site for the collection of HHW. A Reciprocal Use Agreement allows residents to use any of the HHW collection sites located in Anoka, Carver, Dakota, Hennepin, Ramsey, and Washington.

Required strategy:

The strategy listed below is required to be incorporated into the CSWMP because it is relatively simple or has significant environmental benefit.

61. **Encourage retailers to increase consumer awareness of responsible end-of-life handling for products containing lithium-ion batteries.** It is illegal to discard rechargeable batteries in the trash. It is important to manage batteries properly to avoid creating serious safety hazards. HHW sites are safely collecting these, but consumers are not always aware that products they purchase contain lithium-ion batteries. This strategy can be accomplished by sending a letter to all licensed tobacco retailers in your county with information such as how to request signage about HHW drop-off locations and the risks associated with improper disposal of lithium-ion batteries.
62. **Continue participation in the reciprocal use agreement for HHW collection sites.** This agreement allows residents of all seven metro counties to use any collection site located in the TCMA. The MPCA values the convenience provided to TCMA residents with the reciprocity agreement. The agreement should continue to be in place into the future to continue providing this service to area residents.
63. **Partner with cities to increase participation in HHW collection.**

    Traditional methods of HHW collection capture some of this waste, but there are households that do not participate for a variety of reasons. Private companies providing specialized HHW services, retailers, cities, and other counties should collaborate to increase the number of households effectively diverting their HHW from their trash. Expanding methods of collection could increase the amount of HHW collected.

Optional strategies:

The following strategies are optional and may be incorporated into a CSWMP. Each strategy has been assigned a point value, which is added to the total amount of points the county must achieve for approval of their CSWMP by the MPCA.

64. **Host monthly drop-off sites in locations other than a permanent HHW site.**

    Point Value: 8

    The focus can be on a particular type of material, like lawn and garden chemicals in the fall, or a general collection of HHW. Ramsey County has a mobile site for general HHW collection that moves to a new location each month.

Sustainable Building and Deconstruction

Construction, renovation, and demolition of buildings, roads, and bridges produces demolition debris. Traditional demolition is wasteful and destroys usable, valuable materials. Demolition activities usually involve destruction of building materials, which are then mixed and placed in a dumpster. Once materials are mixed, it is difficult to separate them. Mixed materials may be sent for recycling, but at that stage the amount that can be recovered is minimal.

Most of the mixed materials end up going to a landfill. Better handling and preservation of existing materials would reduce unnecessary waste. Materials like concrete, wood, and metals could be diverted for reuse or recycling. In 2021, an estimated 4,842,000 tons of ISW and demolition debris was land disposed. Current ISW designation has resulted in inexpensive land disposal. While it is not the intended use, ISW designation can be used for demolition debris. The result has been growth in non-MMSW (demolition debris and ISW combined) since 2009. By comparison, MMSW experienced modest growth.

Construction and demolition waste landfills in Minnesota are governed by laws promulgated in the late 1980s, which do not require these landfills to be lined. Groundwater monitoring from these landfills found heavy metals at amounts that exceed levels safe for human health. The presence of contaminants of emerging concern were also detected.

Table 6. 2021 disposal in facilities that accept TCMA waste

Waste type	Landfill type	Quantity
Industrial Solid Waste (ISW)	MMSW landfills, ISW Landfills, Class III Demo landfills or to ISW cells at MMSW landfills	3.41 million tons
Construction/Demolition Debris	MMSW landfills, ISW landfills, all types of Demolition Landfills	1.43 million tons
Mixed Municipal Solid Waste (MMSW)	MMSW Landfills	1.10 million tons

Industry has opportunities to improve sustainability in earlier stages of material design and manufacturing. The production of building sector contributes significant GHGe. Building design, maintenance, preservation, and removal also provide opportunities to address sustainability. TCMA counties must consider the broader climate impacts of buildings, beyond end-of-life management.

The greatest environmental benefits are driven by prevention, achieved by reusing existing structures and materials. For example, reuse of buildings with average energy performance provides a greater GHGe reduction when compared to energy efficient new construction. Building preservation and reuse provide the greatest opportunity to avoid GHGe. Furthermore, reused building materials are also diverted from landfills. The TCMA has a low recycling rate for construction and demolition material. While increasing the recycling rate could have benefits, prevention will be the most impactful. Preservation maintains the location and as much of the existing structure as possible. Renovation can provide improved efficiency and usability. Structural moving keeps a functional building in circulation.

Figure 12. Sustainable Building SMM Guidance from most to least preferred management methods



Required strategies:

The strategy listed below is required to be incorporated into the CSWMP because it is relatively simple or has significant environmental benefit.

65. **Implement the use of a Building Material Management Plan.** Also commonly known as Material Conservation and Waste Management Plan, this tool is for buildings going through renovation or deconstruction to document the destination of materials in building/unbuilding projects during and after project completion.

    Require that a building material management plan be used for specific non-government projects or for all publicly owned buildings being modified or removed within the jurisdiction. Jurisdictions must document the type and quantity of materials that get reused, recycled, or landfilled/incinerated for all publicly owned buildings being modified or removed. Consider using the MPCA's Building Material Management Plan Template. It is provided as a customizable Microsoft (MS) Excel spreadsheet so cities, counties, and other organizations can gather building material data to support their programs and convey important information regarding construction, renovation, deconstruction, and demolition goals or requirements within their jurisdiction.

Optional strategies:

The following strategies are optional and may be incorporated into a CSWMP. Each strategy has been assigned a point value, which is added to the total amount of points the county must achieve for approval of their CSWMP by the MPCA.

66. **Prior to demolition of county-owned buildings, require that SMM strategies are considered.**

    Point Value: 7

    For greatest impact, consider implementing these approaches in the order they are listed. Reassign the building for other government purposes. Sell the building to be used as-is or with renovations. If it is not feasible to use the building, deconstruct with all useful materials diverted from the waste stream. Divert a minimum of 75% of materials from disposal and at least 10% of materials reused. Recycle if/when deconstruction is not an option. Consider requiring publicly owned buildings

applying for a demolition permit to provide a feasibility study for deconstruction before a permit is granted.

67. **Host a building material collection event or swap.**

    Point Value: 8

    Partner with supporting cities within the county and with resale non-profits to accept used items in good condition for reuse. Promotional opportunities could include postcards, city newsletters, social media, and email. Promotional outreach should include education on the climate and other environmental and human health impacts of the lifecycle of building materials, guidelines, and lists of what is/is not accepted.

68. **Provide financial assistance to offset the additional cost of building deconstruction, used building material installation, and/or structural moving.**

    Point Value: 8

    Offer grants for building deconstruction, structural moving, and building material reuse to reduce the amount of wasted building materials and the need to manufacture new items, as well as to effectively divert materials otherwise bound for landfill. Partner with organizations that have strong relationships with lower income communities where single-family homes, multi-family units, businesses, and community centers would benefit from funding and assistance to update (ensuring repairs are done in a way that also support energy efficiency). Consider adding a step in the permitting process where the contractor is introduced to these programs.

    For example, Hennepin County began offering deconstruction grants for residents in 2020. Owners of 2–4-unit housing are now offered up to $5,000 ($2 per square foot) to use deconstruction techniques. This grant expanded in 2022 for projects that incorporate used building materials. Ramsey County began offering grants for homeowners and developers in 2021, offering the same funding as Hennepin County for residential properties. Commercial properties are eligible for up to $10,000. Washington County followed suit in 2022.

69. **Provide deconstruction training.**

    Point Value: 8

    To support the “unbuilding” of buildings that have reusable materials, contractors will need deconstruction training. Arrange virtual and in-person courses. Aim to develop a workforce ready to provide deconstruction services within your county. Collaborate with other counties to provide trainings, if desired.

70. **Annually host or aid with home and building repair and refurbishment trainings.**

    Point Value: 8

    These training should encourage extending the life of products and materials over replacement. Many of these types of classes are already offered through community education or building preservation organizations. Sponsoring these courses to provide free or reduced cost enrollment would fulfill this strategy. This should also be paired with EPA’s Renovator Training to avoid lead exposure.

71. **Use purchasing guidelines to require environmental product declaration (EPD) for concrete.**

    Point Value: 7

    Select products with the lowest carbon concrete for all new buildings, sidewalks, and roadways. An EPD is a comprehensive report that includes a life-cycle analysis that provides specific environmental information on a product in a common format. EPDs provide clear information on the environmental benefits of products like energy efficiency. Requiring EPDs for building materials can provide institutions with the information they need to meet specific environmental goals and report on impacts.

State-led strategies:

The following strategies are the responsibility of the MPCA to support counties.

72. **Study waste classification practices.** The MPCA should evaluate the meaning and application of statutory and rule definitions of MMSW, industrial solid waste, and industrial waste. The MPCA will analyze the solid waste system for equity opportunities. Once the evaluation is complete, the MPCA will make recommendations and changes to ensure that all parties within the system understand how to properly classify MMSW, ISW, and demolition debris.
73. **Propose changes to B3 guidelines to strengthen deconstruction requirements.** The sustainable building guideline used by the state is Buildings, Benchmarks & Beyond (B3). B3 studies building performance and develops standards to advance strategies for measuring and increasing performance of buildings receiving state funds. Most buildings participating in the B3 program are state-owned. Yet some buildings developed by local governments, including housing, have participated. The B3 Guidelines (B3-MNBG) are a series of required and recommended performance standards. Among them are energy and waste efficiency standards (SB 2030).
74. **Incentivize deconstruction over landfilling MMSW and demolition debris.** The MPCA has been working with stakeholders connected to sustainable building material management. The goal is to support and incentivize the deconstruction and reuse of demolition debris materials, since the cost of disposal is so low. The MPCA will focus on direct deconstruction incentives.
75. **Lead Sustainable Building Group (SBG) developments.** The MPCA will serve as a technical expert for various built environment conferences, host working groups and meetings, develop legislative proposals to advance waste reduction regulations, and provide guidance for B3 and GreenStep Cities. The stakeholders in this group established a list of final recommendations, which would establish training, grants, ordinance templates, and other incentive programs to encourage reuse in construction and deconstruction.

See Appendix G for the full strategy table.

Appendix A: Overview of the current Twin Cities Metropolitan Area solid waste management system

We cannot solve on the backend the problems that are created upstream. Consumption directly leads to waste and there is little the solid waste industry can do to mitigate the issues caused by overconsumption. In 2020, the TCMA generated an estimated 3.29 million tons of MMSW. Approximately 8.6 cubic yards of non-MMSW was reported in 2021. This waste includes demolition debris, industrial, and medical waste. Non-MMSW is sent to demolition debris and/or industrial waste landfills. The TCMA solid waste infrastructure is comprised of private and public entities. Materials generated by homes, businesses, and institutions are first collected then transported, recycled, recovered, incinerated, or land disposed.

Description of the system

Minn. Stat. § 115A

The goal of this section is to protect the state's land, air, water, and other natural resources and the public health by improving waste management in the state to serve the following purposes:

1. Reduction in the amount and toxicity of waste generated
2. Separation and recovery of materials and energy from waste
3. Reduction in indiscriminate dependence on disposal of waste
4. Coordination of solid waste management among political subdivisions
5. Orderly and deliberate development and financial security of waste facilities including disposal facilities

Minn. Stat. § 473.803 requires metropolitan counties to plan and manage an integrated solid waste system. A recycling implementation strategy for meeting the goal of 75% by 2030 is mandated. The recycling rate includes both traditional recyclables, yard waste, and source-separated compostable materials. If current trends continue, we cannot expect the recycling rate to exceed an average of 61% by 2030. The MMSW recycling rate as of 2021 is 45.2 %, which has grown by almost 20% over the past 10 years.

Collection

Approximately 200 waste hauling businesses are licensed in the TCMA via a regional joint powers agreement to collect and transport MMMSW. State law requires waste haulers to provide volume-based service. TCMA communities have two types of agreements with waste haulers: open collection and organized collection. Open collection allows residents and businesses to choose their waste hauler. Cities that contract with haulers on behalf of communities have systems referred to as organized collection. About 38% of communities in the TCMA have organized trash collection and about 59% have organized recycling collection. Yard waste, organics recycling, and recycling drop-off sites serve many communities.

Toxicity reduction

Waste that is hazardous as defined by federal and state laws and local ordinances poses environmental and public health and safety risks. Toxicity reduction is an effort to manage the risks associated with the hazardous character of waste.

The TCMA addresses the hazardous character or toxicity of waste in two ways. The first, aimed at residents, encourages reduction of wastes with hazardous character, coupled with a network of HHW programs operated by counties. The second, aimed at commercial generators of hazardous waste, includes regulating under the federal Resource Conservation and Recovery Act standards for businesses in the TCMA.

HHW collection programs are imperative for removing toxic materials from the waste stream. Year-round operation of an HHW site is present in each metropolitan county. Efforts to capture HHW also include seasonal, temporary, satellite, or special one-day collections. TCMA residents may use any of the HHW collection sites located in TCMA counties due to an effective reciprocity program among the metro counties.

Chemicals in the environment are a growing concern. Their presence indicates that there are opportunities for reducing exposure to toxic chemicals through pollution prevention. Apart from lead and perhaps mercury, none of these chemicals would have been found in people 70 years ago. Air, water, and soil sampling also document the unintended presence of many toxic chemicals due to human activity.

The MPCA is conducting a PFAS source evaluation and reduction initiative with the goal of supporting operators of PFAS conduits to the environment, such as landfills. Solid waste facilities perform an essential function in society of managing waste while minimizing environmental and human health impacts. Unlike industrial facilities using or producing PFAS products, landfills have limited options for managing PFAS inputs into their facilities, and PFAS levels will reflect a composite of historic and ongoing levels in disposed materials. The MPCA regulates solid and hazardous waste in Minnesota to support an integrated waste management system and to ensure protection of public health and Minnesota's land, air, and water resources.

Recycling

Residential recycling programs consist of curbside collection and drop-off sites. Curbside recycling programs contract with a municipality or operate through subscription service. Most counties provide some funding for municipal programs. There are public drop-off locations for recyclables in five counties. Many businesses have active recycling programs, and commercial recycling accounts for a considerable part of the recycling in the region. The success of the region's recycling program is not only a result of county and city efforts, but also of the significant contribution the private sector has made through the development of markets, provision of drop-off locations, and the many elements needed for the recycling infrastructure.

Recyclables collected are taken directly to a recycling market, a recycling broker, or to an MRF. Materials commonly recovered for recycling include:

- Steel & aluminum cans
- Newspaper and magazines
- Office paper and mail
- Cardboard
- Boxes: food, beverage, toiletries
- Glass jars and bottles

- Plastic bottles, containers, jugs (#1, #2, & #5)
- Cartons

Presently, eight businesses operate MRFs that manage residential recyclable materials generated in the TCMA: Republic in Inver Grove Heights, Republic in Minneapolis, DemCon in Shakopee, Dick's Sanitation (Recycle Minnesota) in Lakeville, Eureka Recycling in Minneapolis, Republic Services in Delano, Tennis Sanitation in Saint Paul Park, and Waste Management in Minneapolis. In 2021, the materials recycled came from these sources: 65.5% from commercial and 34.5% from residential. Historically, 20 to 25% of the residential waste and about 50% of CII waste is recycled.

Lithium-ion batteries should be disposed of via e-waste streams. However, some are disposed of in unsuitable places. Dangerous fires in garbage trucks, at transfer stations, MRFs, and landfills have resulted. Uncontrolled burning of waste is a threat to human health and the environment. Fires cause structural damage that require repairs, increased insurance costs, and require the organizations to spend funds on repairs. Insurers offering coverage to waste facilities may reasonably estimate a high risk of a severe fire breaking out, leading them to pass the financial burden of that danger to their customers. Not only are prices increasing, but also insurers are leaving the market, making it more difficult for MRFs to get insurance. The industry, which had almost 50 insurance options as little as three years ago, now has fewer than 10.

Yard waste

Under state law, yard waste should be separated from MMSW and is banned from land disposal. A few cities offer the collection of yard waste mixed with other organics for composting. Yard waste is managed through county, municipal, and private programs. Yard waste collection sites located throughout TCMA operate year-round or seasonally. They are operated by counties, cities, or private firms. Curbside collection of yard waste occurs in many areas using separate collection vehicles.

Documented yard waste volumes are reported to the MPCA; in 2020,424,762 tons of yard waste was reported in the TCMA. The capture rate for yard waste in TCMA is 88.8%.

Invasive earthworms known as jumping worms are an emerging issue in Minnesota, with confirmed presence in Hennepin and Ramsey counties dating back to 2007. Tree diseases and invasive insects will continue to be an issue, despite efforts to diversify the tree canopy.

EAB is now identified in 30 Minnesota counties and continues to spread, which leads to the creation of wood waste. District Energy's Saint Paul Cogeneration (SPC) facility is the only outlet at this time to manage the hundreds of thousands of tons of wood waste generated each year via biomass.

The PUC regulates energy production activities at SPC, as the facility is a source of energy production. SPC currently processes about 250 tons of wood waste annually. WTE facilities play a strong role in waste management and SPC is increasingly important in dealing with wood waste. EAB projections suggest this will continue to be a pervasive issue, with greater spread and impact.

SPC provides an important service that is environmentally preferable. If SPC were to discontinue services, it would leave the TCMA without a biomass energy resource and would lead to intentional open burning or spontaneous fires. Uncontrolled burning of wood contributes to air pollution by releasing PM2.5, benzene, formaldehyde, acetaldehyde, acrolein, and polycyclic aromatic hydrocarbons (PAHs). Extensive scientific evidence demonstrates short-term exposure to PM2.5 causes cardiovascular health effects. In 2020, reported emissions at SPC were 77,200 tons of CO2e and a combined total of 0.34 tons of PM10 and PM2.5, 20.5 tons VOC and 255 tons NOx. Control equipment at SPC greatly reduces other pollutants like lead, ammonia, and sulfur dioxide.

Organic waste management

Organics recovery programs include food rescue, food-to-livestock, and composting. Each management method can capture different mixtures of feedstock. Waste reduction opportunities to reduce organic materials diverted to trash should take priority. Further reducing or recovering organic materials from the trash can be accomplished through different diversion strategies. The MPCA is assessing the newly released EPA Wasted Food Scale to determine how it applies to operations and activities throughout Minnesota. The Food Scale was developed by EPA's assessment of various common pathways for managing food and prioritizes them based on their environmental impacts and potential contributions to a circular economy.

Figure 13. EPA Wasted Food Scale preferred management methods



Organic materials account for a large portion of the MMSW sent to landfills and resource recovery facilities. The Burnsville Sanitary Landfill conducted a waste characterization study in 2019, which identified organics made up 49.13% of waste sorted. Hennepin Energy Recovery Center conducted a similar study in 2017, which identified organics accounting for 28.8% of total composition of waste. The

nearly 20% difference between facilities could be explained by Hennepin county's early adaption of curbside collection of organics.

Each management method has different requirements regarding what materials are acceptable, but it is clear there is substantial opportunity to reduce or recover organic materials that are currently ending up in the trash.

Access to organics collection has improved and increased in the last six years. Ramsey and Washington will roll out a joint effort for curbside collection to residents by late 2023. These counties are also looking to add anaerobic digestion as an additional method for processing organic waste, as is Hennepin County. Hennepin requires residential collection of organics. Dakota County has passed an ordinance that sets tiered effective dates to require commercial collection for different types of businesses to divert and collect food scraps from their back-of-house operations. Individuals willing to self-haul their organics have access to drop sites in every metro county.

Curbside collection primarily utilizes one of three methods:

1. Collecting organics curbside in a cart – including only food scraps, non-recyclable paper, and compostable plastics, in a compostable bag
2. Co-collecting organics with yard waste
3. Co-collecting organics, in a durable compostable bag, with MMSW (sorting facilities to remove compostable bags are required with this model)

The TCMA is currently served by several food rescue organizations, four food-to-livestock operations with garbage feeder permits (able to accept meat and vegetative food scraps), three large scale composting operations that are permitted to accept SSO, and many yard waste composting facilities. With the introduction of new programs, capacity is now a challenge. Transfer capacity, route density, and access to hauling service also remain a challenge.

In 2020 and 2022, the Legislature increased SCORE funding for the state by $500,000 and $700,000 respectively. The Waste Management Act includes language that requires metro counties to spend half of any increase in funding as compared to a base year of 2014 on organics (i.e., food rescue, composting, food-to-livestock, anerobic digestion). The counties' obligations for organics spending are listed in Table 7. Metro counties detail how funding is spent as part of the annual reporting process. Their reports have confirmed compliance with this requirement and frequently show spending on organics far exceeds their obligation.

Table 7. Organics obligation by county for FY2020-2023

Metro county	FY2020 Organics obligation	FY2021 Organics obligation	FY2022 Organics obligation	FY2023 Organics obligation
Anoka	$104,192.00	$105,832.50	$125,626.00	$126,377.50
Carver	$38,311.00	$38,496.00	$43,430.00	$45,238.00
Dakota	$123,311.50	$123,854.50	$154,999.50	$156,174.00
Hennepin	$375,199.00	$383,780.50	$449,543.50	$448,556.50
Ramsey	$163,542.50	$164,105.00	$183,106.00	$178,877.50
Scott	$47,606.50	$48,828.00	$59,816.00	$61,625.50
Washington	$79,516.50	$77,492.00	$97,598.00	$99,625.50
Metro total	$931,679.00	$942,388.50	$1,114,119.00	$1,116,503.50

TCMA counties reported collecting a total of 549,135 tons of organics in calendar year 2020. Table 9 provides the total amount of organics recovery reported, by type, in the 2021 SCORE report for the TCMA counties.

Table 8. Organics recovered in 2021 (in tons) (data from the 2021 SCORE report)

Material type	Tons collected	Change from 2020
Food to livestock	107,133	-0.8%
Food to people	23,585	34.7%
Other materials	1,944	198%
Source-separated organic materials	79,891	103.7%
Yard Waste	335,379	-12.6%

The yard waste stream is primarily coming from residential sources. The food-to-livestock and food-to-people figures come from commercial sources. The 2020 data showed disparities among metro counties for organics diversion. The metro average decreased from 2019 to 2020 by nearly 20%, while some counties, like Washington, experienced growth year-on-year of nearly 80%.

It is also worth noting that the items included in the organics calculation now include yard waste composting. That policy change took effect in 2013 and now counties include documented yard waste in their annual reports to the MPCA. This change in reporting process resulted in a significant increase in the combined organics/recycling rate. Further increase in the organics recovery rate will likely be more challenging to achieve in future years.

Resource recovery

Three MMSW resource recovery facilities serve the TCMA. The Elk River Resource Recovery Project (GRE-Elk River) was an RDF processing plant owned by Great River Energy (GRE). The site became a WTE facility in 1989 and closed in 2019. GRE-Elk River's operational capacity was about 250,000 tons per year, all of which is now diverted to landfills.

Table 9. Existing resource recovery facility capacity serving the TCMA

MMSW Processing Facility	Permitted capacity	Greater Minnesota-forecast tons per year	Forecast tons per year - TCMA	Forecast tons per year - Total
HERC	365,000	0	365,000	365,000
REC	450,000	0	450,000	450,000
City of Red Wing	36,000	23,000	13,000	36,000

The HERC facility in Minneapolis uses a mass-burn technology, producing energy for district heating and electricity. The facility also recovers ferrous metal for recycling from the ash. HERC managed 361,502 tons of waste in 2021.

The Ramsey/Washington County Resource Recovery Facility (Recycling and Energy Center) is a refuse-derived fuel (RDF) facility owned by Ramsey and Washington counties. The facility was purchased by the two counties in 2016. Mixed waste is sorted into processible and non-processible waste on the tipping floor, processed, and separated into three waste streams: RDF, recyclable metal, and residue. The RDF is transported for combustion to Xcel Energy power plants in Red Wing and Mankato, where it is burned to generate electricity. The facility recovers ferrous and non-ferrous metals for recycling, and unprocessible waste and residue from processing is delivered to landfills. Recycling and Energy Center's permitted capacity is 450,000 tons per year.

The city of Red Wing (City) operates an RDF processing plant in Red Wing. Mixed waste is sorted into processible and non-processible waste on the tipping floor, processed, and separated into three waste streams: RDF, recyclable metal, and residue. The RDF is transported for combustion to Xcel Energy's power plant in Red Wing. The facility recovers a variety of recyclable materials including paper, plastics, and ferrous and non-ferrous metals for recycling. Unprocessible waste and residue from processing is delivered to a landfill. Red Wing's permitted capacity is 16,000 tons per year for metro and surrounding counties and 20,000 tons for Goodhue County.

The three resource recovery facilities have a combined operating processing capacity of 802,627 tons per year, down from the over 1.15 million tons capacity the metro had before GRE-Elk River closed. In addition, there is available unpermitted, but installed capacity, of 40,000 tons per year at HERC. In 2021, PCA prevailed in court on ROD. Since that time, processing capacity has been fully utilized at the three remaining facilities. There is currently no additional capacity, which has increased use of land disposal.

Landfills

In 2021, 33% of the TCMA MMSW was land disposed. Nine landfills received 1,102,177 tons of TCMA MMSW, with 15% destined for landfills located out of state. Figure A-2 shows total amounts of TCMA MMSW that the landfills received in 2021, with 93% of total waste headed to landfill classified as unprocessed MMSW. Four Minnesota landfills receive the majority of TCMA MMSW, with collective remaining permitted MMSW capacity of approximately 10.2 million cubic yards. If these facilities continue to receive waste at approximately the same rate in the future, the permitted capacity will range from 4.9 to 14 years. Notwithstanding, this does not consider the additional design capacity that could potentially be permitted or practices that move materials up the waste management hierarchy.

Table 10. Landfill locations accepting TCMA waste

State	Landfill name	Owner	Total tons
Minnesota	Elk River Landfill SW-74	Waste Management	255,741
Minnesota	Pine Bend Sanitary Landfill SW-45	Republic Services	474,508
Minnesota	Burnsville Sanitary Landfill SW-56	Waste Management	160,481
Minnesota	Spruce Ridge Resource Management Facility SW-6	Waste Management	44,830
Minnesota	Nobles County Landfill Inc SW-11	Waste Connections	2,038
Minnesota	N/A	N/A	736
Wisconsin	Lake Area Landfill	Republic Services	43,606
Wisconsin	Rice Lake Landfill	Allied Waste Services	1,225
Wisconsin	Seven Mile Creek Landfill	GFL Environmental Inc.	27,859
Iowa	Central Disposal Landfill	Waste Management	91,153
MN Total			938,334
Out of State total			163,843
Grand total			1,102,177

Of note, Seven Mile Creek Landfill was acquired by a Wisconsin-based hauler, and it no longer accepts TCMA waste. If TCMA landfills are not allowed to expand, Twin Cities residents could end up with no facility to send their waste. In January 2021, four landfills applied for additional capacity. The agency has made determinations of how TCMA waste would be allocated to the four applicant facilities that requested additional capacity:

- Burnsville Sanitary Landfill – 1,692,893 tons
- Dem-Con Landfill – 627,244 tons
- Pine Bend Sanitary Landfill – 2,398,746 tons
- Rich Valley Landfill – 893,889 tons

Permitting capacity is in flux because two of these facilities have not submitted permit applications to accept MMSW.

Expanding landfill capacity in TCMA is a direct result of the closure of GRE. Minnesota has four MMSW landfills. The TCMA currently houses two, both located in Dakota County. The Burnsville Sanitary Landfill, located in Burnsville, is owned by Waste Management Inc. (WMI). The Pine Bend Sanitary Landfill, located in Inver Grove Heights, is owned by Republic Waste. Both landfills operate methane gas-to-energy systems that capture methane gas generated by the decaying waste. Two other Minnesota landfills that receive significant amounts of TCMA MMSW are the WMI Spruce Ridge Landfill in McLeod County and the WMI Elk River Landfill in Sherburne County. These also operate methane gas-to-energy systems. For the four Minnesota landfills that receive the majority of TCMA MMSW, while the efficiency of the gas collection systems has not been established, it is estimated that an average of 75% of the methane that is captured is used to produce electricity, and the remaining captured methane is flared.

Two out-of-state landfills received TCMA MMSW in 2021, including the Republic Services Lake Area Landfill in Sarona, Wisconsin, and the Rice Lake Landfill in Rice Lake, Wisconsin.

Non-MMSW management

In 2021, an estimated 4,841,899 tons of non-MMSW waste was land disposed. The TCMA is served by nine landfills that accept industrial wastes and/or demolition debris, or non-MMSW. These landfills have approximately 25 million cubic yards of remaining capacity. Non-MMSW includes nonhazardous industrial waste, demolition debris, materials banned from disposal with MMMSW, problem materials, infectious waste, and other waste streams that are not MMSW or otherwise defined or regulated as hazardous waste.

Materials separated for recycling at some demolition debris transfer stations and landfills include concrete, bituminous asphalt, aluminum, copper, steel, brick, mattresses, appliances, and tires. Other materials have the potential to be separated and recycled from the demolition debris. Private businesses own and operate most of the TCMA facilities that manage non-MMSW. There is some public sector activity in managing certain non-MMSW materials in the TCMA, such as tree waste processing and crushing, and concrete or road base material recycling.

Table 11. Non-MMSW landfills accepting TCMA demolition debris

Facility name	Demolition debris tons	Industrial tons
Dawnway Demolition Landfill - SW-303	32,033	0
Dem-Con Landfill Hawick SW-629	14,556	0
Dem-Con Landfill, LLC - SW-290	315,033	141,264
DKV Demolition Landfill - SW-429	762	0
Elk River Landfill - SW-74	2	0
Ladd Demolition Landfill - SW-469	152	0
Pine Bend Landfill - SW-45	761	225,258
Rolling Hills Landfill, Inc - SW-60	0	2,399
Shamrock Landfill -SW-399	51	30
SKB Lansing Landfill - SW-514	316	1,739
SKB Rosemount Industrial Waste Facility – SW-383	885,460	2,775,210
Spruce Ridge Resource Management, Inc. – SW-6	2,924	39,727
Valley Demolition and Recycling, LLC – SW-527	2	0
Vonco II Becker - SW-580	182,708	221,512
Grand total	1,434,760	3,407,139

Appendix B: Environmental justice review

The MPCA defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This will be achieved when everyone benefits from the same degree of environmental protection and has equal access to the decision-making processes that contribute to a healthy environment. In May 2022, the MPCA released the Environmental Justice Framework which established the vision, strategies, and implementation actions for integrating environmental justice principles into the MPCA's work. This report includes a commitment to evaluate the environmental justice implications of program policies. The MPCA is developing an environmental justice review tool, which can be used broadly across all the agency's work, as well as detailed tools for specific program areas. The MPCA will share these tools and resources with counties once they are complete.

The following sections constitute the MPCA's environmental justice review of the MPP. Counties are required to complete an environmental justice review when developing their respective CSWMP.

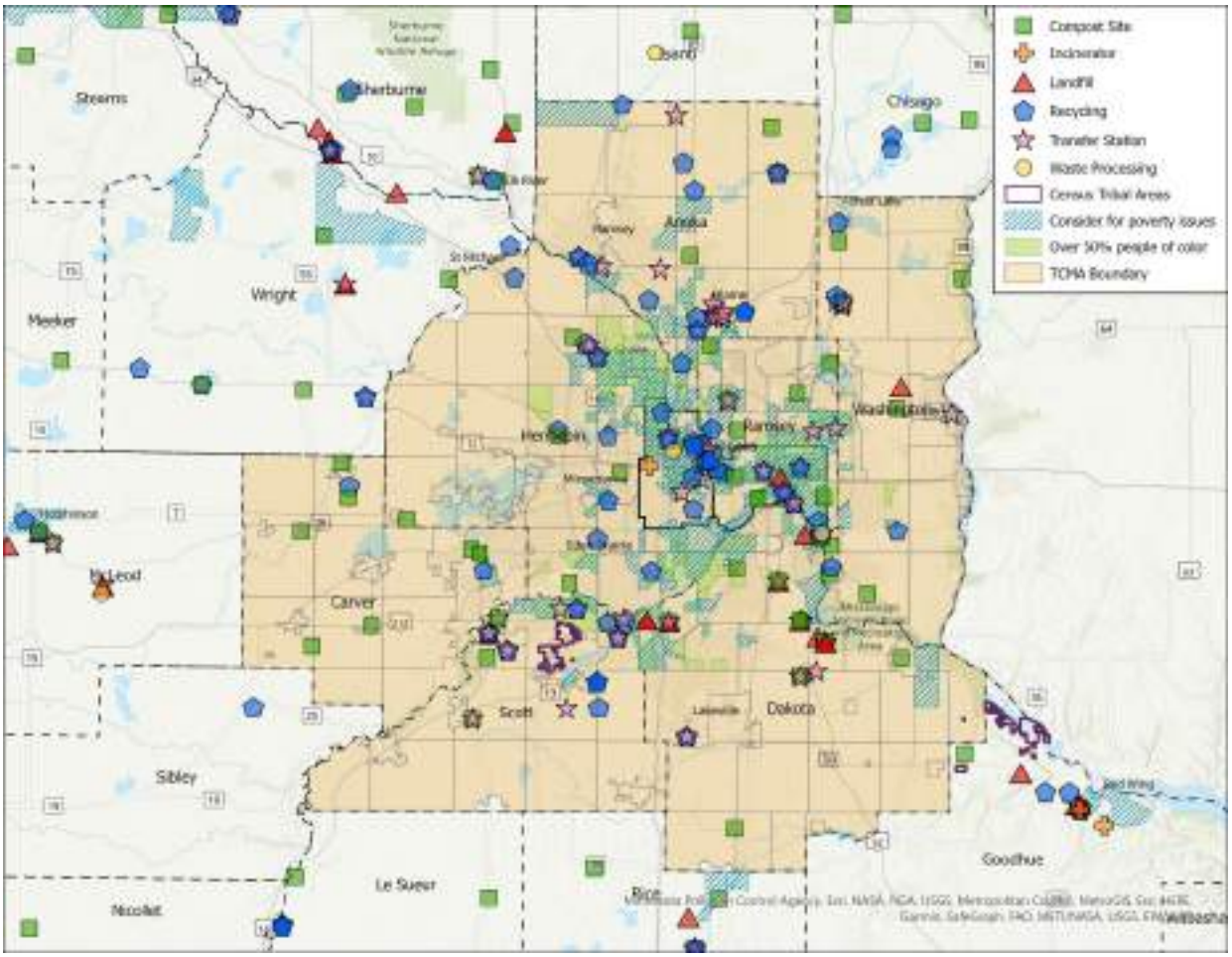
1. Identify potentially affected communities. Identify facilities that are in areas of concern for environmental justice. This is defined by the MPCA as census tracts using data from the U.S. Census and American Community Survey and meet one or both demographic criteria. These two criteria are defined as:
    - Total population of people of color greater than 40%
    - At least 35% of people reported income less than 200% of the federal poverty level
2. Identify who is likely to be affected by the proposed policy. What are the impacts of the proposed policy on communities of concern for environmental justice? Will it create disproportionate impacts or increase existing disproportionate impacts on minority or low-income populations? Examples include impacts on health, quality of life (from noise or visual impacts, etc.), personal finances, etc.
3. Review for impact. What are the opportunities for action? If the proposed policy would result in negative environmental or socio-economic impacts, or would add to cumulative impacts to people of color and low-income populations, what steps could be taken to avoid or mitigate these impacts? Additionally, does the proposed policy present opportunities to address existing disproportionate impacts on people of color, low income, or indigenous populations? Develop a list of likely impacts and actions to ensure that negative impacts are mitigated, and positive impacts are enhanced.
4. Assess engagement. How have you involved community members and stakeholders? What specific measures have been taken to engage community members in areas of concern for environmental justice?
5. CSWMP must include description of how the county has engaged with disadvantaged communities during the development of the CSWMP. Solid waste facilities must also engage with disadvantaged communities in their area when appropriate. Counties and facilities must always consider the impact to residents, particularly the disadvantaged communities that are more difficult to hear from, when making decisions about solid waste management.

Our models show low-income communities and areas of higher concentrations of people of color are at a greater risk from air pollution. Residents in 46% of lower income areas and 91% of communities of color experience air pollution risk above health guidelines (compared to only 32% of communities statewide). For this reason, the MPCA uses these criteria, as well as tribal boundaries, as a preliminary screening to identify areas where additional review or action is needed or desired. Additional information on variables such as language, education, and housing are considered and factored into

decisions and actions for areas where the preliminary screening has indicated a need to take a closer look.

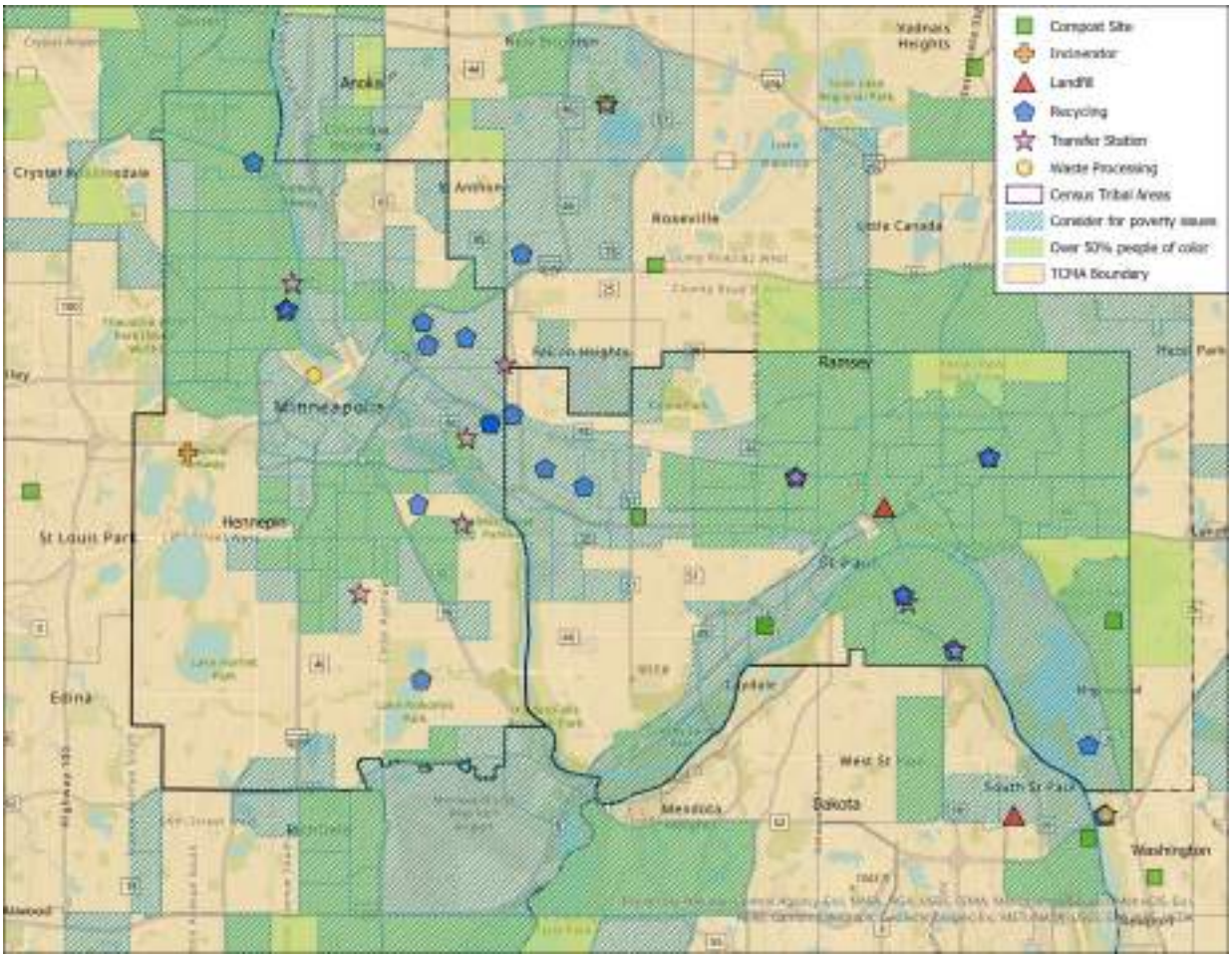
Figures 10 and 11 show solid waste facility locations and census tracts that are considered areas of concern for environmental justice. Areas marked with purple lines are census tracts with more than 40% of the population earning income less than 185% of the federal poverty level. As of 2022, this is an annual income of $51,338 for a family of four.

Figure 14. Map of solid waste facilities and EJ boundaries located within the TCMA



Areas shaded in green are census tracts with greater than 50% people of color.

Figure 15. Map of solid waste facilities and EJ boundaries located within Minneapolis and Saint Paul



The first priority of the MPP is to ensure the proper management of waste to protect human health and the environment. The MPP also supports reducing waste and increasing recycling. The policies and strategies proposed in the MPP are intended to reduce the environmental impacts associated with waste, because reduction in environmental impacts is beneficial to all Minnesotans.

The TCMA is home to several waste management facilities – out of 125 facilities, 42 of these are in areas of concern for environmental justice. Reducing waste generation would mean less material would need to be managed by these facilities. Meeting the landfill diversion goals established in the MPP would likely divert material from landfills to regional recycling, organics recovery, and resource recovery facilities, including the facilities located within areas of concern for environmental justice. The potential impacts include increases in traffic and noise, as well as potential impacts to air quality due to increased vehicular traffic and facility emissions.

If the objectives in the MPP are attained, the region may need more recycling and organics recovery facilities. These facilities would be subject to the standard process for new facility development, outlined in Appendix D. In addition, as described in the MPCA's environmental justice framework when considering permit applications for new facilities and during renewal of existing permits for facilities located in areas of concern for environmental justice, the MPCA will:

- Identify facility and permit types that warrant additional actions based on the potential for adverse effects.

- Identify and evaluate additional measures, beyond meeting established permit limits, to avoid and diminish impacts.
- Increase civic engagement, public participation, and outreach for community groups and residents.
- Foster increased community involvement and actions on the part of the entities that we regulate.
- Consider ways to prioritize work to enhance benefits to areas of concern for environmental justice.

A large role of the MPCA is ensuring that facilities are properly permitted to minimize human health and environmental harm. During permitting for facilities in areas of concern for environmental justice, the MPCA can identify and evaluate additional measures, beyond meeting established permit limits, to avoid and diminish impacts. This could include changing processes or procedures, installing additional pollution control equipment, or otherwise achieving a lower level of pollutant release than required by state or federal requirements. The MPCA can also work with the permittee to incorporate these measures into the permit or supplemental documents as possible.

Compliance and enforcement are other tools the MPCA can use to mitigate potential impacts. The MPCA could determine that more frequent inspections at facilities in areas of concern for environmental justice is needed to ensure the facilities are meeting applicable regulations and permit conditions.

Consistent with the WMA hierarchy, this MPP prefers resource recovery to landfilling. Communities of concern for environmental justice have indicated their concern about air emissions from resource recovery facilities located within their boundaries. To reduce reliance on resource recovery facilities and landfills, this MPP promotes best practices designed to reduce waste and increase recycling and organics recovery. While the MPCA recognizes that waste will continue to be processed at resource recovery facilities and disposed at landfills, the aggressive objectives established in this MPP encourage the TCMA to significantly reduce reliance on these less preferable management methods.

Certain strategies proposed in this MPP would directly benefit communities in areas of concern for environmental justice. For example, the MPP recommends implementing organized collection for MMSW. Organized collection is a more efficient method of managing trash and can lead to reductions in illegal dumping, a common concern in lower income communities. Lower mobile source emissions and reduced truck traffic are additional benefits of organized collection. The MPP also includes an environmental justice review in the permitting process – for new and existing facilities – to ensure that environmental justice concerns are addressed.

Appendix C: Predrafting notice

Statement of subjects expected to be covered by revisions to the Metropolitan Area Solid Waste Policy Plan

Introduction

The Minnesota Pollution Control Agency (MPCA) has started the process to prepare revisions to the TCMA Solid Waste Management Policy Plan (MPP). The current MPP can be viewed online or it can be provided by request. The current MPP was adopted by the MPCA on April 6, 2017. The new revised MPP will be adopted by the MPCA Commissioner by December 31, 2022.

Revisions to the MPP will be prepared in accordance with Minn. Stat. § 473.149. The MPP contains goals and policies for solid waste (i.e., all waste, except wastewater and other liquid wastes) management, including recycling and household hazardous waste management. The statute requires that the MPP contain objectives to decrease the landfilling of MMSW, what most of us consider garbage, and specific components of the solid waste stream, including residuals and ash. The MPP must be followed by entities who play a role in TCMA solid waste management.

The MPCA is required to prepare this pre-draft notice to solicit public comments on the anticipated revisions to the MPP. MPCA welcomes public comments. They will be carefully reviewed and taken into consideration when MPCA makes decisions regarding updates to the MPP. Public comments must be received within 45 days from the date of the publication in the State Register. Questions about the document or the process may be directed to Peder Sandhei at 651-757-2688 or 1-800-657-3864 (toll-free in Minnesota). Public meetings are currently scheduled for May 26, 2021, for MPCA staff to answer questions, and hear comments.

Written comments on the pre-draft notice should be sent to: peder.sandhei@state.mn.us

Comments must be received by the MPCA by 4:30 p.m., C.S.T., July 12, 2021. [Written correspondence may be sent to the following address: Peder Sandhei, Minnesota Pollution Control Agency, 520 Lafayette Rd. N., 2nd Floor, St. Paul, Minnesota 55155-4100]

If you wish to stay informed on the development of the MPP, please submit a comment on the pre-draft notice by the deadline indicated above. All comments will be published on the Agency's MPP website page and commenters will be added to a stakeholder list and be notified of any future MPP developments. If you do not submit a comment on the pre-draft notice but would like to be included on future MPP related distributions, please contact Mr. Sandhei.

Overall approach and philosophy

The MPP revisions will focus on:

- Reduction in the amount of waste generated
- Reduction in the toxicity of waste generated
- Recycling and composting
- Recovery of energy from waste
- Reduction in land disposal (landfilling)
- Coordination of solid waste management among cities, counties, townships, etc.
- Broadening participation and accountability for all parties involved in solid waste management

- Protection of public health and state's air, land, water, and other natural resources
- Additional emphasis on SMM principles and environmental benefits that consider life cycle analysis, such as GHG impacts, rather than tons diverted from land disposal
- Environmental Justice

The MPP will continue to support: SMM principles, treating waste as a resource; minimizing the use of landfills; waste and toxicity reduction; the management of all solid waste; recycling and organics goals; region-wide waste processing; regional coordination; and minimizing environmental impacts. The MPP will continue to support policies aimed at preventing, reducing, and managing all wastes such as household solid waste, construction and demolition waste, industrial solid waste, and ash.

The MPP revisions will be developed consistent with the State policies and purposes expressed in Minn. Stat. § 115A.02 of the Minnesota Waste Management Act (WMA). The MPP will support the WMA hierarchy of preferred waste management methods.

The MPCA will consult with the seven metro counties, the public and private sector, and other interested stakeholders in the revision of the MPP.

Description of how the existing solid waste system serves the Twin Cities Metropolitan Area

The TCMA's current solid waste infrastructure has developed extensively since the passage of the 1980 WMA. In 2019, 47% was recycled or composted, and additional 21.5% was processed for energy recovery, and 31% was landfilled.

The MPP will describe how the existing solid waste system benefits the TCMA, including the environmental benefits, and how the new MPP proposes to increase those benefits. The MPP will also identify the amount of waste and types of materials managed by the different solid waste management methods.

The MPP will show how a comprehensive waste prevention, reuse, recycling, composting, processing, and disposal system to manage solid waste (integrated solid waste system), consistent with the waste management hierarchy, protects public health, supports a vibrant economy, reduces emissions of air pollutants such as GHGs, conserves energy and resources, and produces energy. It will also discuss how the solid waste system can be improved through more effective governance, a more efficient collection system, broadened accountability, and additional landfill reduction.

Addressing obstacles in the metro solid waste system

The MPP will discuss some challenges that face the TCMA solid waste system, including, but not limited to:

- Local government responsibility over solid waste management
- Accountability throughout the system
- Collection of SMM accurate and meaningful data
- Expansion of SMM principles
- A need for effective recycling
- Recycling market development
- Opportunities to advance productive use and disposal of materials

Solid waste management facilities and programs

The MPP will include goals and policies for solid waste management, including recycling consistent with Minn. Stat. § 115A.551, and household hazardous waste management consistent with Minn. Stat. § 115A.96, subdivision 6, in the TCMA.

The MPP will include specific and quantifiable regional objectives for minimizing waste generation and reducing reliance on the practice of landfilling of MMSW and other components of the solid waste stream. The objectives will be stated for a period of at least 20 years. The MPP will also include objectives for waste reduction, reuse, and minimization of solid waste through recycling, organic waste composting, and resource recovery, for a period of at least 20 years.

The MPP will identify:

- Environmental and resource management benefits of waste processing (WTE)
- Quantities and geographic origin of waste requiring processing
- Available WTE facility capacity, and the inter-county regional opportunities for the development of future processing capacity and opportunities for inter-county sharing of waste

The MPP will evaluate the existing state and regional administration structure and make appropriate recommendations that best fulfill the needs of integrated solid waste management. The MPP also will explore issues beyond the TCMA jurisdiction that affect the regional solid waste system.

MPP implementation tools

The MPP will include procedures, standards, and criteria regarding the MPCA review of: CSWMP; annual waste certification reports; waste facility permits; certificates of need; waste designation, and solid waste supply contracts and processing agreements. The usefulness of these reviews will also be examined to determine if some of them should be eliminated, changed or if others are needed.

Finally, the MPP will include standards and criteria for the MPCA review of solid waste facility permits regarding the following matters: general location; capacity; waste supply; operation; processing techniques; environmental impact; effect on existing, planned, or proposed collection services and waste facilities; and economic viability.

Appendix D: Procedures, standards, and criteria

Minn. Stat. § 115A, 116 and 473 authorize the MPCA to formulate and set out procedures, standards, and criteria to implement the Metropolitan Solid Waste Management Policy Plan (MPP) 2023 to 2043 and facilitate the MPCA's review of:

- Solid waste facility permit applications
- Solid waste supply and processing contracts
- Waste district proposals
- Waste designation proposals
- Landfill certificates of need proposals
- County annual and waste certification reports
- County solid waste management plans (CSWMP)

The MPCA will implement the MPP when conducting these reviews. Public and private entities subject to review are encouraged to contact the MPCA before preparing and submitting approval requests. The MPCA will coordinate its review with other applicable state and local procedures.

Solid waste facility terms and definitions

The MPCA will administer the MPP using terms and definitions used in chapters 115A, 116, and 473 and related rules.

Solid waste facility permit applications

The MPCA review of solid waste facilities is governed primarily by Minn. Stat. § 473.823. Minn. Stat. § 473.823, subd. 3(b) provides that a permit may not be issued for the operation of a solid waste facility in the TCMA that is not "in accordance with the Metropolitan Policy Plan." The statute also provides that in making this determination, *"the commissioner shall consider the areawide need and benefit of the applicant facility and the effectiveness of proposed buffer areas to adequately protect surrounding land uses in accordance with the Metropolitan Policy Plan, and may consider, without limitation, the effect of the applicant facility on existing and planned solid waste facilities."* In this section of the MPP, the MPCA establishes the procedures that shall be applied for review of new and existing solid waste facility permit applications, including the information to be submitted in particular applications, when those applications will be requested, and how the MPCA will approve, disapprove, or conditionally approve such facilities.

Minn. Stat. § 473.823 is reproduced below

473.823 RULES AND PERMITS.

Subd. 3. Solid waste facilities; review procedures. (a) The agency shall request applicants for solid waste facility permits to submit all information deemed relevant by the commissioner for review, including without limitation information relating to the geographic areas and population served, the need, the effect on existing facilities and services, the effectiveness of proposed buffer areas to ensure, at a minimum, protection of surrounding land uses from adverse or incompatible impacts due to landfill operation and related activities, the anticipated public cost and benefit, the anticipated rates and charges, the manner of financing, the effect on metropolitan plans and development programs, the supply of waste,

anticipated markets for any product, and alternative means of disposal or energy production.
(b) A permit may not be issued for the operation of a solid waste facility in the metropolitan area which is not in accordance with the metropolitan policy plan. The commissioner shall determine whether a permit is in accordance with the policy plan. In making this determination, the commissioner shall consider the areawide need and benefit of the applicant facility and the effectiveness of proposed buffer areas to adequately protect surrounding land uses in accordance with the policy plan, and may consider, without limitation, the effect of the applicant facility on existing and planned solid waste facilities.
(c) If the commissioner determines that a permit is in accordance with the policy plan, the commissioner shall approve the permit. If the commissioner determines that a permit is not in accordance with the policy plan, the commissioner shall disapprove the permit. Approval of permits may be subject to conditions the commissioner determines are necessary to satisfy criteria and standards in the policy plan, including conditions respecting the type, character, and quantities of waste to be processed at a solid waste facility used primarily for resource recovery and the geographic territory from which a resource recovery facility or transfer station serving such a facility may draw its waste.
(d) A permit may not be issued in the metropolitan area for a solid waste facility used primarily for resource recovery or a transfer station serving the facility, if the facility or station is owned or operated by a public agency or if the acquisition or betterment of the facility or station is secured by public funds or obligations issued by a public agency, unless the commissioner finds and determines that adequate markets exist for the products recovered and that establishment of the facility is consistent with the criteria and standards in the metropolitan and county plans respecting the protection of existing resource recovery facilities and transfer stations serving such facilities.

Procedures for obtaining MPCA approval of solid waste facility permits

Coordination of MPCA review. For existing facilities, the MPCA will request information related to the solid waste facility and information required in the MPP before the MPCA completes review and reissues the permit. The MPCA may request additional information from solid waste facility permit applicants after the adoption of the MPP. The application will need to contain information related to the proposed solid waste facility and information required in the MPP.

Basic information required. To obtain MPCA approval solid waste facility permit applicants must include:

- Information relating to the geographic areas and population served, including highlighting areas of concern for environmental justice
- The need for the facility, including information that shows that new or expanded resource recovery and disposal facilities are consistent with MPCA most recent forecast of waste generation and waste management objectives
- The effect of the facility on existing facilities and services
- For public facilities: The effect of public facilities on existing comparable public and private facilities
- The effectiveness of proposed buffer areas to ensure, at a minimum, protection of surrounding land uses from adverse or incompatible impacts due to landfill operation and related activities
- The anticipated public costs and benefits of the facility
- The anticipated rates and charges
- The manner of financing

- The effect on metropolitan CSWMPs and development programs
- The supply of waste
- Solid waste supply contracts subject to Minn. Stat. § 473.813
- Anticipated markets for any product
- Alternative means of disposal or energy production
- Additional information required by the commissioner, including but not limited to, environmental justice review criteria (see Appendix B for more information)
    - All solid waste facilities located in environmental justice zones must:
        - Do an annual impact review. Identify how the facility is impacting the neighborhood in which it resides. Develop a list of impacts and benefits to the community. Examples of impacts could include air emissions such as particulate matter, traffic concerns due to trucks, odors, or others.
        - Develop a plan for mitigating the negative impacts and enhancing the benefits to the community including the process for community engagement.
        - Engage with the local community on an annual basis to make sure their concerns are addressed in the plan.
- The owner or operator of any landfill or waste combustor shall conduct a waste composition study. Waste composition analysis must include the following:
    - Sampling protocol must follow the most recent ASTM International Test Standard D 5231-92 or an alternative as approved by the MPCA.
    - Material waste type categories must be consistent with the most recent Statewide Waste Characterization or otherwise approved by MPCA prior to the sort occurring

Standards/criteria for approval of solid waste facility permits as consistent and in accordance with the MPP

Following receipt of a complete application, the commissioner shall determine whether a permit is consistent and in accordance with the MPP within 90 days. In making this determination, the commissioner shall consider:

- The area wide need and benefit of the applicant facility.
- The effectiveness of proposed buffer areas to adequately protect surrounding land uses in accordance with the MPP.
- The effect of the applicant facility on existing and planned solid waste facilities.
- The requirements of Restriction on Disposal in Minn. Stat. § 473.848.
- For a solid waste facility used primarily for resource recovery or a transfer station serving the facility and owned or operated by a public agency or if the acquisition or betterment of the facility or station is secured by public funds or obligations issued by a public agency (public facility), the owner must demonstrate that:
    - Adequate markets exist for the products recovered.
    - The public facility does not displace comparable private and public facilities already existing in the area unless the displacement is required in order to achieve the waste management objectives identified in the MPP.
    - The public facility is consistent with the applicable CSWMP.
    - The public facility is necessary to achieve the waste management objectives identified in the CSWMP.

- The public facility is consistent with state policy and purposes outlined in Minn. Stat. § 115a.02 and Minn. Stat. §§ 473.842 to 473.849.

Minn. Stat. § 473.149 provides that *"For solid waste facilities owned or operated by public agencies or supported primarily by public funds or obligations issued by a public agency, the plan shall include additional criteria and standards to protect comparable private and public facilities already existing in the area from displacement unless the displacement is required in order to achieve the waste management objectives identified in the plan."* For solid waste facilities owned or operated by public agencies or supported primarily by public funds or obligations issued by a public agency (public facility), the owner must demonstrate that the public facility:

- Does not displace comparable private and public facilities already existing in the area unless the displacement is required in order to achieve the waste management objectives identified in the CSWMP.
- Is consistent with the applicable CSWMP.
- Is necessary to achieve the waste management objectives identified in the CSWMP.
- Additional information required by the commissioner, including but not limited to, environmental justice review criteria (see Appendix B for more information)
- All solid waste facilities located in environmental justice zones must:
    - Do an annual impact review. Identify how the facility is impacting the neighborhood in which it resides. Develop a list of impacts and benefits to the community. Examples of impacts could include air emissions such as particulate matter, traffic concerns due to trucks, odors, or others.
    - Develop a plan for mitigating the negative impacts and enhancing the benefits to the community including the process for community engagement.
    - Engage with the local community on an annual basis to make sure their concerns are addressed in the CSWMP.
- The owner or operator of any landfill or waste combustor shall conduct a waste composition study every five years. Waste composition analysis must include the following:
    - Sampling protocol for waste composition studies must follow the most recent ASTM International Test Standard D 5231-92 or an alternative as approved by the MPCA.
    - Material waste type categories must be consistent with the 2013 Statewide Waste Characterization or otherwise approved by MPCA prior to the sort occurring
- Is consistent with state policy and purposes outlined in Minn. Stat. § 115A.02 and Minn. Stat. §§ 473.842 to 473.849.

If the commissioner determines that a permit is in accordance with the MPP, the commissioner shall approve the permit. If the commissioner determines that a permit is not in accordance with the MPP, the commissioner shall disapprove the permit.

Solid waste supply and processing contracts

Cities, counties, and towns in the TCMA can enter contracts for the delivery of solid waste to waste facilities and can enter into contracts for the processing of solid waste (Minn. Stat. § 473.813, subd. 1). Before a local unit of government enters into a waste management contract for a period of longer than five years in duration, they must get MPCA approval (Minn. Stat. § 473.813, subd. 2). The success of waste facilities often depends on long-term commitments for waste supplies and processing. It is anticipated that long-term supply and processing contracts may continue to be used as new or existing

contracts are renewed or renegotiated. Existing MPCA contract approvals will remain in effect unless (1) the contract term is extended; or (2) the contract is amended or revised during its term.

Minn. Stat. § 473.813 is reproduced below

473.813 CITIES, COUNTIES, TOWNS; SOLID WASTE CONTRACTS.

Subdivision 1. For up to 30 years. Notwithstanding any contrary provision of law or charter, and in addition to the powers or authority granted by any other law or charter, a city, county, or town in the metropolitan area may directly negotiate and enter into contracts, for a term not to exceed 30 years, for the delivery of solid waste to a waste facility and the processing of solid waste. Contracts made by direct negotiations shall be approved by resolution adopted by the governing body of the city, county, or town.

Subd. 2. Review by commissioner. Before a city, county, or town enters into any contract pursuant to subdivision 1 for a period of more than five years, the city, county, or town shall submit the proposed contract and a description of the proposed activities under the contract to the commissioner for review and approval. The commissioner shall approve the proposed contract if the commissioner determines that the contract is consistent with the metropolitan policy plan, permits issued under section 473.823, and county reports or approved master plans. The commissioner may consolidate the review of contracts submitted under this section with the review of related permit applications submitted under section 473.823 and for this purpose may delay the review required by this section.

Procedures for review of solid waste supply and processing contracts

- **Procedure**: Any city, county, or town entering into a contract for the delivery of solid waste to a waste facility and the processing of solid waste for a term longer than five years, shall submit that contract to the MPCA for review at least 90 days prior to the anticipated effective date of the contract. Contracts subject to this review include waste delivery agreements, organized collection contracts, host community fee agreements in lieu of fees authorized under Minn. Stat. §§ 115A.919 and 115A.921 if they include a waste delivery provision, and other agreements including waste delivery provisions.
- **Application of standards to contracts**: MPCA will approve contracts if the proposed contract is consistent with the MPP, permits issued under Minn. Stat. § 473.823, and county annual reports and approved CSWMP. A contract to deliver waste to a facility that is not specified in the applicable CSWMP will not be approved. To be approved, a contract to deliver waste must have a provision that terminates the contract in less than 30 years.
- **Timely MPCA contract review**: All contracts submitted to the MPCA for review will be reviewed and approved or not approved within 60 days. The MPCA will notify the city, county, or town of its decision, and if the contract is disapproved MPCA will notify the city, county, or town of the reasons for disapproval.
- **Consolidation of contract review with permit review**: MPCA may consolidate the review of contracts submitted under this section with the review of related permit applications submitted under Minn. Stat. § 473.823 and, for this purpose, may delay the review required by this section.
- **Contracts that are inconsistent with the MPP**: If MPCA determines that a contract is not consistent with the MPP, then MPCA may require that the parties to the contract revise its terms and re-submit the revised contract for MPCA approval.

Waste management districts

The procedure, standards, and review criteria for waste management districts is set out in Minn. Stat. §§ 115A.62 to 115A.72. Minnesota counties, including metropolitan counties, can form waste management districts. This authority enables counties to implement waste management practices they may not be able to conduct independently, or which can be more effectively performed jointly. The establishment of a waste management district must be approved by the MPCA. Specific conditions may be incorporated as part of the MPCA's approval. Minn. Stat. § 115A.63, subd. 3 provides that a waste management district formed by metropolitan counties must have the same procedural and substantive responsibilities and duties as a metropolitan county, including requirements for preparing a comprehensive solid waste management plan. The requirements for county solid waste planning are contained in Minn. Stat. § 473.803 and in the MPP.

Waste designation proposals

The Waste Management Act, Minn. Stat. §§ 115A.80 to 115A.893, allows county or waste district to designate a facility where all MMSW generated within its boundaries, or a service area thereof, is required to be delivered. Using designation to direct the waste to a particular destination is referred to as waste designation or waste assurance. The MPCA approval of waste designations is required for designation to take effect. Designation is authorized by the Minnesota Legislature to further state policies and purposes, as articulated in Minn. Stat. § 115A.02, and to advance the public purposes served by effective solid waste management. See Minn. Stat. § 115A.80.

The procedures, standards, and criteria for approval of waste designation are contained in Minn. Stat. §§ 115A.80 to 115A.893.

Landfill Certificate of Need

The Metropolitan Landfill Abatement Act, Minn. Stat. § 473.823, subd. 6, states that no new land disposal capacity for MMSW shall be permitted in the TCMA without a CON issued by the MPCA indicating that the additional disposal capacity is needed. The MPCA must certify need only to the extent that there are no feasible and prudent alternatives to land disposal. Alternatives that are speculative or conjectural cannot be deemed to be feasible and prudent. Economic considerations alone cannot justify the CON or the rejection of alternatives. Minn. Stat. § 473.823, subd. 6 requires the MPCA to include in the MPP the standards and procedures for certifying need. The standards and procedures must be based on the metropolitan disposal abatement plan and the solid waste disposal facilities development schedule, both included in the Metropolitan System Plan (Part 3), and with approved CSWMPs that are consistent with the abatement plan and development schedule.

Minn. Stat. § 473.823, subd. 6 is reproduced below

> *Certification of need. No new mixed municipal solid waste disposal facility or capacity shall be permitted in the metropolitan area without a certificate of need issued by the commissioner indicating a determination that the additional disposal capacity planned for the facility is needed in the metropolitan area. The commissioner shall amend the policy plan, adopted pursuant to section 473.149, to include standards and procedures for certifying need that conform to the certification standards stated in this subdivision. The standards and procedures shall be based on the metropolitan disposal abatement plan adopted pursuant to section 473.149, subdivision 2d, the solid waste disposal facilities development schedule adopted under section 473.149, subdivision 2e, and the provisions of any master plans of counties that have been approved under section 473.803, subdivision 2, and that are consistent with the abatement plan and development schedule. The*

commissioner shall certify need only to the extent that there are no feasible and prudent alternatives to the disposal facility, including waste reduction, source separation and resource recovery which would minimize adverse impact upon natural resources. Alternatives that are speculative or conjectural shall not be deemed to be feasible and prudent. Economic considerations alone shall not justify the certification of need or the rejection of alternatives.

Procedures for obtaining MPCA CON for landfills in the Metropolitan Area

Scope: MPCA will apply these standards to applications for additional MMSW capacity for MMSW landfills located in the Metropolitan Area.

Timing of CON application: MPCA will notify landfills located in the Metropolitan Area and will issue a public communication of MPCA's intent to accept CON applications for additional MMSW land disposal capacity after the adoption of the MPP and after MPCA approval of all county solid waste management plans (CSWMP). If the facility does not currently have an approved permit to accept MMSW, the CON application must come in first, however, the CON determination cannot be finalized until environmental review and other permitting requirements are completed.

Process order:

1. MPCA issues notice of intent to accept CON applications
2. The facility must submit the documents within a 180-day application period following the notice of intent.
3. MPCA reviews applications for completeness after the closure of the 180-day application period. (90-day review period)
4. MPCA issues preliminary CON determinations
5. Must issue public notice to get comment on the preliminary determinations.
6. Facilities must submit a complete permit application within 18 months of receiving a preliminary determination if they do not currently have an MSW permit. If the 18-month deadline is not met, the preliminary capacity will be revoked and either, held until a future notice of intent to accept CON applications is issued, allocated to other Metro facilities that applied or will be held aside for Greater Minnesota facilities to apply for. How that capacity will be treated will be driven by county letters and existing waste flows. The applicant facility will have to wait until the next MPCA intent to accept CON to reapply. If existing preliminary determinations do not have facility permit applications submitted, the 18 months starts at the issuance date of this Plan.
7. Notify the facilities and the public of the preliminary determinations for facilities that need to complete environmental review
8. Final determinations are approved as each facility completes environmental review. The final approvals are not issued at the same time, but rather as each individual facility completes their respective permit processes.
9. The facility cannot use the additional CON until their permit is finalized or a minor modification is completed.

Submittal of CON applications: CON applications from MMSW landfills located in the Metropolitan Area must be submitted within a period of 180 days after MPCA's CON notification is published. A CON application must include the following:

- Annual solid waste estimates. The CON application shall include estimates of the amount (in tons) and type of solid waste to be managed annually at the facility during its design life.

- Origin of waste. The CON application shall include identification of the origin of the solid waste including estimates of the amount of solid waste to be received annually from each county or district of origin. Information about quantities of solid waste from counties or districts outside the metropolitan area shall be based on information in approved CSWMP. Information about quantities of solid waste from counties or districts within the metropolitan area shall be based on information in the MPP and approved CSWMP.
    - If an approved CSWMP does not state that solid waste from a county or district will be managed at the proposed facility, the application shall include a letter from the county or district board of the county or district generating the solid waste indicating that in the county's or district's best estimate the amount of solid waste in question is available for management at the proposed facility. The letter must be consistent with the approved greater Minnesota solid waste management plan (SWMP), the CSWMP, and any applicable CSWMP amendments. Counties shall provide the letter to the facility with projected annual amounts expected to go to the applicant facility. County letters must be specific to the facility or facilities considered in the metro application. New letters must be provided for separate CON requests that occur outside of the metro process. The letter must be signed by the county board or by an employee with documented board approved delegation.
- Alternatives. The CON application shall include an analysis of alternatives to the new or expanded disposal capacity if the new capacity has not been included in the approved Greater Minnesota county solid waste management, the MPP, or CSWMP.
- Estimate errors. If the amount of new capacity needed is greater than the amount identified in the approved CSWMP, SWMP, or the MPP due to assumptions concerning the amount of solid waste generated, the application must document the basis for calculating the amount of capacity.

Public informational meeting on CON application: The MPCA may hold a public informational meeting on its preliminary determination to approve or deny the application for a CON if the commissioner determines that a public informational meeting would help to clarify and resolve issues regarding the CON application.

Standard: No new MMSW disposal facility or capacity shall be permitted in the Metropolitan Area without a CON issued by the commissioner indicating a determination that the additional disposal capacity planned for the facility is needed in the Metropolitan Area. The MPCA will approve CON applications only if MPCA determines that no feasible and prudent available alternative MMSW management facilities, including existing permitted land disposal capacity, can substitute for the proposed capacity.

The MPCA will apply the following criteria to determine whether CON can be granted:

- **Restriction on disposal**: MPCA will not accept or review any application for additional land disposal capacity for a landfill located in the Metropolitan Area unless MMSW resource recovery facilities serving the TCMA are functioning at full capacity and waste has been certified as unprocessible by metro counties.
- **Orderly and deliberate development of facilities**: Pursuant to Minn. Stat. § 115A.02, the MPCA must ensure the orderly and deliberate development of facilities, including landfills. To avoid a situation where the TCMA is dependent on the services of a single disposal facility, MPCA will not grant all CON to one landfill.
- **Tonnage as basis of CON**: MPCA will grant CON in tons to a landfill instead of cubic yards or other volume units.

- **Alternatives**: MPCA will consider existing permitted capacity in the service area of the facility seeking the CON. The fact that a permit for a facility may expire during the expected service life of the facility seeking CON shall not be deemed to extinguish permitted capacity assuming that the existing permitted facility is likely to be re-permitted.
- **Plan consistency**: MPCA will not grant a CON unless the new landfill capacity is consistent with the MPP, with applicable CSWMP, applicable greater Minnesota comprehensive solid waste management plans, and applicable information from other solid waste management jurisdictions outside of the state of Minnesota.
- **Forecasting tons**: If the amount of new capacity needed is greater than the amount identified in the MPP, approved CSWMP or SWMP due to errors in forecasting MMSW generated, the application must document the basis for calculating the amount of capacity needed and provide an analysis of alternatives, including landfill abatement programs.
- **Least cost alternative**: MPCA will not approve a CON application based solely on a determination that it is the least-cost alternative.
- The agency shall revoke or revoke and reissue the certificate of need if the commissioner determines that the information contained in the certificate of need is no longer accurate or that the owner or operator of the disposal facility has not fulfilled all applicable state and federal requirements.

County annual report and waste certification reports

The TCMA counties are required to submit annual solid waste reports and certification reports to the MPCA for approval under Minn. Stat. §§ 473.803, subd. 3 and 473.848, subd 2. The MPCA will review these reports for consistency with the MPP and for consistency with the requirements of Minn. Stat. § 473.848, which states that no person shall dispose of unprocessible MMSW generated in the TCMA at a land disposal facility unless it is certified as unprocessible. Minn. Stat. § 473.848, subd. 4 states that the MPCA may adopt standards for determining when waste is unprocessible and procedures for expediting certification and reporting of unprocessed waste. The MPCA will use the information contained in the reports to enforce Minn. Stat. § 473.848 with respect to permitted waste facilities and public entities. MPCA permitted waste facilities, including MMSW resource recovery facilities and MMSW landfills, are required by state law to comply with Minn. Stat. § 473.848. The restriction on disposal in Minn. Stat. § 473.848, subd. 1 applies only to solid waste management and landfilling within Minnesota. Public entities that manage solid waste or contract for the management of solid waste are required by Minn. Stat. § 115A.46, subd. 5(b) to manage the waste consistent with the CSWMP.

The TCMA counties shall submit certification reports to the MPCA as a separate report before the deadline of April 1, of each year and include the certification report in the annual solid waste report. The TCMA counties may submit more frequent reports, such as quarterly certification reports, during each year to the MPCA to assist MPCA obtain compliance with Minn. Stat. § 473.848.

Minn. Stat. § 473.848 subd. 2 is reproduced below

Subdivision 1. Restriction. (a) For the purposes of implementing the waste management policies in section 115A.02 and metropolitan area goals related to landfill abatement established under this chapter, a person may not dispose of unprocessed mixed municipal solid waste generated in the metropolitan area at a waste disposal facility unless the waste disposal facility meets the standards in section 473.849 and:
(1) the waste has been certified as unprocessible by a county under subdivision 2; or
(2)(i) the waste has been transferred to the disposal facility from a resource recovery facility;

(ii) no other resource recovery facility serving the metropolitan area is capable of processing the waste; and
(iii) the waste has been certified as unprocessible by the operator of the resource recovery facility under subdivision 3.
(b) For purposes of this section, mixed municipal solid waste does not include street sweepings, construction debris, mining waste, foundry sand, and other materials, if they are not capable of being processed by resource recovery as determined by the council.
Subd. 2.County certification; office approval. (a) By April 1 of each year, each county shall submit an annual certification report to the office detailing:
(1) the quantity of waste generated in the county that was not processed prior to transfer to a disposal facility during the year preceding the report;
(2) the reasons the waste was not processed;
(3) a strategy for development of techniques to ensure processing of waste including a specific timeline for implementation of those techniques; and
(4) any progress made by the county in reducing the amount of unprocessed waste.
The report shall be included in the county report required by section 473.803, subdivision 3.
(b) The Pollution Control Agency shall approve a county's certification report if it determines that the county is reducing and will continue to reduce the amount of unprocessed waste, based on the report and the county's progress in development and implementation of techniques to reduce the amount of unprocessed waste transferred to disposal facilities. If the Pollution Control Agency does not approve a county's report, it shall negotiate with the county to develop and implement specific techniques to reduce unprocessed waste. If the Pollution Control Agency does not approve two or more consecutive reports from any one county, the Pollution Control Agency shall develop specific reduction techniques that are designed for the particular needs of the county. The county shall implement those techniques by specific dates to be determined by the Pollution Control Agency.

Standard for approval of county certification: The MPCA will approve a county's reports if it determines that the county is reducing and will continue to reduce the amount of unprocessed waste based on the report and the county's progress in development and implementation of techniques to reduce the amount of unprocessed waste transferred to disposal facilities.

Procedures

- **Required report:** MPCA will notify the TCMA counties that annual reports and certification reports are required to be submitted to the MPCA on or before April 1 each year. Additional quarterly certification reports, including the information required in Minn. Stat. § 473.848, subd. 2, paragraph (a), clauses 1, 2, 3, and 4, may be submitted on or before April 30, July 31, October 31, and January 31.
- **Content and Form:** MPCA will provide forms and instructions to the TCMA counties that outline the information and data required in the annual reports/certification reports.
- **MPCA review and approval:** MPCA will review and approve or disapprove a certification report if it determines that the county's certification shows the county is reducing and will continue to reduce the amount of unprocessed waste.

The MPCA will apply the following criteria to approval of county certification reports

- **Unprocessible waste:** The MPCA will not approve a county certification if it certifies waste as unprocessible when there is reasonably available capacity in the TCMA system that could be used to process solid waste generated in the county. In determining reasonably available capacity, the MPCA will give consideration to the specific geographic area that typically supports each of the processing facilities that serves the TCMA. The TCMA processing system is described in Appendix A, but this system could change periodically. The MPCA will annually provide a list

of processing facilities that serve the TCMA to the counties prior to the date the certification report is due. To be fully utilized, the processing facility must be operating at 100% of its operating capacity, taking into account outages for maintenance and repair.

- **Facility Provided ROD Reports:** The landfills and resource recovery facilities must fill out quarterly reports for submittal to the MPCA. These reports must include the following information:
  - Monthly data provided quarterly
  - County of origin of the waste (Transfer stations must provide to landfills)
  - Projected shortages and days affected
  - Date of notice and date of expected shortage
  - Amount sent to resource recovery on behalf of landfill to cover shortage
  - Other information as needed to determine compliance.
- As stated in the signed settlement agreement, "Landfill shall be entitled to rely on a presumption that each resource recovery facility is operating at full capacity except for any particular time period for which Landfill is notified at the specified email address by a particular resource recovery facility of an Anticipated Shortage 14 days in advance. If the Landfill takes the steps outlined in this Schedule of Compliance, MPCA will not bring an enforcement action and will advise the TCMA counties that the MMSW disposed of at the Landfill for that year will be considered and should be certified as unprocessible."
- If there is a market change in the number of landfills serving the TCMA, then the landfills must agree to revise their compliance plans. The MPCA may facilitate the obligation discussion between facilities if needed. Once new obligations amounts are determined, the facilities must notify MPCA.
- Approval/disapproval
  - Annual reports must enumerate the actions the county is taking and the actions taken on behalf of the county to implement the goals and objectives of the MPP.
  - Annual reports must contain sufficient detail of programs so that the MPCA can determine if programs are effective and embody best practices for the management of waste.
  - Annual reports must show that the county is taking effective actions to ensure that no unprocessible MMSW goes to land disposal facilities in accordance with the requirement of Minn. Stat. § 473.848.
  - MPCA will approve annual reports if the reports describe and report on the specific barriers to implement the objectives and goals of the MPP, contain a description of the county programs that will be implemented to overcome the barriers, and contain recommendations to MPCA to assist in overcoming the barriers.

Regional and County Solid Waste Management Plans (CSWMP)

The Metropolitan counties are required by Minn. Stat. § 473.803 to prepare and submit CSWMP to the MPCA for approval. The MPCA will review the CSWMP in accordance with the requirements of Minn. Stat. §§ 473.149, 473.803, and 473.848. In accordance with Minn. Stat. § 473.803, subd. 2, the MPCA will review the CSWMP for consistency with the MPP. The general content requirements for CSWMP are contained in Minn. Stat. § 473.803. If the MPCA disapproves a CSWMP, the county must within 90 days submit a CSWMP to the MPCA for approval.

Minn. Stat. § 473.803 is reproduced below

473.803 METROPOLITAN COUNTY PLANNING.

Subdivision 1. County master plans; general requirements. Each metropolitan county, following adoption or revision of the metropolitan policy plan and in accordance with the dates specified therein, and after consultation with all affected local government units, shall prepare and submit to the commissioner for approval, a county solid waste master plan to implement the policy plan. The master plan shall be revised and resubmitted at such times as the metropolitan policy plan may require. The master plan shall describe county solid waste activities, functions, and facilities; the existing system of solid waste generation, collection, and processing, and disposal within the county; proposed mechanisms for complying with the recycling requirements of section 115A.551, and the household hazardous waste management requirements of section 115A.96, subdivision 6; existing and proposed county and municipal ordinances and license and permit requirements relating to solid waste facilities and solid waste generation, collection, and processing, and disposal; existing or proposed municipal, county, or private solid waste facilities and collection services within the county together with schedules of existing rates and charges to users and statements as to the extent to which such facilities and services will or may be used to implement the policy plan; and any solid waste facility which the county owns or plans to acquire, construct, or improve together with statements as to the planned method, estimated cost and time of acquisition, proposed procedures for operation and maintenance of each facility; an estimate of the annual cost of operation and maintenance of each facility; an estimate of the annual gross revenues which will be received from the operation of each facility; and a proposal for the use of each facility after it is no longer needed or usable as a waste facility. The master plan shall, to the extent practicable and consistent with the achievement of other public policies and purposes, encourage ownership and operation of solid waste facilities by private industry. For solid waste facilities owned or operated by public agencies or supported primarily by public funds or obligations issued by a public agency, the master plan shall contain criteria and standards to protect comparable private and public facilities already existing in the area from displacement unless the displacement is required in order to achieve the waste management objectives identified in the plan.

Subd. 1a. [Repealed, 1991 c 337 s 90]

Subd. 1b. [Repealed, 1995 c 247 art 1 s 67]

Subd. 1c. County abatement plan. Each county shall revise its master plan to include a land disposal abatement element to implement the metropolitan land disposal abatement plan adopted under section 473.149, subdivision 2d, and shall submit the revised master plan to the commissioner for review under subdivision 2 within nine months after the adoption of the metropolitan abatement plan. The county plan must implement the local abatement objectives for the county and cities within the county as stated in the metropolitan abatement plan. The county abatement plan must include specific and quantifiable county objectives, based on the objectives in the metropolitan abatement plan, for abating to the greatest feasible and prudent extent the need for and practice of land disposal of mixed municipal solid waste and of specific components of the solid waste stream generated in the county, stated in six-year increments for a period of at least 20 years from the date of metropolitan policy plan revisions. The plan must include measurable performance standards for local abatement of solid waste through resource recovery and waste reduction and separation programs and activities for the county as a whole and for statutory or home rule charter cities of the first, second, and third class, respectively, in the county, stated in six-year increments for a period of at least 20 years from the date of metropolitan policy plan revisions. The performance standards must implement the metropolitan and county

abatement objectives. The plan must include standards and procedures to be used by the county in determining annually under subdivision 3 whether a city within the county has implemented the plan and has satisfied the performance standards for local abatement. The master plan revision required by this subdivision must be prepared in consultation with the advisory committee established pursuant to subdivision 4.

Subd. 1d. Plans for required use of resource recovery facilities. Plans proposing designation of resource recovery facilities pursuant to section 473.811, subdivision 10, shall evaluate the benefits of the proposal, including the public purposes achieved by the conservation and recovery of resources, the furtherance of local, district, or regional waste management plans and policies, and the furtherance of the state policies and purposes expressed in section 115A.02, and also the costs of the proposal, including not only the direct capital and operating costs of the facility but also any indirect costs and adverse long-term effects of the designation. In particular the plan shall evaluate:

(a) whether the required use will result in the recovery of resources or energy from materials which would otherwise be wasted;

(b) whether the required use will lessen the demand for and use of land disposal;

(c) whether the required use is necessary for the financial support of the facility;

(d) whether less restrictive methods for ensuring an adequate solid waste supply are available;

(e) all other feasible and prudent waste processing alternatives for accomplishing the purposes of the proposed designation, the direct and indirect costs of the alternatives, including capital and operating costs, and the effects of the alternatives on the cost to generators.

Subd. 1e. [Repealed, 1995 c 247 art 1 s 67]

Subd. 2. Commissioner review. The commissioner shall review each master plan or revision thereof to determine whether it is consistent with the metropolitan policy plan. If it is not consistent, the commissioner shall disapprove and return the plan with its comments to the county for revision and resubmittal. The county shall have 90 days to revise and resubmit the plan for the commissioner's approval. Any county solid waste plan or report approved by the council prior to July 1, 1994, shall remain in effect until a new master plan is submitted to and approved by the commissioner in accordance with this section.

The commissioner shall review the household hazardous waste management portion of each county's plan.

Subd. 2a. Waste abatement. The commissioner may require any county that fails to meet the waste abatement objectives contained in the metropolitan policy plan to amend its master plan to address methods to achieve the objectives. The master plan amendment is subject to review and approval as provided in subdivision 2 and must consider at least:

(1) minimum recycling service levels for solid waste generators;

(2) mandatory generator participation in recycling programs including separation of recyclable material from mixed municipal solid waste;

(3) use of organized solid waste collection under section 115A.94; and

(4) waste abatement participation incentives including provision of storage bins, weekly collection of recyclable material, expansion of the types of recyclable material for collection, collection of recyclable material on the same day as collection of solid waste, and financial incentives such as basing charges to generators for waste collection services on the volume of waste generated and discounting collection charges for generators who separate recyclable material for collection separate from their solid waste.

Subd. 3. Annual report. By April 1 of each year, each metropolitan county shall prepare and submit to the commissioner for approval a report containing information, as prescribed in the metropolitan policy plan, concerning solid waste generation and management within the

county. The report shall include a statement of progress in achieving the land disposal abatement objectives for the county and classes of cities in the county as stated in the metropolitan policy plan and county master plan. The report must list cities that have not satisfied the county performance standards for local abatement required by subdivision 1c. The report must include a schedule of rates and charges in effect or proposed for the use of any solid waste facility owned or operated by or on its behalf, together with a statement of the basis for such charges.

The report shall contain the recycling development grant report required by section 473.8441 and the annual certification report required by section 473.848.

Subd. 4. Advisory committee. Each county shall establish a solid waste management advisory committee to aid in the preparation of the county master plan, any revisions thereof, and such additional matters as the county deems appropriate. The committee must consist of resident representatives, representatives from towns and cities within the county, and representatives from private waste management firms. The committee must include residents of towns or cities within the county containing solid waste disposal facilities. The commissioner or the commissioner's appointee is a nonvoting ex officio member of the committee.

Subd. 5. Role of private sector; county oversight. A county may include in its solid waste management master plan and in its plan for county land disposal abatement a determination that the private sector will achieve, either in part or in whole, the goals and requirements of sections 473.149 and 473.803, as long as the county:

(1) retains active oversight over the efforts of the private sector and monitors performance to ensure compliance with the law and the goals and standards in the metropolitan policy plan and the county master plan;

(2) continues to meet its responsibilities under the law for ensuring proper waste management, including, at a minimum, enforcing waste management law, providing waste education, promoting waste reduction, and providing its residents the opportunity to recycle waste materials; and

(3) continues to provide all required reports on the county's progress in meeting the waste management goals and standards of this chapter and chapter 115A.

CSWMP standards and procedures

The MPP hereby sets out the following specific procedures, standards and review criteria for the administration of Metropolitan CSWMP:

Procedures

- **Scope:** MPCA will review CSWMP submitted to MPCA for approval under Minn. Stat. § 473.803.
- **Timeline for CSWMP:** MPCA requires counties to formulate, submit and obtain MPCA approval of a new CSWMP within 12 months of the MPCA's adoption of the MPP. If a county fails to formulate and obtain MPCA approval of a new CSWMP within 24 months after the MPCA's adopts the MPP, then MPCA may withhold the disbursement of SCORE block grants under Minn. Stat. § 115A.557.
- **Requirements for the contents of CSWMP:** See statute above and additional standards outlined below.
- **MPCA review of CSWMP:** MPCA will review CSWMP and submit comments if there are any deficiencies in the CSWMP in accordance with the standards and criteria outlined below.

Standard. To be approved by the MPCA, the CSWMP must contain the information contained in Minn. Stat. § 473.803 and implement the CSWMP, including the goals and objectives of the MPP. The MPCA will review the CSWMP to determine:

- Whether the CSWMP implements the local abatement objectives for the county and cities within the county as stated in the Metropolitan System Plan (Part 3).
- Whether the CSWMP includes specific and quantifiable county landfill abatement objectives, based on the objectives in the metropolitan landfill abatement plan, for abating to the greatest feasible and prudent extent the need for and practice of land disposal of mixed municipal solid waste and of specific components of the solid waste stream generated in the county, stated in six-year increments for a period of at least 20 years from the date of the MPP revisions.
- Whether the CSWMP includes measurable performance standards for local abatement of solid waste through resource recovery and waste reduction and separation programs and activities for the county as a whole and for statutory or home rule charter cities of the first, second, and third class, respectively, in the county, stated in six-year increments for a period of at least 20 years from the date of the MPP revisions.
- Whether the performance standards implement the metropolitan and county abatement objectives.
- Whether the CSWMP includes standards and procedures to be used by the county in determining annually under Minn. Stat. § 473.803, subd. 3 whether a city within the county has implemented the CSWMP and has satisfied the performance standards for local abatement.
- Whether the CSWMP outlines specific and measurable actions to be taken by entities delegated by the county to implement the MPP.
- Whether the CSWMP outlines specific measures to maintain oversight over entities delegated by the county to implement the MPP.
- Whether the CSWMP outlines accountability measures for solid waste programs delegated to the private sector.
- Whether the CSWMP includes criteria and standards to protect comparable private and public facilities already existing in the area from displacement unless the displacement is required to achieve the waste management objectives identified in the CSWMP. Specifically, the CSWMP must require that for all solid waste facilities owned or operated by public agencies or supported primarily by public funds or obligations issued by a public agency (public facility), the owner must demonstrate that the public facility:
    - Does not displace comparable private and public facilities already existing in the area unless the displacement is required in order to achieve the waste management objectives identified in the CSWMP
    - Is consistent with the applicable CSWMP
    - Is necessary to achieve the waste management objectives identified in the CSWMP
    - Is consistent with state policy and purposes outlined in Minn. Stat. § 115A.02 and Minn. **Stat. §§ 473.842 to 473.849**

Role of private sector; county oversight. Pursuant to Minn. Stat. § 473.803, subd. 5, a county may include in its CSWMP and in its CSWMP for county land disposal abatement a determination that the private sector will achieve, either in part or in whole, the goals and requirements of sections 473.149 and 473.803, as long as the county:

6. Retains active oversight over the efforts of the private sector and monitors performance to ensure compliance with the law and the goals and standards in the MPP and the CSWMP.

7. Continues to meet its responsibilities under the law for ensuring proper waste management, including, at a minimum, enforcing waste management law, providing waste education, promoting waste reduction, and providing its residents the opportunity to recycle waste materials.
8. Continues to provide all required reports on the county's progress in meeting the waste management goals and standards of Minn. Stat. §. 473 and 115A.

To approve a CSWMP that includes this element, the CSWMP must include:

9. Specific quantifiable plans and strategies formulated and provided to the county by the private sector that shows how the private sector will implement applicable portions of the MPP and CSWMP.
10. Specific quantifiable methods and strategies that the county will implement to hold the private sector accountable for achieving waste management objectives. These strategies must include a description of applicable fees, subsidies, agreements, regulations, licenses, reporting requirements, and/or other institutional arrangement that are manifest in the arrangement that the county has with the private sector that will assure the private sector will implement applicable parts of the CSWMP and the MPP.
11. Specific measures that counties will implement to maintain oversight and measurement of outcomes of the programs delegated to the private sector. The CSWMP must also specify what fees, subsidies, agreements, regulations, licenses, reporting requirements, sanctions and/or other institutional arrangements that will be used to correct actions taken by the private sector if, in measuring the actions of the private sector, the county finds that the private entity is not managing waste as specified in the MPP and the CSWMP.

CSWMP approval. While a county is developing a new CSWMP for submittal to the MPCA, the existing CSWMP remains in effect until the MPCA approves or disapproves the new CSWMP. If the MPCA disapproves a county CSWMP, the county shall resubmit the CSWMP with changes that reflect the MPCA's comments within 90 days. If the CSWMP is not approvable after revision, the MPCA will disapprove the CSWMP and will terminate the eligibility of the county for grants pursuant to Minn. Stat. § 115A.557subd. 3(b)(1).

Appendix E: Glossary

Terms used in this MPP are intended to have meanings consistent with state statutes. Any words not defined in this appendix should be understood to have a meaning consistent with state law.

Collection
The aggregation of waste from the place at which it is generated and includes all activities up to the time the waste is delivered to a waste facility. (Minn. Stat. § 115A.03, subd. 5)

Composting
The controlled microbial degradation of organic waste to yield a humus-like product. (Minn. R. 7035.0300, subp. 20)

Construction debris
Waste building materials, packaging and rubble resulting from construction, remodeling, repair and demolition of buildings and roads. (Minn. Stat. § 115A.03, subd. 7). Also referred to in the MPP as construction and demolition waste.

Disposal facility
A waste facility permitted by the MPCA that is designed or operated for the purpose of disposing of waste on or in the land, together with any appurtenant facilities needed to process waste for disposal or transfer to another waste facility. (Minn. Stat. 115a.03, subd. 10)

Governance
Governance is the process by which materials are managed for the public good with an emphasis on highest and best use of materials and overall system sustainability. Governance includes the goals and activities of government entities, businesses, nonprofits, communities, and individual residents.

Hazardous waste
Any refuse, sludge, or other waste material or combinations of refuse, sludge or other waste materials in solid, semisolid, liquid, or contained gaseous form, which because of its quantity, concentration, or chemical, physical, or infectious characteristics may (a) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or b) poses a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. Categories of hazardous waste materials include but are not limited to explosives, flammables, oxidizers, poisons, irritants, and corrosives. Hazardous waste does not include source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended. (Minn. Stat. § 116.06, subd. 11)

Household hazardous waste
Waste generated from household activity that exhibits the characteristics of or that is listed as hazardous waste under MPCA rules but does not include waste from commercial activities that is generated, stored, or present in a household. (Minn. Stat. § 115A.96, subd. 1b)

Industrial waste
Solid waste resulting from an industrial, manufacturing, service, or commercial activity that is managed as a separate waste stream. (Minn. Stat. § 115A.03, subd. 13a)

Industrial solid waste
All solid waste generated from an industrial or manufacturing process and solid waste generated from nonmanufacturing activities such as service and commercial establishments. Industrial solid waste does not include office materials, restaurant and food preparation waste, discarded machinery, demolition debris, municipal solid waste combustor ash, or household refuse. (Minn. R. 7035.0300, subp. 45)

Land disposal
Depositing of materials in a land disposal facility.

Land disposal facility
Any tract or parcel of land, including any constructed facility, at which solid waste is disposed of in or on the land. (Minn. R. 7035.0300, subp. 52)

Leachate
Liquid that has percolated through solid waste and has extracted, dissolved, or suspended materials from it. (Minn. R. 7035.0300, subp. 56)

Local governmental unit
Cities, towns, and counties. (Minn. Stat. § 115A.03, subd. 17)

Long-term care
Actions to prevent or minimize the threat to public health and the environment posed by a mixed municipal solid waste disposal facility that has stopped accepting waste by controlling the sources of releases or threatened releases at the facility (Minn. Stat. § 115B.39, subd. 2.(c)).

Major appliances
Defined by statute as clothes washers and dryers, dishwashers, hot water heaters, heat pumps, furnaces, garbage disposals, trash compactors, conventional and microwave ovens, ranges and stoves, air conditioners, dehumidifiers, refrigerators, and freezers. (Minn. Stat. § 115A.03, subd. 17a)

Materials recovery facility (MRF)
Facility designed for centralized sorting, processing, and/or grading of collected recyclable materials for marketing.

Twin Cities Metropolitan Area (TCMA)
Means the area over which the Metropolitan Council has jurisdiction, including only the counties of Anoka; Carver; Dakota excluding the city of Northfield; Hennepin excluding the cities of Hanover and Rockford; Ramsey; Scott excluding the city of New Prague; and Washington. (Minn. Stat. § 473.121, subd. 2)

Municipal Solid Waste (MSW)
Means mixed municipal solid waste (MMSW), materials banned from MMSW such as yard waste and specific problem materials, recyclable materials, and other solid waste that is solid waste that is generated by residential, commercial, industrial, and community activities.

Mixed municipal solid waste (MMSW)
(a) Garbage, refuse and other solid waste from residential, commercial, industrial and community activities that the generator of the waste aggregates for collection, except as provided in paragraph (b), (b) mixed MSW does not include auto hulks, street sweepings, ash, construction debris, mining waste, sludges, tree and agricultural wastes, tires, lead acid batteries, motor and vehicle fluids and filters, and other materials collected, processed and disposed of as separate waste streams, but does include source-separated compostable materials. (Minn. Stat. § 115A.03, subd. 21)

Non-municipal solid waste (non-MMSW)
Solid waste resulting from construction, demolition, or industrial activities which is not mixed municipal solid waste.

Organic material
Organic waste typically includes food waste, non-recyclable paper products, yard waste, and other materials that readily degrade. According to EPA, "Organic matter in landfills breaks down and releases methane, a potent GHG, and contributes to landfill leachate that can pollute waterways."

Organized collection
A system for collecting solid waste in which a specified collector, or a member of an organization of collectors, is authorized to collect from a defined geographic service area or areas some or all the solid waste that is released by generators for collection. (Minn. Stat. § 115A.94, subd. 1)

Postconsumer material
A finished material that would normally be discarded as a solid waste having completed its life cycle as a consumer item. (Minn. Stat. § 115A.03, subd. 24b)

Problem material
Material that, when it is processed or disposed of with mixed municipal solid waste, contributes to one of the following results: 1) the release of a hazardous substance, or pollutant or contaminant; 2) pollution of water; 3) air pollution; or 4) a significant threat to the safe or efficient operation of a solid waste facility. The four conditions are further defined in Minn. Stat. § 115A.03, subd. 24a.

Processing
Describes the treatment of waste after collection and before disposal. Processing includes, but is not limited to, reduction, storage, separation, exchange, resource recovery, physical, chemical, or biological modification and transfer from one waste facility to another (Minn. Stat. § 115A.03, subd. 25 and 473.848, subd. 5.

Recycling
The process of collecting and preparing recyclable materials and reusing the materials in their original form or using them in manufacturing processes that do not cause the destruction of recyclable materials in a manner that precludes further use. (Minn. Stat. § 115A.03, subd. 25b)

Recycling facility
A facility at which materials are prepared for reuse in their original form or for use in manufacturing processes that do not cause the destruction of the materials in a manner that precludes further use. (Minn. Stat. § 115A.03, subd. 25c)

Recyclable materials
Materials that are separated from mixed municipal solid waste for the purpose of recycling or composting, including paper, glass, plastics, metals, automobile oil, batteries, source-separated compostable materials, and sole source food waste streams that are managed through biodegradative processes. Refuse-derived fuel or other material that is destroyed by incineration is not a recyclable material. (Minn. Stat. § 115A.03, subd. 25a)

Refuse-derived fuel
A product resulting from the processing of MMSW in a manner that reduces the quantity of noncombustible material present in the waste, reduces the size of waste components through shredding or other mechanical means, and produces a fuel suitable for combustion in existing or new solid fuel-fired boilers. (Minn. Stat. § 115A.03, subd. 25d)

Residuals
Waste materials left after recovery of recyclables and/or the physical, chemical, or biological processing of wastes.

Resource recovery
The reclamation for sale, use, or reuse of materials, substances, energy, or other products contained within or derived from waste. (Minn. Stat. § 115A.03, subd. 27)

Resource recovery facility
A waste facility established and used primarily for resource recovery, including related and appurtenant facilities such as transmission facilities and transfer stations primarily serving the resource recovery facility. (Minn. Stat. § 115A.03, subd. 28)

Reusable
Most items can be reused even if the original design was intended for single use, making a reuse definition more difficult. However, this also makes it more important for programming to clarify number of reuses necessary (e.g., grant programs for swapping single-use items for reusables or ordinance requiring reusables for all dine-in food service). Recently, reusable programming and policy has been focusing on food service ware, food packaging, and personal product packaging. These are three main elements defining "reusable" for these types of scenarios:

- **Durable design** – as previously noted, most items can be reused regardless of the original intent. Programs and policies must indicate how durable (i.e., number of reuses to break even with the life cycle impacts of a single-use alternative) an item needs to be considered "reusable"
- **Actual reuse (returns and/or refills)** – more resources go into manufacturing a more durable, reusable item, so actual reuse is needed to offset those impacts. This typically means ensuring a system is in place for individuals to personally refill the item or return it to be refilled or used again. Programs and policies must specify an expectation for how this system will be designed, funded, serviced, and operated long-term.
- **Non-toxic materials** – while there are clear benefits of reusable items and systems, it is critical to test, monitor, and restrict harmful chemicals to limit human and environmental exposures. Often programs and policies emphasize reuse to reduce waste generation or climate impacts from manufacturing and overlook toxicity considerations.

Reuse
The continued use, repair, or repurposing of items or materials which extends the life of resources and decreases the demand for new production. Continued use can include resale (e.g., thrift stores), sharing (e.g., clothing swaps without a financial exchange), or rental (e.g., formal wear rental). When repurposing an item or material, it is in the current form of the product without drastic modifications – this is the main difference between reuse and recycling.

Secondary materials
The marketable or usable products derived from solid or hazardous waste through processing or separation.

Solid waste
Garbage, refuse, or sludge from a water supply treatment plant or air contaminants treatment facilities, and other discarded waste materials and sludges, in solid, semisolid, liquid, or contained gaseous form, resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include hazardous waste; animal waste used as fertilizer; earthen fill, boulders, rock; sewage sludge; solid or dissolved materials in domestic sewage or other common pollutants in water sources, such as silt, dissolved or suspended solids in industrial wastewater effluents or discharges which are point sources subject to permits under section 402 of the federal Water Pollution Control Act; as amended, dissolved materials in irrigation return flows; or source, special nuclear, or by-product materials as defined by The Atomic Energy Act of 1954, as amended. (Minn. Stat. § 116.06, subd. 22)

Solid waste management
The systematic administration of activities that provide for the collection, separation, storage, transportation, transfer, processing, treatment, and disposal of solid waste.

Source separation
Separation of recyclable or compostable materials by the waste generator prior to collection.

Source reduction (see also waste reduction)
An activity that prevents generation of waste or the inclusion of toxic materials in waste, including: (1) reusing a product in its original form; (2) increasing the life span of a product; (2) reducing material used in production or packaging, or changing procurement, consumption, or waste generation habits to result in smaller quantities or lower toxicity of waste generated. (Minn. Stat. § 115A.03, subd. 36b)

Storage
Containment of solid or hazardous waste, in an approved manner, after generation and before collection, for ultimate recovery or disposal.

Sustainable materials management
Describes an approach to serving human needs by using/reusing resources most productively and sustainably throughout their life cycles, generally minimizing the amount of materials involved and all the associated environmental impacts (Source: EPA). SMM focuses on the best use and management of materials based on how they impact the environment throughout their life cycle. SMM considers the impacts of extracting raw materials, scarcity of materials, product design, product use, and reuse.

Transfer station
An intermediate waste facility in which waste collected from any source is temporarily deposited to await transportation to another waste facility. (Minn. Stat. § 115A.03, subd. 33)

Unprocessed mixed municipal solid waste (Unprocessed MMSW)
For the purpose of Minn. Stat. § 473.848, waste is "unprocessed" if it has not, after collection and before disposal, undergone separation of materials for resource recovery through recycling, incineration for energy production, production and use of refuse-derived fuel, composting, or any combination of these processes so that the weight of the waste remaining that must be disposed of in a mixed municipal solid waste disposal facility is not more than 35% of the weight before processing, on an annual average.

Waste flow designation
A requirement by a waste management district or county that all or any portion of the mixed municipal solid waste that is generated within its boundaries or any service area thereof be delivered to a processing or disposal facility identified by the district or county. (Minn. Stat. § 115A.81, subd. 2)

Waste facility
All property real or personal, including negative and positive easements and water and air rights, which is or may be needed or useful for the processing or disposal of waste, except property used for the collection of the waste and property used primarily for the manufacture of scrap metal or paper. Waste facility includes, but is not limited to, transfer stations, processing facilities, and disposal sites and facilities. (Minn. Stat. § 115A.03, subd. 35)

Waste management
Activities that are intended to affect or control the generation of waste and activities which provide for or control the collection, processing, and disposal of wastes. (Minn. Stat. § 115A.03, subd. 36)

Waste reduction (see also source reduction)
An activity that prevents generation of waste or the inclusion of toxic materials in waste, including: (1) reusing a product in its original form; (2) increasing the life span of a product; (2) reducing material used in production or packaging, or changing procurement, consumption, or waste generation habits to result in smaller quantities or lower toxicity of waste generated. (Minn. Stat. § 115A.03, subd. 36b)

Yard waste
Garden wastes, leaves, lawn cuttings, weeds, shrub, and tree waste, and prunings. (Minn. Stat. § 115A.03, subd. 38)

Appendix F: Metro Policy Plan MMSW forecast

Forecasted MMSW using per capita MMSW generation using a combination of ARIMA and baseline forecasting methods.

Data sources

Mixed Municipal Solid Waste (MMSW) Tonnage

All forecasts use tonnage information provided by the counties from their MMSW Certification reports and SCORE reports. Additional work has been done by the MPCA and the counties to ensure these sources are aligned.

Population

Population estimates and forecasts come from the Minnesota State Demographic Center at the Department of Administration. Additional interpolation has been performed on the forecasts to achieve annual values versus 5-year values. If there is no Population estimate available for a given year, the forecast value is used instead.

2020 Population values are sourced from the U.S. Census.

Alternative forecast assumptions

Assumptions for the alternative forecast regarding the amount of diversion of Recycling and Organics from MMSW were sourced from the counties and compiled by the MPCA into a consistent format and applied to the MPCA's forecasted MMSW generation rate.

Methodology

Forecast assumptions

Below is the summary of assumptions used for the MPP forecast:

- Ramsey and Washington counties are combined into one entity due to difficulty in splitting out their WTE and their joint powers agreement
- Metro counties will achieve the 75% recycling rate as laid out in Minn. Stat. § 115A.551 by 2030
    - Using the baseline rate for traditional recyclables and organics, increased recycling and organics diversion will be assumed at a constant rate until the 75% recycling rate is achieved in 2030.
- Total compliance with Restriction on Disposal (ROD) is assumed
    - Capacities for the WTE facilities serving the TCMA provided in Table 12.
    - If there is additional capacity at a given WTE facility, that capacity will be used by all available MMSW in the TCMA regardless of originating county
- Landfilling is assumed to be a minimum of 5% given the need to manage non-processibles, bulky items at WTE facilities and residuals and rejects from recycling and composting facilities.
- Baseline is the last year of observable data since the latest year of data represent the best data available to the counties and their current education and diversion practices.
- The continued operation of HERC is assumed. While the Hennepin County board has instructed staff to develop a plan with HERC closing sometime in the 2028-2040 timeframe, it is currently not clear if that timeline will be met or when within that timeframe the facility would come

offline. If HERC closes during the planning period, the MMSW would be managed via landfilling. The Metro Policy Plan (MPP) is updated every 6 years and a new forecast is developed with each iteration. MPCA will have a better understanding of the future of HERC during the development of the next MPP.

Forecast models

Each county was modeled separately using an Auto-regressive Integrated Moving Average (ARIMA) model on population corrected MMSW tonnage (per capita generation) from 2010 to 2020.

Recycling and Organics was forecasted using a baseline per capita generation (2020) – the tons of traditional recyclables generated per person and the tons of organics generated per person. As the population increases, new residents will have access to the same infrastructure, education, and benefits that current residents do thus increased population will not increase the current per capita generation but will increase total tonnage.

WTE capacity

Hennepin County is the sole provider of MMSW to the HERC facility while Ramsey and Washington split the capacity of the Ramsey-Washington Energy Center. Each of these facilities is assumed to be at capacity due to ROD compliance.

Dakota County will continue to send MMSW to the Red Wing processing facility, estimating 10,000 tons in 2020 and 13,000 tons in all subsequent years.

Table 12. Annual capacity (in tons) for the WTE facilities servicing the TCMA.

Facility	Annual Capacity (in Tons)
HERC	365,000
Ramsey-Washington Energy Center	450,000
City of Red Wing	13,000

Total landfill tonnage

The amount of material estimated to go to landfills is determined by the MMSW forecast created by the MPCA and is the amount remaining after additional diversion is removed from the MMSW and the amount dedicated to WTE is subtracted, as shown in Equation 1.

Equation 1. Calculation for landfill tonnage using MMSW forecast, additional diversion assumptions, and WTE capacity

$$\text{Landfill} = \text{MMSW} - (\text{Additional Diversion} + \text{WTE})$$

Results

The per capita generation point estimate was multiplied by the forecasted population change for each county and management method to provide the total MMSW.

Figure 16. Reported and forecasted TCMA MMSW collection methods amounts in tons

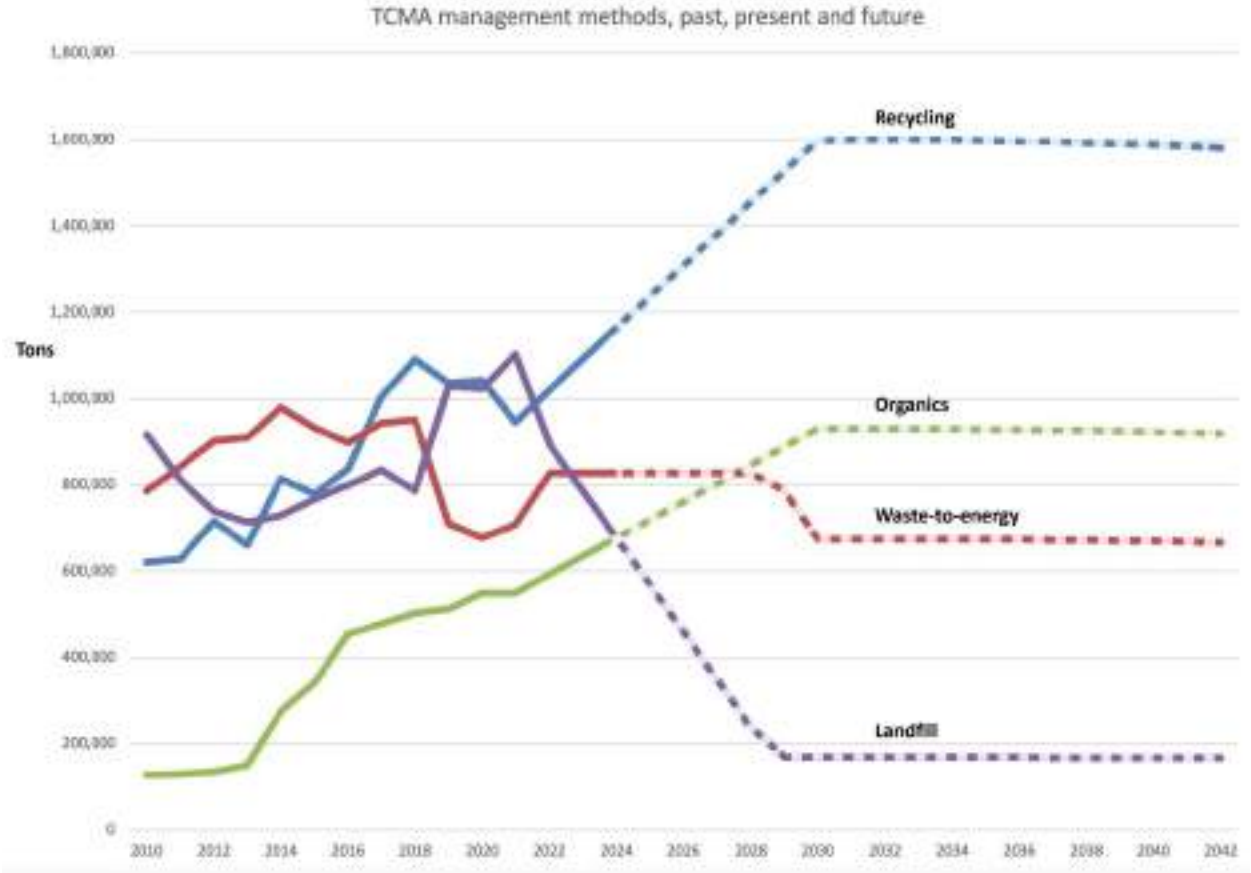


Table 13. Total TCMA MMSW forecast by management method

Year	Landfill	WTE	Recycling	Organics	Total MSW	Total MMSW	Recycling Rate
2010	917,472	785,506	620,069	127,879	2,450,926	1,702,979	31%
2011	810,443	842,273	627,884	130,010	2,410,610	1,652,716	31%
2012	739,152	901,721	715,089	134,292	2,490,254	1,640,873	34%
2013	713,741	908,636	660,166	150,980	2,433,523	1,622,377	33%
2014	728,970	978,326	813,580	275,574	2,796,450	1,707,296	39%
2015	767,491	931,415	778,092	341,745	2,818,743	1,698,906	40%
2016	799,435	897,494	836,135	452,956	2,986,020	1,696,929	43%
2017	834,315	942,536	1,004,251	479,283	3,260,385	1,776,852	46%
2018	785,118	951,181	1,091,967	502,906	3,331,173	1,736,299	48%
2019	1,028,517	710,286	1,036,330	511,934	3,287,068	1,738,803	47%
2020	1,023,749	678,239	1,041,423	549,135	3,292,546	1,701,987	48%
2021	825,124	821,000	1,118,619	590,477	3,355,219	1,809,433	51%
2022	750,682	821,000	1,188,683	627,698	3,388,064	1,720,145	54%
2023	674,392	821,000	1,259,825	665,492	3,420,710	1,612,238	56%
2024	596,250	821,000	1,332,017	703,843	3,453,110	1,503,892	59%
2025	516,260	821,000	1,405,232	742,737	3,485,229	1,395,014	62%

Year	Landfill	WTE	Recycling	Organics	Total MSW	Total MMSW	Recycling Rate
2026	434,457	821,000	1,479,466	782,172	3,517,095	1,285,592	64%
2027	350,828	821,000	1,554,665	822,118	3,548,611	1,175,605	67%
2028	265,388	821,000	1,630,789	862,556	3,579,733	1,065,079	70%
2029	180,521	818,633	1,707,795	903,462	3,610,411	954,059	72%
2030	182,030	728,122	1,785,643	944,814	3,640,609	842,609	75%
2031	183,515	734,060	1,800,245	952,479	3,670,298	842,970	75%
2032	184,973	739,892	1,814,588	960,006	3,699,459	843,113	75%
2033	186,404	745,615	1,828,665	967,391	3,728,075	843,036	75%
2034	187,807	751,230	1,842,477	974,635	3,756,150	842,739	75%
2035	189,184	756,737	1,856,024	981,738	3,783,683	842,225	75%
2036	190,534	762,137	1,869,311	988,703	3,810,684	841,497	75%
2037	191,858	767,433	1,882,342	995,531	3,837,165	840,562	75%
2038	193,157	772,628	1,895,128	1,002,229	3,863,142	839,423	75%
2039	194,432	777,726	1,907,674	1,008,799	3,888,632	838,089	75%
2040	195,683	782,731	1,919,992	1,015,248	3,913,653	836,565	75%
2041	196,911	787,646	1,932,092	1,021,580	3,938,229	834,858	75%
2042	198,120	792,479	1,943,990	1,027,805	3,962,393	832,977	75%

Appendix G: Strategy table

Table 14. Strategy table with point values and interested parties

Code Number	Strategy	Type	Optional Point Value	Interested Parties
1	Increase compliance with Hauler reporting per Minn. Stat. § 115A.93.	Required		haulers, industry, county staff
2	Provide required county reporting.	Required		county staff
3	Require waste composition study at least once every 5 years at all landfills that are located within your county.	Required		landfill operators
4	Improve recycling data collection at businesses within the county.	Optional	7	county staff, businesses
5	Require waste composition study at all landfills.	State-led		MPCA
6	Develop appropriate and consistent waste reporting systems to measure all waste.	State-led		MPCA
7	Continue to explore options for growing the agency's LCA data, modeling, and resources to better support counties in measuring and tracking environmental and human health impacts.	State-led		MPCA
8	Continue to engage with counties in the development of an environmental target that better accounts for and incentivizes programming and actions higher on the hierarchy.	State-led		MPCA
9	Participate in an annual joint commissioner/staff meeting on solid waste.	Required		county staff and board
10	Commit to standardized outreach and education.	Required		county staff, MRFs, residents
11	Engage in efficient and value-added infrastructure planning.	Required		county staff, SW facility operators
12	Develop contingency plans for large facility closures to reduce landfill reliance	Required		county staff, SW facility operators
13	Provide grants for or access to software that can track food waste.	Required		county staff, restaurants, cafeterias
14	Establish partnerships between food rescue organizations and restaurants/stores to increase food rescue.	Required		county staff, food rescue orgs, restaurants, grocery stores
15	Launch bi-annual sustainable consumption challenges for residents.	Required		county staff, residents
16	Implement a formal county sustainable purchasing policy using MPCA guidance.	Required		county staff, vendors
17	Participate in Responsible Public Purchasing Council meetings.	Required		county staff, MPCA

Code Number	Strategy	Type	Optional Point Value	Interested Parties
18	Work with health inspectors to educate restaurants and other establishments that have excess prepared food to donate.	Optional	7	county staff, health dept, restaurants and other food producers/~~s~~purveyors
19	Offer grants or rebates for organizations to transition to reusable food and beverage service ware.	Required		county staff, restaurants , organizations serving food
20	Offer grants for source reduction, reuse, and repair.	Required		county staff, repair and reuse businesses
21	Implement a green meeting policy.	Required		county staff
22	Implement a county policy encouraging all county and city-led events and food providers use reusable food and beverage service ware.	Optional	6	county staff
23	Adopt an ordinance with a mandatory consumer charge or ban for single-use items.	Optional	9	county staff, restaurants
24	Join and/or actively participate in a reuse network, like Reuse Minnesota, to provide county and city staff with learning opportunities to broaden their reuse expertise.	Optional	6	county staff
25	Establish a Repair Ambassador program, like the Recycler/Composters (RCAs) Ambassador programs.	Optional	7	county staff, residents
26	Establish a reuse location for residential drop-off and pick-up.	Optional	7	county staff, residents
27	Establish a curbside set-out day to allow residents to set out used items for reuse.	Optional	7	county staff, residents, reuse businesses
28	Develop standardized guidance and methodology for tracking source reduction and reuse activities and their resulting benefits.	State-led		MPCA
29	Research and pursue financial strategies to best incentivize source reduction and reuse, such as grants and loans.	State-led		MPCA
30	Collect recyclables, organics, and trash on the same day.	Required		county staff, residents, haulers
31	Collect recycling weekly by 2030.	Optional	7	county staff, residents, haulers
32	Pair the option of bi-weekly trash collection with weekly recycling and organics collection.	Optional	7	county staff, residents, haulers
33	Contract for residential recycling and organics by 2030.	Optional	7	county staff, residents, haulers
34	Contract for residential MMSW collection by 2030.	Optional	7	county staff, residents, haulers
35	Recruit a minimum of 12 commercial businesses a year to recycle at least three materials from their operations and promote the environmental and resource benefits.	Required		county staff, businesses

Code Number	Strategy	Type	Optional Point Value	Interested Parties
36	Establish mandatory pre-processing of waste at resource recovery facilities and landfills by 2030.	Required		haulers, landfill operators, transfer station operators
37	Provide assistance to multi-family properties to improve recycling (4 or more units with shared walls	Required		county staff, property managers
38	Assist with tracking commercial recycling self-hauling activities.	State-led		MPCA
39	Support and invest in new facilities and retain processors of recycled material for end markets.	State-led		MPCA
40	Make residential curbside organics collection available in cities with a population greater than 5,000 by 2030.	Required		county staff, residents, haulers
41	Expand backyard composting outreach and resources for residents.	Required		county staff, residents
42	Require management of organics from large commercial food generators by 2033.	Required		county staff, commercial food generators
43	Establish additional organics recycling drop-off sites.	Optional	7	county staff, residents
44	Standardize the role of compostable products in organics recycling programs by 2025.	State-led		MPCA
45	Develop plans to prevent and manage wood waste in each county and throughout the region.	Required		county staff, yard waste processors, tree care and landscaping operators
46	Promote existing programs that use EAB-effected wood for furniture, home goods, flooring, and other purposes.	Required		county staff, local artisans and producers of wood products
47	Composting and mulching operations must continue to be supported.	Required		county staff, composting and mulching operators
48	Update ordinances that address wood burning.	Optional	4	county staff, county board
49	Develop and distribute EAB tree care education programs for privately owned land.	Optional	8	county staff, residents
50	Incentivize tree treatment as a cost-effective strategy to extend the life of ash trees and to reduce the volume of wood waste generated over the next 20 years.	Optional	8	county staff, residents, arborists
51	Allow assessments on property taxes to spread the cost of tree care over a multi-year timeframe.	Optional	9	county staff, residents, arborists
52	Expand composting and mulching capacity beyond existing markets.	Optional	5	county staff, industry
53	Support development of systems that use wood fuel.	Optional	4	county staff, industry
54	MPCA will continue state agency coordination to address wood waste.	State-led		MPCA, DNR, MDA

Code Number	Strategy	Type	Optional Point Value	Interested Parties
55	Require food-derived compost in county construction and landscaping projects.	Required		county staff, industry
56	Find new outlets to increase food to animal operations.	Optional	7	county staff, farmers, restaurants
57	Develop a process for gathering the information necessary to make timelier and consistent policy decisions.	State-led		MPCA
58	Counties must continue to support the implementation of Minn. Stat. § 473.848 Restriction on Disposal.	Required		county staff, industry, facility operators
59	Implement additional fees to better account for the externalities of land disposal.	Optional	4	county staff, industry
60	Participate with the Product Stewardship Committee under the Solid Waste Administrators Association (SWAA).	Required		county staff
61	Encourage retailers to increase consumer awareness of responsible end-of-life handling for products containing lithium-ion batteries.	Required		county staff, retail store operators
62	Continue participation in the reciprocal use agreement for HHW collection sites.	Required		county staff, HHW sites
63	Partner with cities to increase participation in HHW collection.	Required		county staff, HHW sites
64	Host monthly drop-off sites in locations other than a permanent HHW site.	Optional	8	county staff, HHW sites
65	Implement the use of a Building Material Management Plan.	Required		county staff, builders and contractors
66	Prior to demolition of county-owned buildings, require that SMM strategies are considered.	Optional	7	county staff
67	Host a building material collection event or swap.	Optional	8	county staff, residents
68	Provide financial assistance to offset the additional cost of building deconstruction, used building material installation, and/or structural moving.	Optional	8	county staff, residents, builders and contractors
69	Provide deconstruction training.	Optional	8	county staff, builders and contractors
70	Annually host or aid with home and building repair and refurbishment trainings.	Optional	8	county staff, builders and contractors, residents
71	Use purchasing guidelines to require environmental product declaration (EPD) for concrete.	Optional	7	county staff
72	Study waste classification practices.	State-led		MPCA
73	Propose changes to B3 guidelines to strengthen deconstruction requirements.	State-led		MPCA
74	Incentivize deconstruction over landfilling MMSW and demolition debris.	State-led		MPCA
75	Lead Sustainable Building Group (SBG) developments.	State-led		MPCA

Appendix H: Air Toxic and Cumulative Impact Rules

Proposed changes to certain rules will be applicable to HERC. These rules apply only to air quality permits in certain geographic areas of Minnesota. Option B registration permits are exempt from these rules.

Minn. Stat. § 116.065 requires MPCA to adopt rules to implement and govern cumulative impacts analysis in Environmental Justice areas in 7 county metro and cities of Duluth and Rochester. The Notice of Intent to Adopt (NOIA) must be published in the State Register by May 2026. The Cumulative Impacts Analysis Rule will be applicable to facilities with air permits located in or within one mile of an environmental justice area in the TCMA and cities of Duluth and Rochester. HERC will be subjected to Cumulative Impacts Analysis rule once adopted due to its location in an EJ area within Hennepin County and its Part 70 permit. The MPCA may require a Cumulative Impacts assessment, if a petition requesting that a cumulative analysis be conducted by at least 100 individuals who reside or own property in the environmental justice area impacted by the facility and is supported by material evidence that demonstrates a potential adverse cumulative impact. More detail can be found on the MPCA website. Cumulative impacts | Minnesota Pollution Control Agency (state.mn.us)

The Air Toxics Regulations Rule will be applicable to facilities with air permits located in the TCMA. Three years after adopting rules, the MPCA is required amend existing air quality permits to conform to the rules. This applies even if the case there is no pending permit action. HERC will be subjected to this rule once adopted due to its location within Hennepin County and its Part 70 permit. The MPCA must establish testing, monitoring, reporting, record-keeping, and inspection requirements for facilities that reflect:

1. The different risks to human health and the environment posed by the specific air toxics and amounts emitted by a facility, such that facilities posing greater risks are required to provide more frequent evidence of permit compliance, including but not limited to performance tests, agency inspections, and reporting;
2. The facility's record of compliance with air toxics emission limits and other permit conditions; and
3. Any exposure of residents of an environmental justice area to the facility's air toxics emissions.

More information can be found on the MPCA website. Air toxics emissions reporting | Minnesota Pollution Control Agency (state.mn.us)

Appendix I: Public Comments and Responses

Name	Affiliation	Comment	Response
Ally Sutherland	City of Inver Grove Heights	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/mv0yij3_document.pdf	Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing is the process of pulling recyclables out of mixed waste and it can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents, but historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline to allow facilities time to plan the best preprocessing system. The Minnesota Legislature passed a sweeping bill to address and prohibit PFAS in consumer products. The Minnesota Attorney General reached an $850 million settlement with 3M. For more information about this, visit https://3msettlement.state.mn.us/. All past and present research can be found on this page. This language will reduce the amount of PFAS entering landfills. To address landfill leachate, the MPCA is addressing PFAS through our solid waste and wastewater programs. MPCA is also reviewing newly published research on landfill leachate. The plan prioritizes waste reduction, reuse, and recycling as the most important things we can do. These all minimize the amount of waste going to disposal. These activities are funded by the solid waste management tax and landfill fees. A clear and consistent process for MPCA's issuance of CON to landfills statewide is now reflected in the plan.
Aaron Rosenblum	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/k00uigy_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Akira Yano	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/wj0oi5y_document.pdf	The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the Minnesota Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. Thank you for your feedback.
Albert (Shane) McCaffrey	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/qu0fiq5_document.pdf	Metro counties will develop solid waste plans of their own based on this plan. This plan includes strategies to address organics recycling, multi-family, and education.
Alex Burns	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/wq0ri1v_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the Minnesota Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. Thank you for your feedback.
Alice Brandt	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/om04ic8_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Amanda Koehler	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/xw0lii3_document.pdf	Compostable single-use is a better option than conventional single-use. However, reuse is the best option. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. Chickens are not officially considered a solid waste management method, but the additional avenue for food waste management for residents is intriguing.
Amy Sheldon	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ir03iaj_document.pdf	Curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather. Textiles must be dry and clean for both reuse and recycling. The Secondary Materials and Recycled Textiles (SMART) Association estimates that about half of new clothing end up donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbants/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. Minnesota Statute 115A.151 applies to most commercial buildings. Those that contract waste service for 4 cubic yards or more per week are required to recycle at least three materials types. Resident education is addressed in this plan with a strategy that calls for a commitment to standardized outreach and education. We agree that the messaging reaching residents should be easy to understand. Piecemeal efforts by counties, cities, haulers, and other organizations are rarely collaboratively developed and therefore can lead to confusion over what materials can be recycled or composted. Assuring a consistent message from those within the solid waste system would help bring clarity to the users of the system. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. The plan requires counties to standardized outreach and education. This will address the concern that different terms are used throughout the metro and will help to address confusion. Waste reduction in construction and remodeling projects will require many solutions. The state doesn't currently have requirements for construction and remodeling material management. However, there are several waste reduction initiatives and an increase in reuse activities. Removing barriers to buying, selling and donation of surplus materials benefits us all.
Andrea Siegel	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/o502i9s_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Counties are required to complete an environmental justice review when developing their solid waste plans. The requirements are laid out in Appendix B. With the addition of multi-family strategies in the plan, we believe this supports a solid waste system that strives for fair treatment and meaningful involvement of all people. The plan has been amended to allow for counties to propose optional strategies. We encourage all our metro counties to propose strategies that would directly address environmental justice. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the Minnesota Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. Thank you for your feedback.

Name	Affiliation	Comment	Response
Amy Sklar	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/qy0wiok_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Andrea Sit	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/cf07iaq_document.pdf	This plan requires residential curbside organics collection to be region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. The plan includes education requirements that should help create more informed residents. Minnesota has some of the best recycling rates in the nation. There are many systems and requirements in place that assure the materials in resident bins are routed to their intended place. MN statute 115A.95 does not allow for haulers to deliver source-separated recyclable materials to a disposal facility unless the MPCA determines that no other recycling options are available. Except for litter in waterways, it's highly unlikely that any plastic waste from Minnesota ends up in the ocean. County environmental centers and household hazardous waste drop sites are wonderful resources for managing materials safely and to their highest use. The plan has been revised to require counties to promote these sites to residents.
Andrea Tauer	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ad0fiet_document.pdf	Curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather. Textiles must be dry and clean for both reuse and recycling. The Secondary Materials and Recycled Textiles (SMART) Association estimates that about half of new clothing end up donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbants/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact.
Andrew Coyne	City of Stillwater	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/j60hi6j_document.pdf	MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. Wood waste is expected to increase and will require collaboration to find upstream solutions. Planning will be required to avoid open burning.
Andy Healy	ARCA Recycling, Inc.	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/uk0xi04_document.pdf	Appliances at the end of their useful life contain many valuable materials—like steel—that can be recycled. There are also many concerning components, like refrigerants, that need to be managed properly to avoid harm to human health and the environment. MPCA will continue to value appliance recycling and recovery as playing a very important role in solid waste management. MPCA received funding in the last Legislative session for various grants that will be utilized to make address waste issues and climate change reduction.
Ann Hanson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/t20qi10_document.pdf	Due to difficultly with sorting at recyclng centers, black plastic has nearly no market value for recycling. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. Removing barriers for participation was our original intent and we received great feedback on changes to further our progress. Legislative action will be needed to create accountability for those producing waste through product design.
Beverly Mears	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/d308igb_document.pdf	All of the 7-county metro environmental centers and household hazardous waste (HHW) drop-off sites are open to residents of any metro county. Many materials are collected for free, but some require a collection fee. The plan also includes a strategy to expand mobile collection of HHW, which would provide residents with more convenient access.
Bill Keegan	Dem-Con Companies	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/hi0xi5b_document.pdf; https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/fa0fio3_document.pdf	Minnesota has an existing rechargeable battery law. MPCA's Solid Waste Policy Report to the Minnesota Legislature recommends updates to address the full scope of the lithium battery issue. The MPCA is working with partners on legislative proposals to improve the collection and recycling of batteries. A strategy has been added to the plan to implement education programs on proper battery management. Creating safe storage spaces that minimize fire risks at waste facilities is challenging. Thank you for the feedback on Appendix D. You provided many valid points, which were considered when revising the plan. A clear and consistent process for MPCA's issuance of CON to landfills statewide is now reflected in the plan. Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents and historically tip fees have not been the driver for cost. The strategy's timeline has been extended.
Blaine McKeever	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/9r04i6c_document.pdf	Retail drop off is far from ideal, but is currently the best option for plastic film recycling. We can encourage retailers to monitor their collection bins more closely to optimize collection efforts.
Bobby Stewart	Highland Sanitation	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/5l0ji1u_document.pdf	Tax breaks and credits are outside of the scope and authority of the plan. The authority of this plan extends to counties in the metro area. Strategies are included to encourage the development of reuse markets and programs. The Recycling Association of MN has a Recycling Education Toolkit available on their website that has signage and messaging available for use. https://recycleminnesota.org/rec-toolbox/ The strategy for single-use containers has been revised in response to multiple comments. Yard waste and SSO mixed together is undesirable for most compost facilities. Effective composting requires the proper ratio of carbon and nitrogen sources. Co-collection of these materials make it difficult to achieve a consistent ratio. However, if compost facilities and haulers can work together to ensure co-collection works effectively, it would be worth exploring as an option.

Name	Affiliation	Comment	Response
Bonnie Matter	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/cd0wig0_document.pdf	This plan does not have authority to make changes like eliminating plastic bags. However, there is an optional strategy for counties to adopt an ordinance with a consumer charge or ban on disposable single-use items, which is open for a county to interpret as including plastic shopping bags. Convenience is a critical component of success. The plan includes a strategy that would expand curbside collection of organics recycling to all cities with a population of 5,000 or greater. Restaurants cannot place orders directly in customers own containers, but you may bring your containers to restaurants for leftovers. The plan also includes a requirement for counties to provide financial assistance to organizations for transitioning to reusable foodware options. This plan seeks to address and divert unnecessary food waste through strategies that provide access to tracking software, partnering with health inspectors to identify diversion and prevention, and establishing partnerships between food rescue organizations and the businesses that create it. Some manufacturers produce packaging-free products. The strategies in this plan can encourage a shift toward that direction, but we will need more manufacturers to reduce packaging and residents to support these changes. Reducing waste at the source provides the greatest environmental benefit. Legislative action will be necessary to require manufacturers to participate. This plan does not have authority to standardize packaging, but does call for standardized outreach and education on recycling.
Brad Hanzel	Carver County	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/og09i6p_document.pdf	The composting rule changes adopted in 2015 prioritized environmental protection and sought to allow flexibility in compost operations. To expand organics capacity in the region, composters have advocated for the agency to prioritize market development for compost. Additionally, pushing for the expansion of collection programs signals to existing and future operators that there will be material for them to manage. Focusing on these two strategies will support market conditions that can help meet the regions capacity needs. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. MPCA will continue to enforce MN Stat. 473.848, which requires WTE energy facilities to operate at full capacity. It is understood that some counties will supply more waste to those facilities than others. It is also understood that some counties will not be able to meet the total percentage laid out in the Metro Policy Plan. However, it should be noted that MPCA expects counties to support the existing infrastructure when possible as well as continue to implement strategies to avoid land disposal as much as possible. MPCA will defer to the expertise of counties to propose variations to strategies that will work for their residents and haulers. The plan has been amended to allow counties to provide alternative strategies. For required strategies, proposals must achieve comparable objectives. For optional strategies, counties should work with their PCA solid waste planner to determine the point value of the alternative strategy. MPCA acknowledges that data submittal prior to a license renewal may be challenging. This appears in the plan as a best practice to ensure hauler compliance. Carver County may follow the other best practices, which can be effective too. We appreciate that the county understands the value of quality hauler data. Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. This strategy can make collection frequency more convenient for residents but is cost prohibitive and would further exacerbate the driver shortage. Providing additional bins at no cost could achieve the same objective as weekly collection without the added emissions from extra truck routes. The strategy to pair trash and recycling collection has been made optional to address similar hauler concerns. MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. MPCA has requested and received funding to work on wood waste projects which will also include developing markets. Implementing the strategy for county-owned buildings was the original intent of this strategy. The plan has been edited for clarity. Thank you for your valuable feedback.
Bridget Diep	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ea0hinx_document.pdf	Enforcement of 115A.93 Subd 3(c) assures that haulers do not imposing a greater charge on residents who recycle than on residents who do not recycle, which includes organics recycling. Minn. Stat. § 115A.151 requires businesses to collect a minimum of three materials for recycling. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Caleb Werth	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/4j0fiql_document.pdf	Compostable single-use is a better option than conventional single-use that cannot be recycled, but reuse is the best option. MPCA will look to counties to interpret or adjust this strategy to achieve the best outcome given their resources and residents. The strategy has been edited to incorporate the successful and vetted aspects of the Minneapolis ordinance. Many county environmental centers have incorporated reuse areas or plan to in the future. We encourage every metro county to provide this service. Resident education is addressed in this plan with a strategy that calls for a commitment to standardized outreach and education. We agree that the messaging reaching residents should be easy to understand. Piecemeal efforts by counties, cities, haulers, and other organizations are rarely collaboratively developed and therefore can lead to confusion over what materials can be recycled or composted. Assuring a consistent message from those within the solid waste system would help bring clarity to the users of the system. The plan includes a required strategy to offer grants for waste reduction, reuse, and repair. Reuse businesses may be eligible for this funding.
Calla Martin	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/t30ei62_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The optional strategies for sustainable building and deconstruction have high point values, which should incentivize counties to incorporate them in their plans. Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. This is the overarching plan for the metro area. Counties have flexibility to choose optional strategies that they can effectively implement. In order for Minnesota to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question.
Carmela Giardina	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/cl0li07_document.pdf	Recycling refund legislation is very successful at increasing the collection of beverage containers. States with recycling refund often have capture rates greater than 80% for those materials that are covered by the redemption fee. MPCA does not have the authority to require this type of legislation through this plan, because it would take action by the Minnesota Legislature to enact that requirement on beverage manufacturers. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. The types of materials collected in curbside collection programs are determined by the recycling market. If there is an end-use for an additional material that could be collected in a quantity great enough to support an economically viable market, the industry will implement it.
Carolyn Majkrzak	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/tj0oi3v_document.pdf	Thank you for the feedback.
Cassie Lefeber	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/oc0xi78_document.pdf	Due to the varied resources of metro counties, we believe requiring these strategies would place an undue burden on county staff at this time. Impactful optional strategies carry a high point value, which should provide a strong incentive for counties with the appropriate resources to successfully implement. The plan includes a reuse section with several strategies to address barriers and expand reuse access. Drop-off events hosted by the counties are popular with residents, but these events have been shown to be very expensive and time intensive for county staff to plan and execute. Advertising a special collection day at the existing permanent sites could have a similar impact to raise community awareness, perhaps outside of regular hours. Convenience is a critical component of success for organics recycling. The plan includes a strategy that would expand curbside collection of organics recycling to all cities with a population of 5,000 or greater. The plan includes a strategy for the management of organics recycling from large commercial food generators by 2030. It was optional in the draft and has been changed to required. MPCA has been working with the Departments of Agriculture and Health to create content for inspectors to educate licensed facilities about financial assistance, donation, and opportunities to reduce wasted food. The plan has been revised to include the MPCA's commitment to continue work with partner agencies on improved food rescue and prevention efforts. A strategy encouraging county engagement with health inspectors in individual county plans will remain in the plan to help accelerate adoption of the practice but will not be required.

Name	Affiliation	Comment	Response
Chris Kostik	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/750fijm_document.pdf	Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy with an alternative option to provide extra bins at no cost. The single-use container fee is an optional strategy that counties may choose to add to their plans. We will look to the counties to select an approach that will best serve the needs of their residents. Counties will be required to offer grants or rebates for organizations to transition to reusable food and beverage service ware. Restrictions like a bag ban should be determined through county and/or city ordinances. The most effective way to reduce waste is to not create it in the first place. Compostable single-use products are a better option than conventional single-use products that cannot be recycled, but reuse is the best option. Extended producer responsibility (EPR) laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. Packaging: The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting.
Chris Long	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ik06ipl_document.pdf	The plan prioritizes reuse strategies. Reducing the amount of material being managed in the solid waste system provides the greatest environmental benefit.
Chris McConn	Minnesota Resource Recovery Association	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/5x0siqp_document.pdf	MPCA supports the waste hierarchy and values the role of waste-to-energy in the system. We appreciate MRRA's alignment with the agency's stance. Due to the unfolding events in Hennepin County and many comments of concern about the continued operation of the Hennepin Energy Recovery Center, we have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Extended producer responsibility (EPR) laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting. Thank you for your support and valuable feedback.
Christine Popowski	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/t10si2r_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Chris Roloff	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/5f02iba_document.pdf	The reciprocal use agreement among the metro counties allows residents of any metro county to use any of the 7-metro county environmental centers and HHW sites. The single-use container fee is an optional strategy that counties may choose to add to their plans. We will look to the counties to select an approach that will best serve the needs of their residents.
cj stone	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/fm0uik1_document.pdf	Carbon capture and storage (CCS) is a theoretical idea that has not been tested in real world applications. Additional research is needed to confirm that it can be implemented at a scalable level. MPCA would potentially support demonstration research projects to investigate CCS. Landfills and compost facilities are open for use over many years. During this time any collected organic material would be exposed to precipitation and the atmosphere allowing for the generation of decomposition gases. Introducing large quantities of salt into a landfill would increase the risk of groundwater contamination. Composting and anerobic digestion provide benefits beyond the disposal of waste such as creating mulch for reuse or electricity generation. CCS would only be used as a disposal method and therefore would be lower on the solid waste hierarchy. The referenced articles discuss agro-sequestration using various crops specifically chosen for the carbon capture potential. The heterogenous nature of human generated organics used in composting may impact the feasibility of using CCS.
Claire Graupmann	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/3b0jic0_document.pdf	Resident education is addressed in that plan with a strategy that calls for a commitment to standardized outreach and education. We agree that the messaging reaching residents should be easy to understand. Piecemeal efforts by counties, cities, haulers, and other organizations are rarely collaboratively developed and can lead to confusion over what materials can be recycled or composted. Assuring a consistent message from those within the solid waste system would help bring clarity to the users of the system. The plan includes many waste reduction strategies. The plan requires counties to standardized outreach and education. Using consistent terms throughout the metro should help to reduce confusion.

Name	Affiliation	Comment	Response
Commissioner Liz Workman, Board Chair	Dakota County	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ow0fibx_document.pdf	Appendix G now includes a column identifying interested parties expected to be impacted by each strategy in the Metro Policy Plan. Based on comments received, its clear that the MPCA needs to play a role in creating regional consistency. As the leading state agency, MPCA is committed to coordinating and facilitating regional meetings to discuss solid waste issues. The plan has been modified to clarify the role that MPCA will play. If a county and the MPCA have conflicting compliance rates, that demonstrates a need to collaborate and identify the source of this anomaly. If the MPCA has an outdated license list from the county, this could be the source of the discrepancy. Implementing this strategy for county owned buildings was the intent of this strategy. The plan has been edited for clarity. Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. Wood waste is expected to increase and will require collaboration to find upstream solutions. Planning will be required to avoid open burning. The plan has been revised to include a state-led strategy aimed at inter-agency coordination. MPCA promotes the use of compost to MNDOT and enterprise wide. Food-derived compost requirements in some metro counties and cities has bolstered markets. The region's food waste can have a beneficial use in metro construction projects. MPCA must promote robust markets for compost. One avenue is through partnerships with other state agencies. However, the MNDOT specification may not be the right tool for a statewide market development strategy for food-derived compost. In much of Greater Minnesota, food-derived compost is not established. Facilities and compost sites may be remote. Current MNDOT specifications do allow for use of food-derived compost. However, requiring only food-derived compost statewide is not currently feasible. The volume of compost used under MNDOT specifications exceeds the supply of food-derived compost. Additionally, some projects are located far from sources of food-derived compost. These statewide specifications must be achievable through a variety of feedstocks. MPCA will continue to enforce MN Stat. 473.848, which requires WTE energy facilities to operate at full capacity. It is understood that some counties will supply more waste to those facilities than others. It is also understood that some counties will not be able to meet the total percentage laid out in the Metro Policy Plan. However, it should be noted that MPCA expects counties to support the existing infrastructure when possible. The MPCA also has many strategies that expect counties to move materials up the hierarchy via reuse, recycling, and composting whether they have access to WTE or not. Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents, but historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline in order to allow facilities more time to plan. The metro forecast was developed as described in the methodology included within Appendix F. Organics and recycling tonnages were calculated based on needed benchmarks to achieve the 75% recycling goal by 2030. Capacity has historically expanded as programs have come online and as needed. Organics processors (i.e., compost sites and anerobic digestion facilities) are only likely to make the necessary investments in expanding their capacity if/when they have assurances that materials will be available to be managed. New capacity could come from a variety of sources, including already announced expansions, the initiation of operations at already permitted sites, management of organics at facilities outside the metro region and/or the development of new sites. The forecast is a more useful planning tool in its current format than it would be if it were to reflect an estimate of new capacity that may not accurately reflect real capacity in 2025. The MPCA is generally supportive of adequately funding programs at a state, county, and city-level. Legislative changes are outside the scope of the plan. The plan provides a waste forecast of anticipated generation. Waste reduction is determined by comparing forecasted population growth with documented solid waste generation data. Ideally, the strategies proposed throughout the plan result in future reported generation rates as less than forecasted. The vast number of strategies creates a wide range of possible systems/programs. It wouldn't be possible to estimate costs for all outcomes. It is expected that metro counties consider costs of implementation as they select strategies for their County Solid Waste Plans. MPCA will allow counties to recommend alternative strategies that will be approved by MPCA on a case-by-case basis. The standardized education strategy has been edited to address your concern.
Connor Stratton	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/8o0bihe_document.pdf	MPCA is committed to addressing the GHG contributions the solid waste system produces. This plan seeks to hold counties accountable for assuring meaningful effort is being put forth into the greatest impact reduction activities, like source reduction. MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Cora Preston	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/1s03igu_document.pdf	Ramsey County will soon roll out curbside pick-up for food scraps: https://www.ramseycounty.us/residents/recycling-waste/collection-sites/food-scraps. Making this an easier option for residents should increase participation and divert more food waste from landfills. An optional strategy that counties may choose to add to their plans would require a fee on takeout containers. We will look to the counties to plan for an approach that will best serve the needs of their residents. There is flexibility in how counties fulfill this strategy and also to better align with the waste heirarchy, which values recycling over composting. Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. Piecemeal efforts by counties, cities, haulers, and other organizations are rarely collaboratively developed and therefore can lead to confusion over what materials can be recycled or composted. Assuring a consistent message from those within the solid waste system would help bring clarity to the users of the system.
Corissa Nohrenberg	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/s60bigf_document.pdf	A required strategy calls for expanded backyard composting outreach and resources for residents. Those resources would provide guidance and materials for residents to set up their own backyard compost. Encouraging a reduction in paper marketing materials is a great source reduction idea. Recycling is exempt from the solid waste management tax, so a tax break is already in place. The State and counties could do a better job of making this clear to residents. The cost of curbside collection is outside of the scope of this plan. Haulers establish the costs for service. The Minnesota Department of Corrections (DOC) work release program is something materials recovery facilities (MRFs) have historically used. However, this practice was interrupted during the COVID-19 pandemic due to both safety concerns as well as limited availability of incarcerated workers at MRFs.
Curt Wynkoop	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/pz0nihy_document.pdf	An analysis of existing data shows that higher participation rates are realized with single-sort recycling than historical rates with multiple streams. Switching from one bin to 5-6 different types in bags or containers would be very difficult. Additionally, workers now use hydraulic systems to empty rolling carts. Under the old system, workers had to physically empty 5-6 different bags or containers into different compartments in the truck. This resulted in injuries that are now avoidable through the simplified single-stream system.
D B	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/720gicf_document.pdf	The MPCA has a responsibility to assure the solid waste system is equitable and does not create an undue burden on any community in the Twin Cities Metro Area.
Dagny Heimisdottir	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/oe0vi52_document.pdf	The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.

Name	Affiliation	Comment	Response
Dale Lutz	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/840pi2a_document.pdf; https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/sx07iea_document.pdf	Thank you for sharing the information about CCC for WTE facilities. MPCA is aware of carbon capture technology and the Minnesota Resource Recovery Association is exploring partnerships with carbon capture technology for WTE facilities located in MN. Carbon captured in MN could be deep well injected into bedrock as close as North Dakota, but there are some technical hurdles to cross prior to that, most notably the pipeline infrastructure to get the CO2 transported efficiently. Solving climate change will require a wide range of creative solutions and CCC could be one of the tools.
Daniel Rosenblum	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/w60bims_document.pdf	Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting. MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. This plan seeks to manage waste to its highest and best use.
Deb Leibel	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/c90gibr_document.pdf	Organized collection systems provide many overall benefits to residents, if implemented properly. Establishment of an organized collection system is a local decision and therefore, this strategy will remain optional. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Delaney Welle	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/oa0ai9g_document.pdf	Convenience is a critical component of success. A required strategy in the plan expands curbside collection of organics recycling to all cities with a population greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. Counties are able to pursue the implementation of an ordinance to tax single-use items. Restrictions like a bag ban should be determined through county and/or city ordinances. Education must be a priority to improve our system. In addition, different types of education are important to reach different people. The plan calls for robust education in all seven metro counties.
denise dawson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/d20yicn_document.pdf	Minnesota Statute 115A.93 Subd. 3 prohibits haulers from imposing a greater charge on residents who recycle than on residents who do not recycle. The initial draft of this plan explored the feasibility of weekly recycling collection, which was determined to cause an undue burden on the haulers without evidence of an increase in collection of recyclable materials.
Diane Ballentine	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ah03i9n_document.pdf	Compostable single-use products are a better option than conventional single-use products, but reuse is the best option.
Diane Edson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/wv0si8b_document.pdf	Contamination is a serious issue plaguing the recycling stream. Penalizing violators would be difficult to enforce. The plan focuses on education strategies to mitigate the issue. Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. Recycling refund legislation is very successful at increasing the collection of beverage containers. States with recycling refund often have capture rates greater than 80% for materials covered by the redemption fee. MPCA does not have the authority to require this type of legislation through this plan. This would require action by the Minnesota Legislature to enact a requirement on beverage manufacturers. The plan includes a strategy for the management of organics recycling from large commercial food generators by 2030. It was optional in the draft and has been changed to required, based on public comments.
Dick Evans	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/l606i7z_document.pdf	The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
don nelson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/0905i8v_document.pdf	Compostable single-use products are a better option than conventional single-use products that cannot be recycled, but reuse is the best option. The plan requires expansion of curbside organics collection to a greater number of households. Terracycle can fill the gaps in collection of materials that cannot be diverted/processed at a traditional recycling facility. Reducing or eliminating these materials is best. For unavoidable waste, it's a great option to assure these materials stay out of landfills and WTE facilities.

Name	Affiliation	Comment	Response
Donna Lindberg	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/wb0aiby_document.pdf	Educational requirements appear throughout the plan. School districts are required to collect and recycle at least three types of recyclables in their schools, although contamination of the recyclables can be a challenge. Curbside collection of organics recycling is a requirement in the plan.
Doug Gurian-Sherman	MN EJ Table and MCEA	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/310qidv_document.pdf	MPCA used up-to-date peer-reviewed science as a basis for the recommendations in this report. The strategies of this plan have merit for reducing waste generation and disposal. We acknowledge that some are more effective and impactful than others. State statute backs the waste hierarchy, and the plan has a strong emphasis on the top of the hierarchy to reduce waste to the extent possible. MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The objectives of the plan show that we are attempting to increase traditional recycling by 20%, organics by 11% and to reduce overall waste generation by 5%. If the Metro area can successfully achieve these objectives, the solid waste system will generate far fewer greenhouse gases.
Doug Heuer	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/7r0vihm_document.pdf	Reducing waste is a keystone theme in this plan. Replacing single-use containers with reusable containers is an effective way to reduce waste. We encourage counties to address solutions to reduce reliance on single-use waste through several optional strategies.
Douglas Carnival	McGrann Shea Carnival Straughn & Lamb, Chartered	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/w104i70_document.pdf; https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/w104i70_document.pdf	Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. The MPCA is tasked with enforcing state law as written. MPCA continues to support the 75% recycling goal. We have and will continue to support a greater emphasis on waste prevention and reuse because of their increased benefits. MPCA continually reviews goals and requirements for ways they can be improved or revised and recommend revisions as appropriate. Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents, but historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline. MPCA acknowledges that an additional cost may not change human behavior, but these added costs could provide resources to fund programs that can focus on alternatives to disposal. It is the intention of the MPCA that the tax/fee would be utilized by the county to reinvest in education and alternatives to disposal. The vast number of strategies creates a wide range of possible systems/programs. It wouldn't be possible to estimate costs for all outcomes. It is expected that metro counties consider costs of implementation as they select strategies for their County Solid Waste Plans. Minnesota has a rechargeable battery law. Updates to the law are needed to address the full scope of the lithium battery issue. The MPCA is working with partners on legislative proposals to improve the collection and recycling of batteries. A strategy has been added to the plan to implement education programs on proper battery management. Creating safe storage spaces that minimize fire risks at waste facilities is challenging. Minnesota Statute 473.149 Subd 3 (b) states that revisions to the plan are exempt from rulemaking. The statute also puts in a robust public comment and engagement process that guides the MPCA in development of the Metro Policy Plan. The plan states that required strategies must be included in county plans in order for approval by MPCA pursuant to MN Stat 473.803. Only those criteria and standards as laid out in Appendix D are required of facilities. Required strategies in the body of the plan are requirements that counties must include in their solid waste plans. County plans set policies and goals. Counties are expected to implement their plans, which may require the introduction of ordinances.
Drew Hatzenbihler	Morrison County	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/hp0bilj_document.pdf	Greater Minnesota CON is currently identified in rule. Issuance of CON is not done for a set number of years, but rather for the volume of waste anticipated for a set amount of time. Time-based CON is challenging, because it requires long-term forecasts that must account for uncertainty. When landfill capacity is constrained, MPCA and the affected facilities must coordinate to ensure that there is no disruption to the system that results in illegal dumping of waste.
Elia Rubio	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/5x0micx_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Elizabeth Aseltine	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/010lirl_document.pdf	Recycling refund legislation is very successful at increasing the collection of beverage containers. States with recycling refund often have capture rates greater than 80% for those materials that are covered by the redemption fee. MPCA does not have the authority to require this type of legislation through this plan, because it would take action by the Minnesota Legislature to enact that requirement on beverage manufacturers.
Elizabeth Kittelson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/3n0ri2d_document.pdf	Universally-sized collection bins are the best option for hauler safety. If other accomodations could ease your burden, that may be feedback you can share with your city officials.
Elizabeth Shvedenko	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ip0ui7n_document.pdf	Curbside organics recycling pickup programs play an important role in solid waste diversion.
Elke Zimmermann	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/fe0yi56_document.pdf	Contract for residential recycling and organics by 2030 is an optional strategy in the plan. Organized collection has numerous benefits and can lower costs for all types of service (i.e., MSW, recycling, organics) to residents of a community. Resident education is addressed in this plan with a strategy that calls for a commitment to standardized outreach and education. We agree that the messaging reaching residents should be easy to understand. Piecemeal efforts by counties, cities, haulers, and other organizations are rarely collaboratively developed and therefore can lead to confusion over what materials can be recycled or composted. Assuring a consistent message from those within the solid waste system would help bring clarity to the users of the system. The draft plan did not include strategies for multi-family housing. Strategies for multi-family recycling, organics recycling, and reduction have been added to the final plan. The plan includes a strategy to establish a curbside set-out day to allow residents to set out used items for reuse. This should lead counties to eliminate prohibitive ordinances and policies.

Name	Affiliation	Comment	Response
Emily Barker	Minnesota Reusables Coalition	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/y909i8d_document.pdf	A strategy requiring counties to establish their own green meeting policy now appears in the plan. In response to comments received from cities and counties, the strategy for reusables at county events will remain optional. Compostable single-use products are a better option than conventional single-use products that cannot be recycled, but reuse is the best option. MPCA will look to counties to interpret or adjust this strategy to achieve the best outcome given their resources and residents. The strategy has been edited to incorporate the successful and vetted aspects of the Minneapolis ordinance. MPCA received funding in the last legislative session for grants that will address waste issues and climate change reduction. Quality tracking of materials is the key to successful solid waste management. Measuring our successes and failures allows us to advance the system in a meaningful, data-based way. The plan has been amended to allow counties to provide alternative strategies. For required strategies, proposals must achieve comparible objectives. For optional strategies, counties should work with their PCA solid waste planner to determine the point value of the alternative strategy. This state-led strategy is a brief description of the complex work PCA staff will continue to focus on.
Emily Beltt	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/5j0aifi_document.pdf	Ramsey County will soon roll out curbside pick-up for food scraps: https://www.ramseycounty.us/residents/recycling-waste/collection-sites/food-scraps. Making this an easier option for residents should increase participation and divert more food waste from landfills.
Emma Marlar	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/v30ci5l_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts.MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Eric Brace	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/8q0zi2o_document.pdf	Convenience is a critical component of success. The plan includes a strategy that would expand curbside collection of organics recycling to all cities with a population of 5,000 or greater. The most effective way to reduce waste is to not create it in the first place. Compostable single-use products are a better option than conventional single-use products that cannot be recycled, but reuse is the best option. The plan requires expansion of curbside organics collection to a greater number of households. Making a new product emits greenhouse gases that contribute to climate change and requires a lot of materials and energy - raw materials must be extracted from the earth, and the product must be fabricated then transported to wherever it will be sold. As a result, reduction and reuse are the most effective ways you can save natural resources, protect the environment and save money.
Erin Oakley	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/kd0zil6_document.pdf	The most effective way to reduce waste is to not create it in the first place. Making a new product emits greenhouse gases that contribute to climate change and requires a lot of materials and energy—raw materials must be extracted from the earth, and the product must be fabricated then transported to wherever it will be sold. As a result, reduction and reuse are the most effective ways you can save natural resources, protect the environment, and save money. The plan includes many strategies targeted at improving diversion of businesses.
Evan Mulholland	MN EJ Table and MCEA	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/vk0sidn_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Decentralized waste management is an interesting concept. In many ways, this plan is pushing for strategies that do just that. By prioritizing waste reduction, reuse, recycling, and composting over disposal methods, the idea of moving material into decentralized management is in this plan. The plan contains strategies to diversify our end markets for recycling, compost, and wood waste. When it comes to diversifying trash outlets, MPCA would be receptive to discussing what those options could be that also are protective of the environment. The Metro Policy Plan will not be including a HERC shut down by 2025 scenario. At the time of publication, Hennepin County is in the process of developing a plan to close HERC between 2028 and 2040. CON for land disposal facilities is not contingent on the Metro Plan having that scenario published. CON needs are evaluated as need arises, and landfills can expand without a forecast that states that it's needed if conditions in the region are substantially different than the time that the forecast was developed. Forecasts for non-MSW were inadvertently omitted from the draft plan. Non-MSW forecasts, including ash estimates, have been added. Waste-to-energy facilities reduce waste volume by about 75%, greatly reducing the amount of space needed for land disposal. Additionally, ash is homogeneous and chemically-stable, which reduces some of the risks of land disposal. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the Minnesota Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The draft plan did not include strategies for multi-family housing. Strategies for multi-family recycling, organics recycling, and reduction have been added to the final plan.
Frank Hornstein	Minnesota Legislature	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ov0ki2k_document.pdf	Forecasts for non-MSW were inadvertently omitted from the draft plan. Non-MSW forecasts, including ash estimates, have been added. Waste-to-energy facilities reduce waste volume by about 75%, greatly reducing the amount of space needed for land disposal. Additionally, ash is homogeneous and chemically-stable, which reduces some of the risks of land disposal. MPCA uses the Metro Policy Plan cycle to increase the expectations for county plans by requiring additional items for them to include. In addition, in previous cycles, MPCA has met with underperforming counties to work with them to see better results. MPCA intends to await the response of the counties in their solid waste plans. We have the authority to approve or deny plans and will work to enforce this statute within our authority in order to continue to push the region toward the 75% goal. MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. MPCA is supportive of significantly reducing the burning of fossil fuels by 2040. The challenge for the waste management sector is that data indicates that landfills generate greater amounts of greenhouse gases than WTE facilities do because of the methane generated. Well intended policy can create unintended consequences. MPCA agrees that we need to consider the best ways to reduce emissions from combusting certain materials. For example, the ban on mercury in batteries had a huge impact on reducing mercury emissions from WTE facilities. The Hennepin County Board passed a resolution requiring that county staff develop a plan to close HERC between 2028 and 2040. It is clear to MPCA that Hennepin County is taking the intent from the Minnesota Legislature seriously and MPCA does not feel the need to interject into their on-going process.
G R	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/2k0tipk_document.pdf	Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting.

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Gael Zembal	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/r10cih2_document.pdf	Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. One strategy in the plan encourages donation of excess food from restaurants and grocery stores with the help of health inspectors. Resident education is addressed in that plan with a strategy that calls for a commitment to standardized outreach and education. We agree that the messaging reaching residents should be easy to understand. Piecemeal efforts by counties, cities, haulers, and other organizations are rarely collaboratively developed and therefore can lead to confusion over what materials can be recycled or composted. Assuring a consistent message from those within the solid waste system would help bring clarity to the users of the system. The Minnesota State Legislature has enacted rules to maintain the integrity of the recycling system. MN Statute 115A.95 was written to ensure that once material is collected for recycling, it must be taken to a recycling processing facility or end market. This law prohibits material that is collected as recycling from being taken to a landfill and ensures that material collected for recycling is indeed being recycled. In addition, Minnesota imposes a solid waste tax on every ton of solid waste disposed. Counties also impose a separate solid waste tax if material is disposed of in their county. Minnesota does not tax material that is taken to a recycling processing facility. This makes recycling cheaper than disposal. In the 1990's private companies and the public sector made investments in the recycling system to make recycling more desirable. When overseas markets closed their borders to recyclable materials in 2017, Minnesota companies made even more investments to make sure material was clean and ready for end markets. Cleaner material and fewer contaminates in bales of recyclable material mean companies will buy Minnesota's recyclable material over others and at a better price. Minnesota has good, stable end markets for recyclable materials because of the investments made over the last 30+ years. Recycling is important to Minnesota's local economy. Overall, recycling helps support nearly 78,000 jobs in Minnesota. Over 330 manufactures in Minnesota use recycled material in their products. There is a strategy in the plan for counties to expand backyard composting outreach and resources. Placing a backyard compost pile at least 20 feet away from habitable buildings is widely accepted as a measure to mitigate the associated risks. This is an optional strategy that counties may choose to add to their plans. The strategy requires the adoption of an ordinance with a mandatory consumer charge for take out containers.
Gerald Stiff	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/j00oiio_document.pdf	Education is addressed throughout the plan and plays a very important role in the success of a functional solid waste system. Your county, city, and hauler are all great resources for learning how to best dispose or find a new use for a waste or material.
H McCrillis	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/xg0rih6_document.pdf	Black plastics are not recyclable due to limitations of the sorting equipment at recycling facilities. The optical sorter cannot read the resin type. Elimination of black plastic in packaging would be more beneficial than recycling it.
Hannibal Hayes	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/o00diq3_document.pdf	MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. Wood waste is expected to increase and will require collaboration to find upstream solutions. Planning will be required to avoid open burning.
Heidi Blum	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/910nig3_document.pdf	The draft plan did not include strategies for multi-family housing. Strategies for multi-family recycling, organics recycling, and reduction have been added to the final plan based on comments like yours.
Helen M Carrillo	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/gt0zi7p_document.pdf	Preventing contamination through education is less costly and more effective than establishing a penalty system with compliance officers.
Ivy Booth	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/fn0bib5_document.pdf	The plan includes a strategy for the management of organics recycling from large commercial food generators by 2030. The point value of this strategy has been raised to reflect the impactfulness of the strategy and recognize the amount of work required of county staff to accomplish it. Thanks for your support of this impactful strategy.
J Forman	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/m10zih4_document.pdf	Compostable single-use products are a better option than conventional single-use products, but reuse is the best option. Replacing single-use containers with reusable containers is an effective way to reduce waste. We encourage counties to address solutions to reduce reliance on single-use waste through several optional strategies.
Jacquelyn Chlebeck	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/px04i37_document.pdf	Thank you for the feedback. The plan includes education strategies that the counties will execute. A visit to a solid waste facility can be exceptionally enlightening.
Jake Heidelberger	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/i409ifm_document.pdf	Ramsey County will soon roll out curbside pick-up for food scraps: https://www.ramseycounty.us/residents/recycling-waste/collection-sites/food-scraps. Making this an easier option for residents should increase participation and divert more food waste from landfills.

Name	Affiliation	Comment	Response
Jane Dow	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/7c03i4d_document.pdf	Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting. MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The plan includes many strategies to address food waste. MPCA advocates for diversion of food waste to the extent of the plan's authority. Food waste rescue activities beyond what is included in the plan would require legislative action and/or county/city ordinance passage. Recycling refund legislation is very successful at increasing the collection of beverage containers. States with recycling refund often have capture rates greater than 80% for those materials that are covered by the redemption fee. MPCA advises the MN Legislature in the Solid Waste Policy Report to implement a statewide deposit refund program.
Janet Court	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/sc0hiaj_document.pdf	The most effective way to reduce waste is to not create it in the first place. Making a new product emits greenhouse gases that contribute to climate change and requires a lot of materials and energy—raw materials must be extracted from the earth, and the product must be fabricated then transported to wherever it will be sold. As a result, reduction and reuse are the most effective ways you can save natural resources, protect the environment, and save money.
Jay Krafthefer	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/gi0mi6z_document.pdf	Recycling refund legislation is very successful at increasing the collection of beverage containers. States with recycling refund often have capture rates greater than 80% for those materials that are covered by the redemption fee. MPCA advises the Minnesota Legislature in the Solid Waste Policy Report to implement a statewide deposite refund program.
Jayson Smart	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/dd06i88_document.pdf	The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. The plan includes a required strategy to offer grants for waste reduction, reuse, and repair. Reuse businesses may be eligible for this funding.
Jeanne Nordland	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/vv0ji04_document.pdf	Thank you for the feedback. The plan now includes a suggestion to include worm composting in public outreach. There are a lot of plastics in landfills. This approach is still being researched and developed, but could potentially be part of our waste reduction approach in the future.
Jeanne Norrgard	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/4q08igk_document.pdf	The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. Reducing the amount of material being managed in the solid waste system provides the greatest environmental benefit. To truly be successful in waste reduction, upstream policies must be put into place by the Minnesota Legislature that result in the generation of fewer materials. MPCA supports minimizing disposal options (e.g., WTE and landfill) as much as possible. The plan focuses on waste reduction, recycling, and composting to meet the 75% diversion goal. The 75% disposal avoidance goal is determined by state statute and MPCA intends to aggressively push for improvement in all feasible areas. Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway.
Jenna Olson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/vs0cl90_document.pdf	Curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather. Textiles must be dry and clean for both reuse and recycling. The Secondary Materials and Recycled Textiles (SMART) Association estimates that about half of new clothing end up donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbants/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact.
Jennifer Hoese	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/yc0zii3_document.pdf	Every collection program has varying implementation costs. In some communities, curbside organics will be absorbed into existing trash fees and compostable bags will be provided by their county. In other communities, a separate hauler collects the organics recycling. This is more expensive and residents experience higher fees for that type of service.
Jenny Cook	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ok05in1_document.pdf	Thank you for the feedback. We will re-examine how to better engage the public for the next iteration of the plan.

Name	Affiliation	Comment	Response
Jessica Kullander	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/3k0ziph_document.pdf	All the 7-county metro HHW drop-off sites are open to residents of any metro county. Aside from textile recycling, every site will collect the items you listed and many other types of household hazardous waste. The plan includes a strategy to provide additional drop sites or collection events for these items. Curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather. Textiles must be dry and clean for both reuse and recycling. The Secondary Materials and Recycled Textiles (SMART) Association estimates that about half of new clothing end up donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbents/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Jessica Strasser	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/230tigd_document.pdf	Bringing your own container for takeout is an effective source reduction behavior. Incentivizing that behavior through fee avoidance should encourage some to participate.
Jessica Tritsch	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/5y09igo_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the Minnesota Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. Thank you for your feedback.
Jo Chambers	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/uy0ei6y_document.pdf	The Twin Cities metro area has some of the highest recycling rates in the nation. Our waste is managed locally, with some materials going to landfills in Wisconsin and Iowa, and therefore is not disposed of near an ocean. Additionally, MN statute 115A.95 does not allow for haulers to deliver source-separated recyclable materials unless the MPCA determines that no other disposal method is available. Minnesota has a robust local recycling market as well. Consumption behaviors need to shift to be less wasteful and it will require cooperation between government, retailers, manufacturers, and consumers.
Joel Jensen	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/lv0ni8d_document.pdf	The bag fee is an optional strategy that counties may choose to add to their plans. The strategy requires the adoption of an ordinance with a mandatory consumer charge for takeout containers and is open for counties to propose a different approach that achieves the same objective. Extended producer responsibility (EPR) laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. Packaging: The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting. Convenience is a critical component of success for organics recycling. The plan includes a strategy that would expand curbside collection of organics recycling to all cities with a population of 5,000 or greater. The plan includes a strategy for the management of organics recycling from large commercial food generators by 2030. It was optional in the draft and has been changed to required. MPCA has been working with the Departments of Agriculture and Health to create content for inspectors to educate licensed facilities about financial assistance, donation, and opportunities to reduce wasted food. The plan has been revised to include the MPCA's commitment to continue work with partner agencies on improved food rescue and prevention efforts. A strategy encouraging county engagement with health inspectors in individual county plans will remain in the plan to help accelerate adoption of the practice but will not be required.
John Borden	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/qp0kili_document.pdf	The draft plan did not include strategies for multi-family housing. Strategies for multi-family recycling, organics recycling, and reduction have been added to the final plan based on comments like yours.
John Gunyou	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/hb0uig9_document.pdf	Thank you for the feedback.
John Sullivan	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/290sidm_document.pdf	Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting.

Name	Affiliation	Comment	Response
Joseph Robinson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/lf0nikj_document.pdf	Resident education is addressed in that plan with a strategy that calls for a commitment to standardized outreach and education. We agree that the messaging reaching residents should be easy to understand. Piecemeal efforts by counties, cities, haulers, and other organizations are rarely collaboratively developed and therefore can lead to confusion over what materials can be recycled or composted. Assuring a consistent message from those within the solid waste system would help bring clarity to the users of the system. The Minnesota State Legislature has enacted laws to maintain the integrity of the recycling system. MN Statute 115A.95 was written to ensure that once material is collected for recycling, it must be taken to a recycling processing facility or end market. This law prohibits material that is collected as recycling from being taken to a landfill. This ensures that once material is collected for recycling, it is getting recycled. Minnesota has some communities that use the Pay-as-you-throw (PAYT) model and volume-based pricing is required in MN Stat. 115A.9301. Extended producer responsibility has been shown to be very effective tool to divert waste to recycling in Canada, Europe, and other states in the U.S. In order for Minnesota to utilize this type of program, the MN Legislature would have to create new laws with requirements on manufacturers. This plan does not have authority to make statewide changes. Policy recommendations for the MN Legislature are found in the MPCA's Solid Waste Policy Report.
Judy Huber	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/p70ziil_document.pdf	Please contact management at the Eagan Community Center with this request. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Juli Albright	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/r70diqu_document.pdf	Contract for residential recycling and organics by 2030 is an optional strategy in the plan. Organized collection has numerous benefits and can lower costs for all types of service (i.e., MSW, recycling, organics) to residents of a community. The plan includes several strategies for reducing wasted food. Food donation is part of those recommendations.
Julie Ketchem	WM	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/sh0nih6_document.pdf; https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/m30gicl_document.pdf	Contamination is a serious issue plaguing the recycling stream. The plan focuses on education strategies to mitigate this issue. Contract for residential recycling and organics by 2030 is an optional strategy in the plan. Organized collection has numerous benefits and can lower costs for all types of service (i.e., MSW, recycling, organics) to residents of a community. Every collection program has varying implementation costs. In some communities, curbside organics will be absorbed into existing trash fees and compostable bags will be provided by their county. In other communities, a separate hauler collects the organics recycling. This is more expensive, and residents experience higher fees for that type of service. Durable composable bag systems reduce the number of trucks needed for collection, as the bags are placed in the garbage bins. There are opportunities for costs to residents and haulers to be minimized. Counties, cities, haulers, and the state will learn a lot about the best method to provide organics collection to residents as this program implemented. Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. MPCA position is that the settlement agreement about restriction on disposal with WM and Republic Services has been effective. The language that was agreed upon in the settlement negotiations has provided the flexibility to the landfills and to the waste-to-energy (WTE) facilities to navigate the challenge of when the facility is at capacity. The 14-day notification period addresses most of the concerns that you are stating about closures and outages. The landfills have 14 days to adjust and coordinate with WTE facilities to ensure capacity needs are met. MPCA has and will continue to focus on generators of waste. However, the pre-processing strategy is an acknowledgement that—despite out best education efforts—a certain percentage of residents will continue to discard recyclable material into the trash. MSW processing is needed to get county recovery rates closer to 75%. Education efforts will continue, and efforts will be made to tie those efforts to the values of our residents. Source separation is the best way to recover materials and to ensure the highest value of those materials. Human behavior is unpredictable. Preprocessing can recover additional recyclables, mainly metals. The cost of collection is the primary driver of cost to residents, but historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline. Sustainable materials management (SMM) is the best way to reduce the impacts of our waste generation. The plan is consistent with the goals of SMM. The vast number of strategies creates a wide range of possible systems/programs. It wouldn't be possible to estimate costs for all outcomes. It is expected that metro counties consider costs of implementation as they select strategies for their County Solid Waste Plans. The current process for issuing CON is arduous. However, the MPCA also is tasked with ensuring that waste facilities are developed in an orderly and deliberate manner. The lengthy process ensures that there is need for a landfill to be developed. As such, MPCA views certificate of need as a critical step in the permitting process for MSW landfills. The revoke and reissue language appears in MN Rule 9215.0940. This rule grants MPCA the right to revoke and reissue CON. This aligns metro CON with the Greater Minnesota Rule. Additionally, the Metro Policy Plan is required to be consistent with existing rules and statutes when applicable. Historically, MPCA has never rescinded capacity from a landfill without also reissuing capacity. The plan has been revised to clarify that this requirement applies to landfills and WTE facilities. The composition analysis can also be conducted at appurtenant facilities. This requirement applies to all landfills and WTE facilities within the 7-county metro area. The result is that five additional sites will now be required to perform waste composition studies. Minnesota has a rechargeable battery law. Updates to the law are needed to address the full scope of the lithium battery issue. The MPCA is working with partners on legislative proposals to improve the collection and recycling of batteries. A strategy has been added to the plan to implement education programs on proper battery management. Creating safe storage spaces that minimize fire risks at waste facilities is challenging. The plan is consistent with protecting our existing infrastructure. Larger policy discussions on topics like the bottle bill and EPR should be handled through the legislative process. Additionally, legislative proposals are not discussed in the plan, because of their state-wide impacts.
Julie Schramke	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/3j0oi73_document.pdf	Plastic resin codes may give the impression that all plastic is recyclable, but the recycling symbol was co-opted for this code system. Contamination is a serious issue plaguing the recycling stream. The plan focuses on education strategies to mitigate this issue.
Julie Svendahl	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/zq0ai2d_document.pdf	Education must be a priority to improve our system. In addition, different types of education are important to reach different people. The plan calls for robust education in all seven metro counties. Resident education is addressed in this plan with a strategy that calls for a commitment to standardized outreach and education. We agree that the messaging reaching residents should be easy to understand. Piecemeal efforts by counties, cities, haulers, and other organizations are rarely collaboratively developed and therefore can lead to confusion over what materials can be recycled or composted. Assuring a consistent message from those within the solid waste system would help bring clarity to the users of the system.
Kait Sergenian	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/hh01i8v_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.

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Kala Fisher	City of Saint Louis Park	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/uh0ti4h_document.pdf	Feedback from our metro cities is so important to assure the success of our plan. On Strategy 4: Improve recycling data collection at businesses within the county. This strategy is optional and it intended to give counties a broader understanding of recycling rates. We will work with counties on their plans, and some may choose to incorporate this optional strategy. Several metro counties track business data. We will encourage a process that is not unduly burdensome. On Strategy 17: Work with health inspectors to educate restaurants and other establishments that have excess food to donate. This strategy has been amended to include diversion for inedible food waste. On Strategy 20: Implement a county policy encouraging all county and city-led events and food providers use reusable food and beverage service ware. Thank you for providing context on the implications of the strategy as it appeared in the draft. This strategy has been revised to clarify intended outcomes and to limit the scope to the county. On Strategy 21. Adopt an ordinance with a mandatory consumer charge for take-out single-use cups, containers, and utensils. This is an optional strategy that counties may choose to add to their plans. We will look to the counties to plan for an approach that will best serve the needs of their residents. This has been revised to allow more flexibility in how counties fulfill this strategy and also to better align with the waste heirarchy. On Strategy 25. Establish a curbside set-out day to allow residents to set out used items for reuse. This is an optional strategy that counties may choose to include in their solid waste plans. It is a good way to make reuse more convenient for residents. However, if any county wants to propose other reuse strategies, the provides them the freedom to do that. The plan includes a new strategy to require counties to promote their reuse outlets that are located in the county. On Strategy 28: Collect recycling weekly by 2025. Interested parties have raised concerns on the undue burden of weekly recycling. Accordingly, this now appears in the plan as an optional strategy. Strategy 34: Establish mandatory pre-processing of waste at resource recovery facilities and landfill by 2025. Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents. But historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline and allow for alternative proposals. On Strategy 37: Make residential curbside organics collection available in cities with a population greater than 5,000. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. The plan has been clarified to include language that this strategy is for single-family residential. On Strategy 38. Expand backyard composting outreach and resources for residents. Thank you for the feedback. The plan has been edited to allow for more flexibility in how counties promote backyard composting activities. On Strategy 40: Standardize the role of compostable products in organics recycling programs by 2025. This strategy has been edited for clarity.
Karen Kiener	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/h303iaf_document.pdf	Thank you for the feedback. A predraft meeting was held on May 26, 2021 with a comment period of 6 weeks afterward. We will evaluate our approach to the predraft notice and ways of gathering input for our next plan.
Karissa VanErem	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ea0pilj_document.pdf	The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Katherine Haun Schuring	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/t10iic4_document.pdf	Thank you for the feedback and support of this plan. Reducing the amount of food waste that currently is managed through landfills and waste-to-energy is our goal. In Minnesota, the Department of Agriculture sets food labeling requirements. While best by and sell by date labeling is outside of the scope of this plan, the MPCA plays an imporant role in providing expertise and perspective to our fellow state agencies. Curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather. Textiles must be dry and clean for both reuse and recycling. The Secondary Materials and Recycled Textiles (SMART) Association estimates that about half of new clothing end up donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbants/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. Private companies like Terracycle and Ridwell help fill the gaps by collecting materials that are difficult and costly for counties to process and manage. Black plastics are not recyclable due to limitations of the sorting equipment at recycling facilities. The optical sorter cannot read the resin type. Elimination of black plastic in packaging would be more beneficial than recycling it. Reusable takeout containers might be a better option to reduce the waste associated with takeaway food. This has been prioritized in the plan by requiring counties to provide grant funding to organizations to transition to reusable options.
Kathleen Karsko	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/aq0gi5o_document.pdf	The plan includes an optional strategy for counties to establish a reuse set out day. The plan requires counties to standardized outreach and education. This will address the concern that different terms are used throughout the metro and will help to address confusion.
Kathy Ulmer	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/rt0ei8m_document.pdf	MN statute 115A.95 does not allow for haulers to deliver recyclable materials collected from residents to landfills, unless the MPCA determines that no other disposal method is available. Due to the extensive reporting required by haulers and solid waste facilities, we have the data to prove our recycables are being recycled. Minnesota has a strong recycling market and some of the highest recycling rates in the nation. While recyclables may end up in landfills in other states, Minnesota has a strong system of checks and balances to assure materials places in recycling bins by residents are routed to facilities that truly recycle them.
Kelly Gryting	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/nh0oiod_document.pdf	We received a lot of feedback about weekly recycling collection. Interested parties alerted us to the undue burden weekly recycling would have on their operations, both cities and haulers. Accordingly, this now appears in the plan as an optional strategy. We agree that the messaging reaching residents should be easy to understand. A strategy in the plan requires counties to commit to standardized outreach and education for residents. Piecemeal efforts by counties, cities, haulers, and other organizations are rarely collaboratively developed and can lead to confusion over what materials can be recycled or composted. Assuring a consistent message from those within the solid waste system would help bring clarity to the users of the system.
Kelly Lindsay	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/9008i1f_document.pdf	An HOA is a legal entity that may enforce rules in your neighborhood. The HOA restriction on placement of bins is outside the scope of the PCA's authority. Carver County may adapt a strategy to establish a curbside set-out day into their solid waste plan. Carver County staff operate their environmental center independently of the MPCA. Carver County may propose a strategy to extend the hours of the environmental center to be more accessible to the public. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. There are several options for disposing of shredded paper, particularly document destruction organizations such as Shred-It. Those companies shred and recycle the documents that they manage and usually work with large commercial customers. They may also participate in document shredding days for residents that counties host. Your comment inspired a strategy that counties should establish a document destruction day for residents.
Ken Smith	Ever-Green Energy	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/pb0gigt_document.pdf	State statute defines yard waste as including garden wastes, leaves, lawn cuttings, weeds, shrub and tree waste, and prunings in Minn. Stat. § 115A.03. Sites that refuse large wood waste items like logs often lack the equipment or space to process these into small pieces. The Minnesota Department of Agriculture has enacted a quarantine to limit the movement of firewood. MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. Wood waste is expected to increase and will require collaboration to find upstream solutions and assure there is adequate space at our wood yards. Planning will be required to avoid open burning. Market development for wood waste is called for in the plan. MPCA is aware that additional markets beyond St. Paul Co-generation will be needed to ensure outlets are available in the future. Markets can include composting, bio-char, lumber markets, or others that MPCA may not have yet considered. We will be looking to the county solid waste plans to propose solutions for supporting the continued operation of wood yards within their counties.

Name	Affiliation	Comment	Response
Ken Stewart	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/150bi5j_document.pdf	The scope of this plan is dictated by Minn. Stat. § 473.149. This plan has many strategies for reduction, such as food waste reduction grants, increasing food rescue from restaurants and grocery stores, and sustainable purchasing policies at counties. However, the most effective waste reduction efforts will require legislative changes.
Kim B	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/910midy_document.pdf	Organics and recycling collected from schools tends to have higher contamination rates. Focusing education on students and staff to improve this behavior could help improve diversion rates. There is a required strategy in the plan to offer grants or rebates for organizations to transition to reusable food and beverage service ware. The school district can work with Washington County to purchase reusable trays to replace Styrofoam trays. Dakota County's ordinance to require commercial collection of organics has been a success. The plan has a strategy that would require counties to coordinate on their outreach and education efforts. Washington County has great resources for recycling and waste prevention, with a helpful website: https://www.ramseycounty.us/residents/recycling-waste/education/education-resources An HOA is a legal entity that is subject to state laws and may be subject to the strategies selected in your county's solid waste plan. The plan has an optional strategy for counties to adopt an ordinance with a mandatory consumer charge for take-out single-use cups, containers, and utensils. The Washington County Environmental Center in Woodbury is an excellent resource. This is the great challenge for this moment in our history. We are surrounded by easy consumption and disposal. Capturing products for a circular economy is challenging and will require support and advocacy by citizens like you. Establishing incentives for creating less waste is a great idea, but tracking it would be very difficult.
Kim Kuhn	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/460bi84_document.pdf	Curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather. Textiles must be dry and clean for both reuse and recycling. The Secondary Materials and Recycled Textiles (SMART) Association estimates that about half of new clothing end up donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbants/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. The plan includes many waste reduction strategies that incorporate financial incentives.
Kim Rollie	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/m708i2f_document.pdf	The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Kris Lovaas	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/s00cics_document.pdf ; https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/kq0ai3r_document.pdf	Thank you for the feedback. The plan has been revised to make the weekly collection strategy optional. This strategy has the opportunity to make collection frequency more convenient for residents, but may be cost prohibitive and further exacerbate the driver shortage. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Ky Schmidt	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/v30qicr_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Laura Grevas	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/zb0wi53_document.pdf	The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Lauren Allen	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ao0gi2p_document.pdf	The Minnesota Legislature passed a sweeping bill to address and prohibit PFAS in consumer products. The Minnesota Attorney General reached an $850 million settlement with 3M. For more information about this, visit https://3msettlement.state.mn.us/. To learn more about PFAS in Minnesota, visit https://www.pca.state.mn.us/pfas-in-minnesota.
Laurie Rossin	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/uq0ci78_document.pdf	The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Leanna Goose	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ox0eieg_document.pdf	E-waste recycling must be convenient. The plan calls for convenient drop site access for residents. The plan requires pre-processing at landfills to remove recyclable material, but we will continue to strive for e-waste collection upstream for the most effective recovery of materials.
Lee Mehrkens	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ld07ih4_document.pdf	Organics recycling is the highest and best use for inedible food waste. Single-use plastics can be recycled, but they can also be replaced with reusable options. The plan places greater emphasis on addressing the root problem and expanding reduction efforts.

Name	Affiliation	Comment	Response
Leigh Behrens	Partnership on Waste and Energy	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ic0xi2n_document.pdf	Thank you for your support of our many impactful strategies. Thank you also for calling attention to the importance of being mindful of the words we choose. We have amended to plan to remove harmful terms. MPCA will defer to the expertise of counties to propose variations to strategies that will work for their residents and haulers. The plan has been amended to allow counties to provide alternative strategies. For required strategies, proposals must achieve comparable objectives. For optional strategies, counties should work with their PCA solid waste planner to determine the point value of the alternative strategy. Implementing strategy 60 for county owned buildings was the original intent of this strategy. The plan has been edited for clarity. Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. The public education and backyard composting strategies have been edited to address your concerns. Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing is the process of pulling recyclables out of mixed waste and it can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents, but historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline to allow facilities time to plan the best preprocessing system. MPCA will look to counties to interpret or adjust this strategy to achieve the best outcome given their resources and residents. Hauler reporting is a shared responsibility for the state and county. Without cooperation from counties and accurate license lists, the MPCA cannot rely on the information collected. Both the state and counties benefit from the collection of this data. Sharing in the responsibility ensures accuracy and efficiency. MPCA views increased compliance as a partnership effort. Counties need to maintain and share hauler license lists with the MPCA. State leadership is needed to assure consistency. Sustainable materials management (SMM) is the best way to reduce the impacts of our waste generation. The plan is consistent with the goals of SMM. The MPCA relies on EPA's WARM for decision-making but does not require counties to do the same if other models are found to be reliable and consistent with an SMM approach. Extended producer responsibility (EPR) laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. Packaging: The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting.MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. Wood waste is expected to increase and will require collaboration to find upstream solutions. Planning will be required to avoid open burning. Market development for wood waste is called for in the plan because MPCA is aware that additional markets beyond St. Paul Co-generation will be needed to ensure outlets are available for wood waste in the future. Markets can be composting, biochar, lumber markets, or others that MPCA may not be considering at this time. The MPCA has a role in promoting use of compost with other agencies including MNDOT and the Department of Administration. Some metro counties and cities have already utilized this strategy in a way that has helped to bolster markets for food-derived compost. Expanding that practice in the region makes sense, in part because of where the most substantial food waste is generated. As such, its geographically close to metro construction projects. While the MPCA must also work with partner state agencies to promote more robust markets for compost - the MNDOT specification may not be the right tool for a statewide market development strategy for food derived compost. In many areas of the state food derived compost is not yet available and/or may be manufactured substantial distances away. Current MNDOT specifications do allow for use of food derived compost. However, requiring only food derived compost statewide is not currently feasible. The volume of compost used under MNDOT specifications exceeds the supply of food derived compost and some projects are located far from sources of food derived compost. These challenges are also why specifications must be flexible enough to offer compost from multiple varieties of feedstocks.
Leslie Frick	Sustainable Stillwater	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/d30hi2j_document.pdf	Thank you for your support of our many impactful strategies. On Strategy 21: Adopt an ordinance with a mandatory consumer charge for take-out single-use cups, containers, and utensils. This is an optional strategy that counties may choose to add to their plans. We will look to the counties to plan for an approach that will best serve the needs of their residents. This has been revised to allow more flexibility in how counties fulfill this strategy and also to better align with the waste heirarchy. The plan also requires counties to offer grants or rebates for organizations to transition to reusable food and beverage service ware. Washington County has developed many opportunities for reuse and reduction. The environmental center houses a free product room. The county organizes a group of repair volunteers for fix-it clinics and instructional videos. Their webpage also provides many resources and infomation on reuse. You can find more here: https://www.co.washington.mn.us/3175/Reduce-and-Reuse
Leslie Leik	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ck0pip4_document.pdf	Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. Many communities in the Twin Cities Metro Area have enacted backyard burning/nuisance burning ordinances. These types of requirements are out of scope for this plan, but you may reach out to your local city to learn of similar ordinances. The draft plan did not include strategies for multi-family housing. Strategies for multi-family recycling, organics recycling, and reduction have been added to the final plan. The plan includes a strategy to incentivize treatment for affected trees. The language in this strategy has been revised to address a wider range of pathogens that effect other tree species as well. We advocate for home repair to the extent that is within scope of this solid waste plan.
Leslie Martin	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/sk0birb_document.pdf	Compostable single-use products are a better option than conventional single-use products that cannot be recycled, but reuse is the best option. The plan requires counties to provide financial assistance to organizations to transition to reusable food and beverage service ware.
Libby Parker	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ep0wiq4_document.pdf	The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Lilita Keire	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/i10bij6_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Linda Bruemmer	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/c909i9d_document.pdf	Ridwell provides pickup for materials that counties tend to collect at their environmental centers or HHW drop-off sites. Some waste types are not appropriate for curbside collection and require residents to safely deliver them to environmental centers. Shredded paper is difficult for recycling centers to sort. Inquire with Ramsey County or St. Paul about shredding events if you'd like to recycling your shredded paper. Curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather. Textiles must be dry and clean for both reuse and recycling. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. The preferred method to dispose of Teflon-coated cookware is through the trash. When other opportunities to recover these items exist, MPCA will promote them. Minnesota Statute 115A.95 does not allow for haulers to deliver source-separated recyclable materials to landfills unless the MPCA determines that no other disposal method is available. The State, counties, and cities assure collected recycling is being recycled.

Name	Affiliation	Comment	Response
Lisa Cerney	Hennepin County	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/rq0mic3_document.pdf	The plan has been revised to make the weekly recycling collection strategy optional. This strategy can make collection frequency more convenient for residents but may be cost prohibitive and further exacerbate the driver shortage. MPCA still sees weekly collection as a best practice but agrees that it should be a local decision. The commercial recycling strategy will remain as required. Counties have the flexibility to implement more stringent requirements than those presented in the plan. The Plan has been edited to allow for counties to pursue the regulatory approach, in addition to or in lieu of assistance. Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing is the process of pulling recyclables out of mixed waste and it can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents, but historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline to allow facilities time to plan the best preprocessing system. MPCA will look to counties to interpret or adjust this strategy to achieve the best outcome given their resources and residents. Hauler reporting is a shared responsibility for the state and county. Without cooperation from counties and accurate license lists, the MPCA cannot rely on the information collected. Both the state and counties benefit from the collection of this data. Sharing in the responsibility ensures accuracy and efficiency. MPCA views increased compliance as a partnership effort. Counties need to maintain and share hauler license lists with the MPCA. State leadership is needed to assure consistency. The plan has been amended to allow counties to provide alternative strategies. For required strategies, proposals must achieve comparable objectives. For optional strategies, counties should work with their PCA solid waste planner to determine the point value of the alternative strategy. MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. Wood waste is expected to increase and will require collaboration to find upstream solutions. Planning will be required to avoid open burning. The wood waste section has been modified to reflect that treatment may be more cost effective for healthy trees. MPCA promotes the use of compost to MNDOT and enterprise wide. Food-derived compost requirements in some metro counties and cities has bolstered markets. The region's food waste can have a beneficial use in metro construction projects. MPCA must promote robust markets for compost. One avenue is through partnerships with other state agencies. However, the MNDOT specification may not be the right tool for a statewide market development strategy for food-derived compost. In much of Greater Minnesota, food-derived compost is not established. Facilities and compost sites may be remote. Current MNDOT specifications do allow for use of food-derived compost. However, requiring only food-derived compost statewide is not currently feasible. The volume of compost used under MNDOT specifications exceeds the supply of food-derived compost. Additionally, some projects are located far from sources of food-derived compost. These statewide specifications must be achievable through a variety of feedstocks. Implementing the building material management plan strategy for county-owned buildings was the original intent of this strategy. The plan has been edited for clarity.
Lisbeth Petersen	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/a906imz_document.pdf	Recycling refund legislation is very successful at increasing the collection of beverage containers. States with recycling refund often have capture rates greater than 80% for those materials that are covered by the redemption fee. MPCA advises the Minnesota Legislature in the Solid Waste Policy Report to implement a statewide deposite refund program.
Liz Borchardt	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ri06ikhdocument.pdf	All metro counties have online resources on how and where to dispose of items banned from curbside collection bins. County HHW drop-off sites and many retail outlets collect clean, dry plastic bags for recycling. Reusable produce bags are a great option if you are looking to reduce your reliance on plastic. Curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather. Textiles must be dry and clean for both reuse and recycling. The Secondary Materials and Recycled Textiles (SMART) Association estimates that about half of new clothing end up donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbants/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Lois Norrgard	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ra0zikw_document.pdf	The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the Minnesota Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. MPCA is still learning how best to engage with impacted communities with our planning processes and there is a long way to go to get the levels of engagement that we'd like. However, MPCA received six times the comments received for the prior plan. Most of these comments were from community members rather than our usual industry/county contacts. MPCA will continue to improve community outreach, but we are pleased with the progress made between this plan and the prior plan. The Minnesota State Legislature has enacted laws to maintain the integrity of the recycling system. MN Statute 115A.95 was written to ensure that once material is collected for recycling, it must be taken to a recycling processing facility or end market. This law prohibits material that is collected as recycling from being taken to a landfill. This ensures that once material is collected for recycling, it is getting recycled. In addition, Minnesota imposes a solid waste tax on every ton of solid waste disposed. Counties also impose a separate solid waste tax if material is disposed of in their county. Minnesota does not tax material that is taken to a recycling facility. In the 1990s private companies and the public sector made investments in the recycling system to make recycling more desirable. When overseas markets closed their borders to recyclable materials in 2017, Minnesota companies made even more investments to make sure material was clean and ready for end markets. Cleaner material and less contamination in bales of recyclable material mean companies will buy Minnesota's recyclable material over others and at a better price. Minnesota has good, stable end markets for recyclable materials because of the investments made over the last 30+ years. Recycling is important to Minnesota's local economy. Overall, recycling helps support nearly 78,000 jobs in Minnesota. Over 330 manufactures in Minnesota use recycled material in their products. The single-use container fee is an optional strategy that counties may choose to add to their plans. We will look to the counties to select an approach that will best serve the needs of their residents. Counties will be required to offer grants or rebates for organizations to transition to reusable food and beverage service ware. Restrictions like a bag ban should be determined through county and/or city ordinances. The most effective way to reduce waste is to not create it in the first place. Compostable single-use products are a better option than conventional single-use products that cannot be recycled, but reuse is the best option.
loraine allison	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/320si01_document.pdf	Recycling refund legislation is very successful at increasing the collection of beverage containers. States with recycling refund often have capture rates greater than 80% for those materials that are covered by the redemption fee. MPCA advises the Minnesota Legislature in the Solid Waste Policy Report to implement a statewide deposite refund program.
Lori Belz	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/yo0oi86_document.pdf	The plan was authored by MPCA staff. The length of the plan is due to the breadth of topics covered and complicated solid waste system of the Twin Cities Metro Area. The single-use container fee is an optional strategy that counties may choose to add to their plans. The strategy was edited to be more customizable for counties to include problematic materials. We will look to the counties to select an approach that will best serve the needs of their residents. Counties will be required to offer grants or rebates for organizations to transition to reusable food and beverage service ware. Restrictions like a bag ban should be determined through county and/or city ordinances. The most effective way to reduce waste is to not create it in the first place. Compostable single-use products are a better option than conventional single-use products that cannot be recycled, but reuse is the best option. The draft plan did not include strategies for multi-family housing. Strategies for multi-family recycling, organics recycling, and reduction have been added to the final plan. The plan includes a strategy to establish a curbside set-out day to allow residents to set out used items for reuse. This should lead counties to eliminate prohibitive ordinances and policies.

Name	Affiliation	Comment	Response
Lori Olinger	Coalition for Plastic Reduction	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/dt01i17_document.pdf	Over-consumption is at the root of the planet's environmental crisis, with impacts beyond the waste produced at the end of useful life. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the MN Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The metro forecast was developed as described in the methodology included within Appendix F. Organics and recycling tonnages were calculated based on needed benchmarks to achieve the 75% recycling goal by 2030. Capacity has historically expanded as programs have come online and as needed. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The Minnesota Legislature passed a sweeping bill to address and prohibit PFAS in consumer products. The Minnesota Attorney General reached an $850 million settlement with 3M. For more information about this, visit https://3msettlement.state.mn.us/. To learn more about PFAS in Minnesota, visit https://www.pca.state.mn.us/pfas-in-minnesota. Removing PFAS from consumer products will lead to a reduction of PFAS in our solid waste stream. The most effective way to reduce waste is to not create it in the first place. Making a new product emits greenhouse gases that contribute to climate change and requires a lot of materials and energy - raw materials must be extracted from the earth, and the product must be fabricated then transported to wherever it will be sold. As a result, reduction and reuse are the most effective ways you can save natural resources, protect the environment, and save money. Counties measure and report to the PCA on reduction and reuse efforts. The plan includes many strategies to address food waste. MPCA advocates for diversion of food waste to the extent of the plan's authority. Food waste rescue activities beyond what is included in the plan would require legislative action and/or county/city ordinance passage. Extended producer responsibility (EPR) laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting. Minnesota has a rechargeable battery law. Updates to the law are needed to address the full scope of the lithium battery issue. The MPCA is working with partners on legislative proposals to improve the collection and recycling of batteries. A strategy has been added to the plan to implement education programs on proper battery management. Creating safe storage spaces that minimize fire risks at waste facilities is challenging. Much like EPR, legislative action will be necessary to implement changes. Recycling refund legislation is very successful at increasing the collection of beverage containers. States with recycling refund often have capture rates greater than 80% for those materials that are covered by the redemption fee. MPCA advises the MN Legislature in the Solid Waste Policy Report to implement a statewide deposit refund program. Thank you for these thoughtful suggestions for the county sustainable purchasing policy strategy. Adding more prescriptive language will ensure there is a metro-wide consistent movement toward waste reduction through purchasing activities. The plan is only for the metro area. MPCA's Solid Waste Policy Report has recommendations for EPR and other legislation that would have state-wide impacts regarding the use of plastics.
LuAnn Johnson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/sn0yi9x_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the Minnesota Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. Extended producer responsibility (EPR) laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting.

Name	Affiliation	Comment	Response
Lucy Mullany	Minnesota Zero Waste Coalition	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/7s08i6f_document.pdf	All 7-county metro HHW drop-off sites are open to residents of any county. Every site will collect the items you listed and many other types of household hazardous waste. The plan includes a strategy to provide additional drop sites or collection events for these items. Continuous end-market development is paramount to a functional recycling system. MPCA agrees that strong markets for glass and other challenging materials is something that needs constant attention from the State and our partners. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. The plan includes a strategy that would encourage the development of additional reuse infrastructure. The plan calls for waste composition to be conducted every 5 years, which is consistent with requirements that waste-to-energy facilities must follow. Consistency in requirements is important, so the 5-year time frame will remain. The counties rely on business data to track recycling information, and it is a county-level decision to require or ask for cooperation when they work to collect that information. Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting. This plan does not have authority to make statewide changes. Any bans or policy recommendations from MPCA can be found in our statewide Solid Waste Policy Report to the Minnesota Legislature. Efforts to improve the e-waste EPR law that exists in Minnesota are underway. Minnesota has a rechargeable battery law. Updates to the law are needed to address the full scope of the lithium battery issue. The MPCA is working with partners on legislative proposals to improve the collection and recycling of batteries. A strategy has been added to the plan to implement education programs on proper battery management. Creating safe storage spaces that minimize fire risks at waste facilities is challenging. MPCA has been working with the Departments of Agriculture and Health to create content for inspectors to educate licensed facilities about financial assistance, donation, and opportunities to reduce wasted food. The plan has been revised to include the MPCA's commitment to continue work with partner agencies on improved food rescue and prevention efforts. A strategy encouraging county engagement with health inspectors in individual county plans will remain in the plan to help accelerate adoption of the practice but will not be required. MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Rulemaking for AD facilities has not yet occurred at the MPCA. Existing rules for similar facilities accepting similar materials exist, but we acknowledge that rules specific to AD facilities would be useful. With that said, MPCA has included guidance on AD in the Metro Plan for the time being and believe that we are able to permit AD facilities in a manner that is protective of the environment. The agency is responsible for ensuring compliance with state law. The Minnesota Zero Waste Coalition may contact elected officials to advocate for a change to Minnesota's state law. Minnesota already requires the most protective requirements on landfills. MPCA staff regularly evaluates landfill design to see if additional protections are needed and implement them as needed. Also, most landfills have air permits also to regulate air emissions, but more data is needed to assess the amount of fugitive emissions escaping off the working face. Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents, but historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline so that facilities and counties have more time to prepare. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible.
M T	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/k90hirb_document.pdf	A fee can be an effective strategy to reduce single-use bags from the solid waste system. Those are instituted at a city-level through the passage of an ordinance. Collecting recyclables is one way for an organization to raise funds. Container deposits in other states have been very effective in collecting those materials. Financial incentives to inspire behavior change can be successful. In order for Minnesota to utilize this type of program, the Legislature would need to pass new laws. Contract for residential recycling and organics by 2030 is an optional strategy in the plan. Organized collection has numerous benefits and can lower costs for all types of service (i.e., MSW, recycling, organics) to residents of a community. Convenience is a critical component of success. The plan includes a strategy that would expand curbside collection of organics recycling to all cities with a population of 5,000 or greater. Dumpster diving is not illegal in Minnesota, but it's important to adhere to local laws and ordinances pertaining to trespassing. Minnesota charges a solid waste management tax for trash. It is 9.75% of the sales price for residential waste and 17% for self-haul and commercial. Recycling and composting are tax-exempt to support those services and encourage participation in those programs. Minnesota Statute 115A.93 requires haulers and recyclers to report to MPCA. The plan calls for added emphasis on compliance in this area. Minnesota Statute 115A.9301 requires that larger volume containers must cost more than small containers, but the difference in cost is not outlined. Overtime, pay-as-you-throw systems have been shown to reduce the total amount of waste. While a compostable bag being disposed of in a curbside organics collection is better than a plastic bag being landfilled, moving toward a reusable option is the best way to reduce waste. A requirement for compostable plastic produce bags would require legislative action. Most cities have litter ordinances. Solid waste facilities have requirements in their permits to ensure that litter is picked up. Additionally, industrial storm water permittees are required to clean and maintain all impervious areas where debris may accumulate. Counties may propose a strategy to address litter in their solid waste plans. The plan does not carry the authority to phase out or tax advertisements and promotions. The plan includes a strategy to require reusable containers at county events. Counties are free to expand this requirement within the scope of authority of their county solid waste plans. The plan includes many strategies to increase reuse activities. We encourage counties to identify any of their own ordinances that work as a barrier for reuse. This plan does not have authority to create a tax rebate, but removing barriers to properly dispose of e-waste is important.
Maggie Yauk and Jonelle Hubbard	Anoka County	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/6w0xic8_document.pdf	County highway departments can incorporate SSOM compost in construction projects, which can be assured by creating a county policy. Cities can require the application of compost to help the site vegetation recover from the impact of the construction. MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. Wood waste is expected to increase and will require collaboration to find upstream solutions. Planning will be required to avoid open burning. Implementing the Building Material Management Plan strategy for county owned buildings was the intent of this strategy. The plan has been edited for clarity. Contract for residential recycling and organics by 2030 is an optional strategy in the plan. Organized collection has numerous benefits and can lower costs for all types of service (i.e., MSW, recycling, organics) to residents of a community.
Marco Fields	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/960oi0c_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Marcus Buckley	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/g60bii6_document.pdf	MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. Wood waste is expected to increase and will require collaboration to find upstream solutions. Planning will be required to avoid open burning.

Name	Affiliation	Comment	Response
Margaret Anderson Kelliher	City of Minneapolis Department of Public Works	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ad01ipy_document.pdf	MPCA agrees that additional funding would benefit all levels of governance. Additional resources help create a better system, resulting in higher diversion rates. Compostable single-use products are a better option than conventional single-use products that cannot be recycled, but reuse is the best option. MPCA will look to counties to interpret or adjust this strategy to achieve the best outcome given their resources and residents. The strategy has been edited to incorporate the successful and vetted aspects of the Minneapolis ordinance. Congratulations on receiving the SWIFR grant to re-open the North Transfer Station. The residents will benefit from expanded reuse and recycling drop-off opportunities. Drop-off events hosted by the counties are popular with residents, but these events have been shown to be very expensive and time intensive for county staff to plan and execute. Advertising a special collection day at the existing permanent sites could have a similar impact to raise community awareness, perhaps outside of regular hours. Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. Minnesota has a rechargeable battery law. Updates to the law are needed to address the full scope of the lithium battery issue. The MPCA is working with partners on legislative proposals to improve the collection and recycling of batteries. A strategy has been added to the plan to implement education programs on proper battery management. Creating safe storage spaces that minimize fire risks at waste facilities is challenging. Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents, but historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline to allow counties and facilities time to prepare. Thank you for the feedback. The plan has been edited to allow for more flexibility in how counties promote backyard composting activities. The plan has been amended to allow counties to provide alternative strategies. For required strategies, proposals must achieve comparable objectives. For optional strategies, counties should work with their PCA solid waste planner to determine the point value of the alternative strategy. The State of Minnesota has a "Green Meeting Policy" to reduce the waste associated with meetings. Additionally, our Office of Enterprise Sustainability addresses and promotes sustainability at affiliated events. This strategy has been revised to clarify intended outcomes and to limit the scope to the county. The vast number of strategies creates a wide range of possible systems/programs. It wouldn't be possible to estimate cost for all outcomes. It is expected that metro counties consider costs of implementation as they select strategies for their County Solid Waste Plans. This is an optional strategy that counties may choose to include in their solid waste plans. It is a good way to make reuse more convenient for residents. However, if any county wants to propose other reuse strategies, the provides them the freedom to do that. The plan includes a new strategy to require counties to promote their reuse outlets that are located in the county.
Margaret Oconnor	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/630giki_document.pdf	Most cities have litter ordinances. Solid waste facilities have requirements in their permits to ensure that litter is picked up. Additionally, industrial storm water permittees are required to clean and maintain all impervious areas where debris may accumulate. Counties may propose a strategy to address litter in their solid waste plans. Recycling refund legislation is very successful at increasing the collection of beverage containers. States with recycling refund often have capture rates greater than 80% for those materials that are covered by the redemption fee. MPCA does not have the authority to require this type of legislation through this plan, because it would require action by the MN Legislature to enact that requirement on beverage manufacturers. Extended producer responsibility (EPR) laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For us to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. Packaging: The Partnership on Waste and Energy—which includes Hennepin, Ramsey, and Washington counties—are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. EPR can require proper labeling for reuse, recycling, or composting.
Marianne Brenckman	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/pv01iga_document.pdf	The plan prioritizes education with strategies to educate residents. The plan also prioritizes reuse strategies. Reducing the amount of material being managed in the solid waste system provides the greatest environmental benefit. The draft plan did not include strategies for multi-family housing. Strategies for multi-family recycling, organics recycling, and reduction have been added to the final plan. Composting and recycling bins in public places tend to become contaminated. Several counties have designated drop sites for residents to self-haul their source-separated organics to locked bins. This remains the best practice for communities without curbside collection. The MPCA's Solid Waste Policy Report to the Legislature contains recommendations to introduce extended producer responsibility (EPR) laws. EPR laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: • Influence manufacturer design to improve recyclability, repair and reuse • Reduce material use and toxicity • Improve recovery for reuse, repair and recycling • Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements • Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. In order for Minnesota to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. Packaging: The Partnership on Waste and Energy (Hennepin, Ramsey, Washington), are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. Compostable packaging: EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. Packaging labeling: EPR can require proper labeling for reuse, recycling, or composting.
Marissa Galan	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ee08ik5_document.pdf	Contract for residential recycling and organics by 2030 is an optional strategy in the plan. Organized collection has numerous benefits and can lower costs for all types of service (i.e., MSW, recycling, organics) to residents of a community.
Mark D'Alencar	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/3h05ie8_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Mark Snyder	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/k20fi1r_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the MN Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. Additional capacity requirements to expand recycling and composting operations will be addressed in the Resource Management Report to the Minnesota Legislature. Waste composition studies are a requirement for WTE facilities via all current air permits. Thank you for your feedback.
Martha Henderson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/j60rinr_document.pdf	Increasing the types of materials collected in curbside programs and reducing/subsidizing costs would contribute to a higher recycling rate. One caveat is that curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather and low quality materials. Textiles must be dry and clean for reuse and made from natural fibers for recycling. The Secondary Materials and Recycled Textiles (SMART) Association estimates that about half of new clothing are donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbents/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. Private companies like Terracycle and Ridwell help fill the gaps by collecting materials that are difficult and costly for counties to process and manage.

Name	Affiliation	Comment	Response
Mary Allen	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/jp04iiz_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Mary Forte	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ic04io9_document.pdf	A fee can be an effective strategy to reduce single-use bags from the solid waste system. Those are instituted at a city-level through the passage of an ordinance. Access to quality compostable bags is important to the success of a curbside collection program. The plan has been revised to address this concern. Black plastics are not recyclable due to limitations of the sorting equipment at recycling facilities. The optical sorter cannot read the resin type. Reducing black plastic in packaging and plant containers would be more beneficial than recycling it. The plan includes a strategy that would expand curbside collection of organics recycling to all cities with a population of 5,000 or greater. Convenience is a critical component of success. Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: • Influence manufacturer design to improve recyclability, repair and reuse • Reduce material use and toxicity • Improve recovery for reuse, repair and recycling • Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements • Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. For Minnesota to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. Metro counties offer helpful guides for recycling, organics recycling, and household hazardous waste. Recycling advertising can be very effective, but is also expensive and requires consistency. Educating children about the solid waste system early on can build good habits. Counties, cities and industry have focused on school programs as a cost-effective way of reaching school-aged children. The plan has an optional strategy for counties to adopt an ordinance with a mandatory consumer charge for take-out single-use cups, containers, and utensils. These items can be collected and self-hauled to scrap metal recyclers or county environmental centers. In small quantities, these items can be discarded in the garbage.
Mary Holm	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/880fi95_document.pdf	All of the 7-county metro HHW drop-off sites—sometimes referred to as environmental center—are open to residents of any county. Many materials are collected for free, but some require a collection fee. Every collection program has varying implementation costs. In some communities, curbside organics will be absorbed into existing trash fees and compostable bags will be provided by their county. In other communities, a separate hauler collects the organics recycling. This is more expensive and residents experience higher fees for that type of service.
Mary Miller	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/wp0jiif_document.pdf	Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: • Influence manufacturer design to improve recyclability, repair and reuse • Reduce material use and toxicity • Improve recovery for reuse, repair and recycling • Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements • Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. In order for Minnesota to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. The plan includes a strategy for the management of organics recycling from large commercial food generators by 2030. It was optional in the draft and has been changed to required, based on public comments.
Mary Sheehan	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ud0zi22_document.pdf	Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: • Influence manufacturer design to improve recyclability, repair and reuse • Reduce material use and toxicity • Improve recovery for reuse, repair and recycling • Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements • Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. In order for Minnesota to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question.
Mary Ann Hood McCann	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/k00mic5_document.pdf	Residents of Minnesota are not required to recycle. However, state law requires that residents have an opportunity to recycle. Our elected officials have deemed requirements to participate in recycling a step too far. Education is incorporated into several strategies in the plan. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers.
Matt Clark	Hennepin GRE	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/lk0eibp_document.pdf	MPCA supports the waste hierarchy and values the role of waste-to-energy in the system. Due to the unfolding events in Hennepin County, MPCA re-examined our approach to the waste-to-energy section of the plan. Included in those changes is a comparison of the impacts of waste-to-energy and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that there is a good plan in place when large infrastructure decisions occur to ensure that waste is managed with the least environmental impact. MPCA supports minimizing disposal options (WTE and landfill) as much as possible and the plan focuses on waste reduction, recycling, and composting in an effort to meet the 75% goal.
Meghan Kosowski	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/cd0pikq_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the MN Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. The Metro Plan has 14 strategies dedicated to reduction of waste and reuse efforts. There are also many strategies focused on recycling and organics collection - all of which will reduce the need for both WTE and landfilling if implemented.
Merle Davis Matthews	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/180ii7q_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the MN Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. Thank you for your feedback.

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Michael O'BRIEN	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/iq0ri7r_document.pdf	The MPCA can support reuse efforts through grants and no- or low-interest loans. Counties are required by this plan to offer grants for waste reduction, reuse, and repair. There are many scrap metal recycling collection points available in the metro area, including at each county-run environmental center and household hazardous waste drop-off site. County outreach and education strategies have been revised to increase awareness of this. This plan does not have authority to make changes like eliminating plastic bags. However, there is an optional strategy for counties to adopt an ordinance with a consumer charge or ban on disposable single-use items, which is open for a county to interpret as including plastic shopping bags. Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair, and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair, and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements. Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. Consumers must be responsible for ensuring that products at end-of-life are routed to the proper collection system. The Solid Waste Policy Report includes recommendations to the Minnesota Legislature to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. SCORE and LRDG funds are provided to counties for recycling programs and to support waste reduction and management of household hazardous wastes and problem materials. This funding is often passed through to cities and associated programs. The costs of curbside collection are determined by haulers. However, fees and taxes are placed on trash to support recycling, organics, and reuse programs. Organized collection systems have greater power to set volume-based costs for residents. The plan advocates for communities that have not yet done so to transition to organized collection.
Michele Fluhr Fraser	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/5y0iiam_document.pdf	Minnesota has some of the best recycling rates in the nation. There are many systems and requirements in place that assure the materials in resident bins are routed to their intended place. MN statute 115A.95 does not allow for haulers to deliver source-separated recyclable materials to a disposal facility unless the MPCA determines that no other recycling options are available. The plan includes education requirements that should help create more informed residents. The plan prioritizes reuse and reusable water bottles are a great substitute for throw-away bottles.
Molly Libra	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/im0gidy_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the MN Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. Thank you for your feedback.
Nadine Teisberg	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ma0kimk_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Nan Roberts	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/jc0gi7n_document.pdf	Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: Influence manufacturer design to improve recyclability, repair and reuse; Reduce material use and toxicity; Improve recovery for reuse, repair and recycling; Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements; Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. In order for Minnesota to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. Packaging: The Partnership on Waste and Energy (Hennepin, Ramsey, Washington), are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. Compostable packaging: EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. Packaging labeling: EPR can require proper labeling for reuse, recycling, or composting. MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. Wood waste is expected to increase and will require collaboration to find upstream solutions. Planning will be required to avoid open burning. Organized collection systems provide many overall benefits to residents if implemented properly. MPCA views the establishment of an organized collection system as a local decision and therefore, this strategy will remain optional. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. The plan includes a strategy to diversify and expand mobile collection sites for household hazardous waste. The plan includes many waste reduction strategies that incorporate financial incentives. This is a significant contributor to our waste system and has long been considered inert, which we now know to be false. Setting up systems to reuse a greater amount of building materials would reduce the amount of useful materials that are otherwise wasted. Websites that facilitate the free exchange of goods remove many barriers to waste reduction. Household hazardous waste collection centers are located throughout the metro area. Residents of any county may visit any of these locations to dispose of items not collected in curbside programs.
Nancy Williams	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/kp0mi1g_document.pdf	This plan seeks to manage waste and materials at their highest and best use. Strategies to encourage restaurants to adopt a system of reuse is the main goal.
Nathan Wunrow	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/jw0mird_document.pdf	Most of the waste-to-energy facilities are exempt from the Carbon-Free by 2040 bill. HERC is the one facility that is not exempt from the bill.
Nell Pierce	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/fw01ily_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the MN Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. MPCA is still learning how best to engage with impacted communities with our planning processes and there is a long way to go to get the levels of engagement that we'd like. However, MPCA received six times the comments received for the prior plan. Most of these comments were from community members rather than our usual industry/county contacts. MPCA will continue to improve community outreach, but we are pleased with the progress made between this plan and the prior plan. Thank you for your feedback.

Name	Affiliation	Comment	Response
Nick Klisch	Cottonwood County	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/w806in8_document.pdf	MPCA supports the waste hierarchy and values the role of waste-to-energy in the system. Due to the unfolding events in Hennepin County, MPCA re-examined our approach to the waste-to-energy section of the plan. Included in those changes is a comparison of the impacts of waste-to-energy and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that there is a good plan in place when large infrastructure decisions occur to ensure that waste is managed with the least environmental impact. MPCA supports minimizing disposal options (WTE and landfill) as much as possible and the plan focuses on waste reduction, recycling, and composting in an effort to meet the 75% goal.
Pam Bain	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/fd05iqe_document.pdf	Minnesota Statute 115A.93 Subd. 3 prohibits haulers from imposing a greater charge on residents who recycle than on residents who do not recycle. The plan includes a strategy to diversify and expand mobile collection sites for household hazardous waste and bulky items. Organics recycling curbside collection requirements are included in this plan as well.
Pam Peterson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/gc0qif9_document.pdf	Organized collection (the city contracts with one hauler) has numerous benefits and can lower costs for all types of service (i.e., MSW, recycling, organics) to residents of a community. Contract for residential recycling and organics by 2030 is an optional strategy in the plan.
Pat Medford	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/jg02iqx_document.pdf	Available science does not suggest that separating dry and wet waste would provide beneficial results. However, the MPCA agrees that all recoverable material should be diverted from disposal for recycling and composting. Keeping organics and slimy waste out of the trash, could help with pulling additional recycling from the waste stream on the back end.
Paul Gardner	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/c50bi9y_document.pdf	Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: • Influence manufacturer design to improve recyclability, repair and reuse • Reduce material use and toxicity • Improve recovery for reuse, repair and recycling • Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements • Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. In order for Minnesota to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question.
Peter Butler	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/dk0qimd_document.pdf	The costs of curbside collection are determined by haulers. However, fees and taxes are placed on trash to support recycling, organics, and reuse programs. Organized collection systems have greater power to set volume-based costs for residents. The plan advocates for communities that have not yet done so to transition to organized collection. Minnesota Statute 115A.9301 requires that larger volume containers must cost more than small containers, but the difference in cost is not outlined. Overtime, pay-as-you-throw systems have been shown to reduce the total amount of waste.
Rachel Jongeward	City of Saint Paul-Parks & Recreation Department/Forestry	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/zb05ii7_document.pdf	Wood waste is expected to increase and will require collaboration to find upstream solutions. MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. Existing wood yards are often innudated with materials and the absence of a tip fee may not be feasible as more wood material is introduced. We will be looking to the county solid waste plans to propose solutions for supporting the continued operation of wood yards within their counties. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. As this plan is a roadmap for county solid waste plans, the wood burning ordinance strategy is for counties to review and update open burning ordinances they have. Counties may require cities to do the same. MPCA staff will work with counties on their solid waste plans and will evaluate if the inclusion of certain optional strategies are realistic and feasible. As the language of the wood waste section was revised to be inclusive of tree diseases and insect infestations, tree maintenance and treatment has a more solid role in supporting tree cover and reducing wood waste. The strategy to allow for assessments on property taxes is an optional strategy. We trust that counties will only include this if there is community buy-in for this approach.
Rachel Lindholm	City of Richfield	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/kq0xi10_document.pdf	The draft plan did not include strategies for multi-family housing. Strategies for multi-family recycling, organics recycling, and reduction have been added to the final plan. The plan includes a strategy for the management of organics recycling from large commercial food generators by 2030. It was optional in the draft and has been changed to required, based on public comments. Continuous end market development is paramount to a functional recycling system. The MPCA has been working to develop local end markets since the 1990's and continues to look for ways to strengthen local markets for recyclables. Minnesota has good, stable end markets for recyclable materials because of the investments made over the last 30+ years. Recycling is important to Minnesota's local economy. Overall, recycling helps support nearly 78,000 jobs in Minnesota. Over 330 manufactures in Minnesota use recycled material in their products. In the 1990's private companies and the public sector made investments in the recycling system to make recycling more desirable. When overseas markets closed their borders to recyclable materials in 2017, Minnesota companies made even more investments to make sure material was clean and ready for end markets. Cleaner material and less contamination in bales of recyclable material mean companies will buy Minnesota's recyclable material over others and at a better price. Interested parties have raised many concerns about the undue burden weekly recycling would have on their operations. Accordingly, this now appears in the plan as an optional strategy. The most effective way to reduce waste is to not create it in the first place. Making a new product emits greenhouse gases that contribute to climate change and requires a lot of materials and energy - raw materials must be extracted from the earth, and the product must be fabricated then transported to wherever it will be sold. As a result, reduction and reuse are the most effective ways you can save natural resources, protect the environment, and save money. Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents, but historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline to allow facilities and counties time to plan. We have considered bans on various materials over time, but often bans are not effective for materials that are easily hidden in garbage bags. They work quite well for large items like televisions because those can be diverted at the tip floor of facilities. The plan has been amended to allow counties to provide alternative strategies. For required strategies, proposals must achieve comparable objectives. For optional strategies, counties should work with their PCA solid waste planner to determine the point value of the alternative strategy. Partner organizations are identified when they can contribute to the effectiveness of a strategy. The organics section of the plan has been edited to include MNCC. MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. Wood waste is expected to increase and will require collaboration to find upstream solutions. Planning will be required to avoid open burning. In 2019, the Minnesota Environmental Quality Board prepared an Emerald Ash Borer report with coordination from several state agencies. It can be found at this link. Emerald Ash Borer (EAB) | Minnesota Environmental Quality Board (state.mn.us)
Rachel Wormer	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/f40yic9_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.

Name	Affiliation	Comment	Response
Randy Cameron	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/8i09i61_document.pdf	The Hennepin County HHW drop-off facilities in Bloomington and Brooklyn Park accept cast iron sinks. The reciprocal use agreement among the metro counties allows residents of any county to use any of the 7-metro county sites. The MPCA website has a list of 450 medication collection sites with a site locator: https://www.pca.state.mn.us/news-and-stories/dont-flush-medicines-down-the-drain Prescription drugs can also be discarded in the trash. The label should be removed and the contents should be made unappealing by adding something inedible such as cat litter to the bottle. Your county, city, and hauler can provide resources for understanding how to use your curbside collection properly.
Rebecca Boyer	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/jr03i2n_document.pdf	While drop-off sites have served some, MPCA agrees that it must be more convenient for people to participate in greater numbers. The plan requires residential curbside organics collection region-wide in cities greater than 5,000. If your home is in a city with a population of at least 5,000, this service will be available to you within the timeframe of this plan.
Rebecca Gaida	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/5q0uiq1_document.pdf	MPCA agrees that it must be more convenient for people to participate in composting in greater numbers. The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. Many counties offer organics drop-off sites, which have been successful at capturing food waste for households without curbside collection. Planning and establishing additional drop-off sites for the collection of organics recycling has been added as an optional strategy to the plan. Fix-It clinics are effective at reducing waste by extending the life of existing items. Strategies to promote repair include establishing a Repair Ambassador program, bi-annual sustainable consumption challenges for residents, requiring a formal county sustainable purchasing policy that prioritizes repairability of goods, and grants that support repair operations. Thank you for your support of strategies that promote reuse and repair. County environmental centers and household hazardous waste (HHW) drop-off sites expand the scope of materials accepted based on a variety of factors. Some items require a fee for disposal due to the cost of safely disassembling and disposing of certain materials. Another approach is to establish disposal fees at the time of purchase, requiring legislative regulation. Thank you for your support of some of our most impactful strategies. We appreciate the feedback. The single-use container fee is an optional strategy that counties may choose to add to their plans. We will look to the counties to select an approach that will best serve the needs of their residents. Counties will be required to offer grants or rebates for organizations to transition to reusable food and beverage service ware.
Regina Kurandina	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/m304i1l_document.pdf	The plan calls for residential curbside organics collection to be required region-wide in cities greater than 5,000. MPCA agrees that it must be more convenient for people to participate in greater numbers. Recycled Textiles (SMART) Association estimates that about half of new clothing end up donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbents/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. Many of our metro counties have recycling ambassador programs. If your county has a program, you may sign up for the 6-week training, which will prepare you to volunteer at community events. MPCA is working in collaboration with DNR and local governments to create a cooperative plan for wood waste management. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. Wood waste is expected to increase and will require collaboration to find upstream solutions. The plan includes strategies to avoid open burning, incentivize treatment, and ease the financial burden on homeowners. Removing barriers to recycling and composting is the goal. The plan includes strategies for this and we'll look to the metro counties to develop solutions that are effective for their residents. Most of the TCMA counties have a Recycling Ambassador program that uses volunteers to help people recycle more effectively. We are sure they would love to have you as a volunteer.
Richard Olson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/x60gi4n_document.pdf	Reducing waste is a keystone theme in this plan. Replacing single-use containers with reusable containers is an effective way to reduce waste. We encourage counties to address solutions to reduce reliance on single-use waste through several optional strategies.
Robert LeClaire	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ok02iqq_document.pdf	Children can be powerful change agents, encouraging their families to properly use curbside collection services. The plan addresses several strategies to increase education and outreach. While this strategy won't eliminate contamination, it should help to increase proper disposal among residents. MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. MPCA is able to issue CON as needed and does not need a no-HERC scenario in the Plan to issue future CON. Organics recycling is easily contaminated by even the well-intentioned individuals. Strategies to expand organics collection work best when paired with education, outreach, and guidance. The Minnesota State Legislature has enacted laws to maintain the integrity of the recycling system. MN Statute 115A.95 was written to ensure that once material is collected for recycling, it must be taken to a recycling processing facility or end market. This law prohibits material that is collected as recycling from being taken to a landfill. This ensures that once material is collected for recycling, it is getting recycled. In addition, Minnesota imposes a solid waste tax on every ton of solid waste disposed. Counties also impose a separate solid waste tax if material is disposed of in their county. Minnesota does not tax material that is taken to a recycling facility. If the facility exceeds 15% residual, the residual is subject to the solid waste management tax. Most facilities stay below that rate meaning that more than 85% of what is collected goes to new products. In the 1990s private companies and the public sector made investments in the recycling system to make recycling more desirable. When overseas markets closed their borders to recyclable materials in 2017, Minnesota companies made even more investments to make sure material was clean and ready for end markets. Cleaner material and less contamination in bales of recyclable material mean companies will buy Minnesota's recyclable material over others and at a better price. Minnesota has good, stable end markets for recyclable materials because of the investments made over the last 30+ years. Recycling is important to Minnesota's local economy. Overall, recycling helps support nearly 78,000 jobs in Minnesota. Over 330 manufactures in Minnesota use recycled material in their products.
Robert Sieber	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/op0sikt_document.pdf	Educational requirements appear throughout the plan, most importantly a requirement for counties to standardize these messages. Our metro counties are tasked with assuring that information reaches all their residents. HHW sites are located in every metro county and accept all the materials you mention. Public space collection of waste that requires sorting has always been a challenge. However, resources exist that could help. We will work with our metro counties on their plans to assure we are regionally improving public education.
Rochelle Michel	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/200licl_document.pdf	As a school administrator, MPCA encourages you to work with your county and city to explore existing programs and funding opportunities.
Ruth Shaw	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/q40wi4v_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.

Name	Affiliation	Comment	Response
Ryan O'Gara	SKB Waste Connections	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/eo0ki90_document.pdf	Contamination is a serious issue plaguing the recycling stream. The plan focuses on education strategies. This issue will require several solutions and preprocessing can play an important role. Source separation is the best way to recover materials and to ensure the highest value of those materials. However, despite our best efforts, human behavior is unpredictable. Preprocessing can recover additional recyclables, especially metals. The cost of collection is the primary driver of cost to residents, but historically tip fees have not been the driver for cost. The plan has been modified to extend the timeline to allow for facilities and counties to plan. In addition, the plans states that pre-processing needs to happen, not that it must be done at each location. Weekly recycling collection was identified as a strategy that would be costly. In response, this strategy was moved from required to optional.
Sabrina Thompson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/dw06iin_document.pdf	A state-wide bag fee would require a legislative change.
Sandra Dascalos	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/r80pi8x_document.pdf	Resident education is addressed in this plan with a strategy that calls for a commitment to standardized outreach and education. We agree that the messaging reaching residents should be easy to understand. Piecemeal efforts by counties, cities, haulers, and other organizations are rarely collaboratively developed and therefore can lead to confusion over what materials can be recycled or composted. Assuring a consistent message from those within the solid waste system would help bring clarity to the users of the system. Strategies to promote repair include establishing a Repair Ambassador program, bi-annual sustainable consumption challenges for residents, requiring a formal county sustainable purchasing policy that prioritizes repairability of goods, and grants that support repair operations. Thank you for your support of strategies that promote reuse and repair.
Sandra Wolfe wood	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/pp0xipt_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the MN Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. Thank you for your feedback.
Sara Hollie	Ramsey County	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/og0bidl_document.pdf	Thank you for your support of this plan and for the clarifications you provided. Counties are required to complete an environmental justice review when developing their own solid waste plans. The requirements are laid out in Appendix B. With the addition of multi-family strategies in the plan, we believe this supports a solid waste system that strives for fair treatment and meaningful involvement of all people. The plan has been amended to allow for counties to propose optional strategies. We encourage all our metro counties to propose strategies that would directly address environmental justice. Thank you for calling attention to the importance of being mindful of the words we choose. We have amended to plan to replace the words identified in your letter. The plan went through a plain language review to increase accessibility.Based on comments received, it's clear that the MPCA needs to play a role in creating regional consistency. As the leading state agency, MPCA is committed to coordinating and facilitating regional meetings to discuss solid waste issues. The counties are responsible for submitting data to MPCA in a timely matter. Ultimately, the counties have a responsibility to ensure that their data sources provide information when needed. MPCA provides facility data to counties as soon as it is available after the March 1st deadline. Wood waste is expected to increase and will require collaboration to find upstream solutions. MPCA is working in collaboration with DNR and local governments to create a cohesive plan for wood waste management. The Environmental Quality Board released the Emerald Ash Borer in Minnesota report in 2019. This report provides many strategies that were incorporated into this plan. Existing wood yards are often inundated with materials and the absence of a tip fee may not be feasible as more wood material is introduced. We will be looking to the county solid waste plans to propose solutions for supporting the continued operation of wood yards within their counties. The plan has been modified to be inclusive of other tree disease issues, such as Oak Wilt. As this plan is a roadmap for county solid waste plans, the wood burning ordinance strategy is for counties to review and update open burning ordinances they have. MPCA promotes the use of compost to MNDOT and enterprise wide. Food-derived compost requirements in some metro counties and cities has bolstered markets. The region's food waste can have a beneficial use in metro construction projects. MPCA must promote robust markets for compost. One avenue is through partnerships with other state agencies. However, the MNDOT specification may not be the right tool for a statewide market development strategy for food-derived compost. In much of Greater Minnesota, food-derived compost is not established. Facilities and compost sites may be remote. Current MNDOT specifications do allow for use of food-derived compost. However, requiring only food-derived compost statewide is not currently feasible. The volume of compost used under MNDOT specifications exceeds the supply of food-derived compost. Additionally, some projects are located far from sources of food-derived compost. These statewide specifications must be achievable through a variety of feedstocks. MPCA has been working with the Departments of Agriculture and Health to create content for inspectors to educate licensed facilities about financial assistance, donation, and opportunities to reduce wasted food. The plan has been revised to include the MPCA's commitment to continue work with partner agencies on improved food rescue and prevention efforts. A strategy encouraging county engagement with health inspectors in individual county plans will remain in the plan to help accelerate adoption of the practice but will not be required. Points were awarded to strategies based on its place on the waste hierarchy and our best estimate of the level of difficulty. We appreciate the feedback on this strategy's point value and have adjusted it accordingly. As mentioned above, counties may propose optional strategies when developing their solid waste plans. Rulemaking for AD facilities has not yet occurred at the MPCA. Existing rules for similar facilities accepting similar materials exist, but we acknowledge that rules specific to AD facilities would be useful. The MPCA is working to incorporate our use to SMM and lifecycle analysis in our approach to emerging technology. While the waste hierarchy is a useful tool, we acknowledge it may be limited in its ability to assess the nuance of complicated and novel technologies.
Shane McCaldran	Hennepin CRA	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/g90gih0_document.pdf	MPCA has added strategies to the plan to address multi-family housing units.
Sharon Hansen	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/el0lihi_document.pdf	A fee or ban on bags can be an effective strategy to reduce single-use bags from the solid waste system. Those are instituted at a city-level through the passage of an ordinance. Minnesota charges a solid waste management tax for trash. It is 9.75% of the sales price for residential waste and 17% for self-haul and commercial. Recycling and composting are tax-exempt to support those services and encourage participation in those programs. MPCA advises the MN Legislature in the Solid Waste Policy Report to implement a statewide deposit refund program. TCMA residents are able to use any household hazardous waste drop-site in any 7-metro county. The plan also calls to expand access via temporary drop-sites that rotate and cater to different areas throughout each county.
Sheree` Bochenek	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/tu0dia5_document.pdf	A fee can be an effective strategy to reduce single-use bags from the solid waste system. Those are instituted at a city-level through the passage of an ordinance. Exposing e-waste to weather could result in transporting contaminants via stormwater and reduced usability of components/materials. These items are accepted at all HHW sites throughout the 7-county metro. All household hazardous waste (HHW) sites throughout the metro collect batteries and plastics (1, 2, and 5). Curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather. Textiles must be dry and clean for both reuse and recycling. The Secondary Materials and Recycled Textiles (SMART) Association estimates that about half of new clothing end up donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbants/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. If a partnership with a private company like Ridwell can help counties to divert more materials from landfills and WTE facilities at a price that isn't burdensome to residents, the MPCA supports that approach. The MPCA cannot require stores to post signs that remind customers to bring along bags. However, customers can request this of management at stores. Trader Joe stores have a reminder sign.

Name	Affiliation	Comment	Response
Sherri Nichols	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/740wirm_document.pdf	Retail drop off is far from ideal, but is currently the best option for plastic film recycling. We can encourage retailers to monitor their collection bins more closely to optimize collection efforts.
Sheryl Lewis	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/vm0hiit_document.pdf	Collecting bulky items from curbsides is challenging to coordinate and execute. We do encourage counties to follow the lead of several metro cities to establish curbside set-out days for items that can be reused through a strategy.
Soren Stevenson	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/520kidl_document.pdf	Minnesota Statute 609.671 subd. 13. outlines the solid waste disposal violations to be enforced by the MPCA. This is outside the scope of this plan and statute. MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. In response, we have re-examined our approach to the waste-to-energy section of the plan. Included in those changes is a comparison of the impacts of waste-to-energy and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that there is a good plan in place when large infrastructure decisions occur to ensure that waste is managed with the least environmental impact. MPCA supports minimizing disposal options (WTE and landfill) as much as possible and the plan focuses on waste reduction, recycling, and composting in an effort to meet the 75% goal. Cumulative air impact is outside of the scope of this solid waste document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The costs of curbside collection are determined by haulers. Organized collection can provide cities a chance to negotiate more favorable pricing to incentivize collection of materials higher on the waste hierarchy. Minnesota requires volume-based pricing, so smaller containers are less expensive, However, the current price breaks are not very significant. Larger price breaks have the potential to create a significant incentive. The plan requires residential curbside organics collection to be offered region-wide in cities with populations greater than 5,000. Organics recycling and food scrap programs must be more convenient for people to participate in greater numbers.
Stephani Booker	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/pv0zih6_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
Stephanie Abbas	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/6y02iaz_document.pdf	Compostable single-use products are a better option than conventional single-use products that cannot be recycled, but reuse is the best option. MPCA will look to counties to interpret or adjust this strategy to achieve the best outcome given their resources and residents. The strategy has been edited to incorporate the successful and vetted aspects of the Minneapolis ordinance. Ramsey County will soon roll out curbside pick-up for food scraps: https://www.ramseycounty.us/residents/recycling-waste/collection-sites/food-scraps. Making this an easier option for residents should increase participation and divert more food waste from landfills.
Steven Bern	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/qd0vipd_document.pdf	Burning plastic does produce CO2. Logistically, it would be difficult to divert only plastic to landfills. However, landfills would still allow plastics to degrade, which produces two greenhouse gases, methane and ethylene. The best way to avoid this would be to reduce or ban plastic at it's source entirely, which is outside of the purview of this plan.
Susan J Sperl	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ph0nidw_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.
t k readio	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/ee0aigk_document.pdf	The Minnesota State Legislature has enacted laws to maintain the integrity of the recycling system. MN Statute 115A.95 was written to ensure that once material is collected for recycling, it must be taken to a recycling processing facility or end market. This law prohibits material that is collected as recycling from being taken to a landfill. This ensures that once material is collected for recycling, it is getting recycled. In addition, Minnesota imposes a solid waste tax on every ton of solid waste disposed. Counties also impose a separate solid waste tax if material is disposed of in their county. Minnesota does not tax material that is taken to a recycling facility. In the 1990's private companies and the public sector made investments in the recycling system to make recycling more desirable. When overseas markets closed their borders to recyclable materials in 2017, Minnesota companies made even more investments to make sure material was clean and ready for end markets. Cleaner material and less contamination in bales of recyclable material mean companies will buy Minnesota's recyclable material over others and at a better price. Minnesota has good, stable end markets for recyclable materials because of the investments made over the last 30+ years. Recycling is important to Minnesota's local economy. Overall, recycling helps support nearly 78,000 jobs in Minnesota. Over 330 manufactures in Minnesota use recycled material in their products.
Tess Dornfeld	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/bs08iqv_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. The 5% waste reduction goal references the total generation of waste. Despite our best efforts, consumption influences waste generation. To truly be successful in waste reduction, upstream policies must be put into place by the MN Legislature that result in fewer materials being generated. The 75% goal is determined by state statute as the disposal avoidance goal and MPCA intends to aggressively push for improvement in all areas that are feasible. The plan includes required strategies for counties to reduce and divert food waste, launch bi-annual sustainable consumption challenges for residents, and to implement a formal county sustainable purchasing policy. There are also strategies to support reuse and repair through volunteer program, outreach, and grants. Thank you for your feedback.
Thea Ulen	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/2f0nip6_document.pdf	Curbside collection of textiles has been discontinued by municipal programs due to the exposure to weather. Textiles must be dry and clean for both reuse and recycling. The Secondary Materials and Recycled Textiles (SMART) Association estimates that about half of new clothing end up donated. Of the clothing that is donated, about 20% are sold in reuse outlets, 25% are shipped overseas, 50% are used as absorbants/rags/stuffing, and about 5% head to landfills or WTE facilities. That means that over half of all textiles end up in the garbage. For a material to be recycled, it needs to be used to create a new product. Fast fashion has resulted in an onslaught of low-quality textiles that have no reuse nor recycling value. Durable textiles made from natural fibers and extending the life via proper care and repair can help reduce personal impact. County HHW drop-off sites and many retail outlets collect clean, dry plastic bags for recycling. Reusable produce bags are a great option if you are looking to reduce your reliance on plastic.

Name	Affiliation	Comment	Response
Thomas Picquet	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/gr0ki5l_document.pdf	Extended producer responsibility laws have been shown to be a very effective tool to achieve the following, provided the right incentives and requirements are included in the EPR legal framework: • Influence manufacturer design to improve recyclability, repair and reuse • Reduce material use and toxicity • Improve recovery for reuse, repair and recycling • Help create a sustainable and circular economy for the materials and products covered by specific EPR requirements • Manufacturers and others along the product chain share in the financial and physical responsibility for collection, reuse, and recycling of products at the end of their useful lives. This includes the role for consumers that must be responsible for ensuring that end-of-life products get into the collection system that's provided. In order for Minnesota to utilize this type of program, the Minnesota Legislature would have to create new laws with requirements for manufacturers and other parties that have a role in the cycle of commerce for the products and materials in question. Packaging: The Partnership on Waste and Energy (Hennepin, Ramsey, Washington), are working on issues raised by MPP commenters regarding the need to address quantities, types, and management of packaging materials. Compostable packaging: EPR can provide a better pathway for compostable packaging to be collected and directed to a commercial composting facility. Packaging labeling: EPR can require proper labeling for reuse, recycling, or composting.
Tony Kwilas	Minnesota Chamber of Commerce	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/3p07ifd_document.pdf	Minnesota Statute 473.149 Subd 3 (b) states that revisions to the plan are exempt from rulemaking. The plan includes a robust public comment process, which provides interested parties an opportunity to provide feedback. The vast number of strategies creates a wide range of possible systems/programs. It wouldn't be possible to estimate cost for all outcomes. Metro counties should consider costs of implemention as they draft their County Solid Waste Plans. WasteWise is an important player in the metro area to assist businesses with waste reduction expertise.
Tracy Goetz	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/tn0riai_document.pdf	Styrofoam is difficult to transport and has low market value. These qualities make styrofoam an challenging feedstock for recycling. The plan contains an optional strategy to discourage use of single-use items such as plastic bags.
Whitney Khan	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/i802i9z_document.pdf	Maggots and flies play a very important role in the decomposition process, but the lifecycle from maggot to fly takes 3-4 weeks. Assure that your BPI-compostable bags are tied shut and that your bin is set out every week for pick-up. If maggots continue to be a nuisance, try cleaning your bin with vinegar occasionally. Many waste reduction requirements and suggestions appear in the plan. The incorporation of many different waste reduction approaches will provide the best outcome. The Minnesota State Legislature has enacted laws to maintain the integrity of the recycling system. MN Statute 115A.95 was written to ensure that once material is collected for recycling, it must be taken to a recycling processing facility or end market. This law prohibits material that is collected as recycling from being taken to a landfill. This ensures that once material is collected for recycling, it is getting recycled. In addition, Minnesota imposes a solid waste tax on every ton of solid waste disposed. Counties also impose a separate solid waste tax on material disposed of in their county. Minnesota does not tax material accepted at a recycling facility. In the 1990s, private and public investments in the recycling system made recycling more desirable and viable. When overseas markets closed their borders to recyclable materials in 2017, Minnesota companies made even more investments to make sure material was clean and ready for end markets. Cleaner material and less contamination in bales of recyclable material mean companies will buy Minnesota's recycled feedstock over others and at a better price. Minnesota has good, stable end markets for recyclable materials because of the investments made over the last 30+ years. Recycling is important to Minnesota's local economy. Overall, recycling helps support nearly 78,000 jobs in Minnesota. Over 330 manufactures in Minnesota use recycled material in their products. Your county, city, and hauler can provide resources for understanding what is and is not recyclable for curbside collection. It can be confusing and the MPCA along with local governments is working on etter education materials.
Darla Evanosky	Resident	https://scs-public.s3-us-gov-west-1.amazonaws.com/env_production/oid333/did200071/pid_206566/assets/merged/o90siju_document.pdf	MPCA received many comments of concern about the continued operation of the Hennepin Energy Recovery Center. We have re-examined our approach to the waste-to-energy (WTE) section of the plan. Changes include a comparison of the impacts of WTE and landfills and acknowledgement of the possible closure that will be determined by the Hennepin County Board. It is critical to ensure that large infrastructure decisions are being made with consideration to environmental and environmental justice impacts. MPCA supports minimizing disposal options of WTE and landfill as much as possible and the plan focuses on waste reduction, recycling, and composting to meet the 75% goal. Cumulative air impacts are outside of the scope of this document. Air quality impacts will be addressed as part of the cumulative air impact rule-making effort that is underway. Thank you for your feedback.

EXHIBIT 4

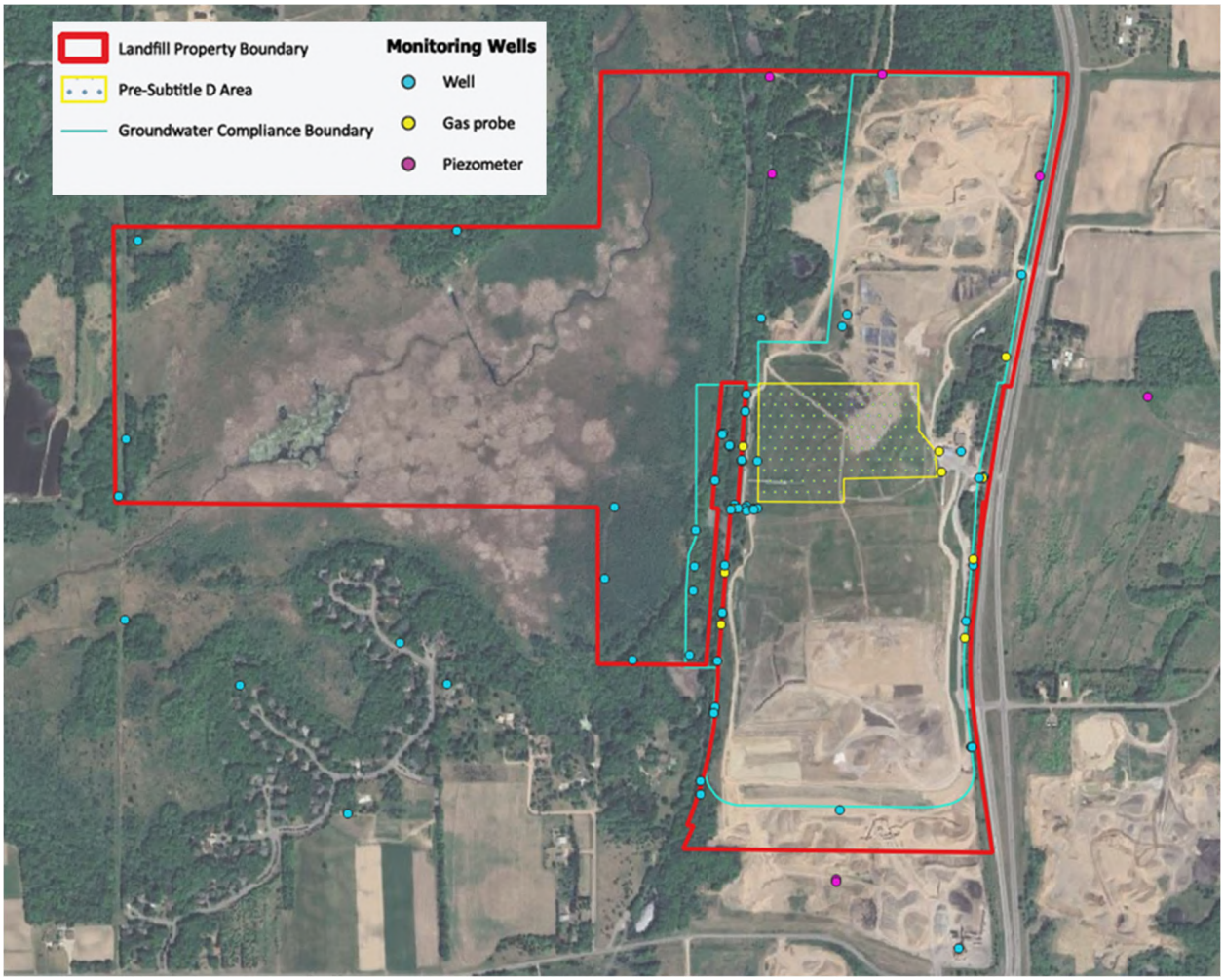
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EXHIBIT 5

Prepared by: EOR

For Sherburne County

ELK RIVER LANDFILL: Review of Groundwater Contamination Issues



October 13, 2025

EOR water ecology community

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ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

Abiotic degradation	Degradation of compounds through natural and chemical processes (other than biological degradation)	*Cometabolic biodegradation*	Biodegradation of a contaminant while growing on a different compound. No benefit to the microbe and may have some toxic effects to it.
Aerobic degradation	Degradation of compounds using microorganism metabolic pathways that require oxygen	*Compliance Boundary*	Area around landfill required to meet intervention limits (See aqua outline in cover map)
Anaerobic degradation	Degradation of compounds using microorganism metabolic pathways that do not require oxygen	*Compliance Wells*	Wells located in close proximity to the landfill
Anoxic	Complete lack of oxygen	*CO_2*	Carbon Dioxide
Biodegradation	Degradation of compounds with use of microorganisms	*Downgradient*	Position down along a gradient
Capping	A type of cover over landfill material to prevent the spread of contamination	*EOR*	Emmons & Olivier Resources
Chlorinated ethenes	Common organic contaminate, includes trichloroethene (TCE)	*ERL*	Elk River Landfill
HHRA	Human Health Risk Assessment A process to evaluate the nature and probability of adverse health effects in humans	*Terminal electron acceptors*	Last compound to receive an electron in an electron transport chain
HRL	Human Risk Limits	*TOC*	Total Organic Carbon
Hydraulic Conductivity (K)	Ability for liquid to flow through a porous medium	*Trichloroethene (TCE)*	Toxic volatile chemical with 3 chlorines

IL	Intervention Limit	*Vinyl Chloride*	Toxic chlorinated ethene with 1 chlorine
Liners	Synthetic barriers that mitigate the migration of leachate.	*XRD*	X-Ray Diffraction. Using x-ray beams to identify atomic structure of compounds.
MDH	Minnesota Department of Health	*Cis-1,2-dichloroethene (cis-DCE)*	Product of trichloroethene degradation. With 2 chlorines
MNA	Monitored natural attenuation. Naturally occurring contaminant reduction.	*95% Confidence Interval*	In all samples, 95% of them will contain the true [value] between value A and value B
MPCA	Minnesota Pollution Control Agency		
ND	Non-detected		
ORP	Oxidation Reduction Potential A measurement of how aerobic or anaerobic a water sample is		
PCE	Tetrachloroethylene, a toxic volatile organic compound		
pH	Measure of acidity or basicity		
Reductive dechlorination	Cleaving of covalent bond between chlorine and carbon, releasing chloride ions. Occurs only under anaerobic (no oxygen) conditions		

1. EXECUTIVE SUMMARY

Emmons & Olivier Resources, Inc. (EOR) developed a Groundwater Contamination report for the Elk River Landfill site on behalf of Sherburne County. This report evaluates the effectiveness of the monitored natural attenuation (MNA) remediation approach for groundwater contamination at the Elk River Landfill (ERL). Portions of the landfill, including several cells constructed between 1972 and the mid-1980s, were built without liners, contributing to a contamination plume in the lower sandy aquifer southwest of the landfill. The primary contaminant of concern is vinyl chloride, with additional detections of trichloroethene (TCE), cis-1,2-dichloroethene (cis-DCE), and elevated sulfate levels.

ERL is currently in a state implemented groundwater corrective action plan, which includes MNA and the replacement of residential water supply with deeper wells. This approach was selected based on guidance from the Minnesota Pollution Control Agency (MPCA) and previous corrective action evaluations. Sherburne County has requested an independent review of remediation documents to assess the ongoing effectiveness of MNA in addressing groundwater contamination downgradient from ERL. This report summarizes the findings of that review based on technical assessments provided by Barr Engineering. Overall, the ERL has been evaluated quite thoroughly. However, there are three main issues with the MNA method as it is applied in the 2024 Initial Performance Evaluation report.

Issue #1: A primary assumption used in the projection calculations is not met

The assumption that the contaminant plume is stable is inaccurate, because the assumption relied on data from well P-342L as evidence of the plume's stability. However, given that this well is located beyond the plume's predicted terminus, coupled with the fact that other wells have detected rising chloride levels, it becomes apparent that the claim that the plume has achieved steady state is inaccurate.

Issue #2: Bulk attenuation projections do not address the real problem

The second issue pertains to a set of scenarios in the 2024 Initial Performance Evaluation that predict the behavior of vinyl chloride contamination in the groundwater beneath ERL and evaluate the effectiveness of natural attenuation in reducing contaminant concentrations before reaching residential water supplies.

- Scenario A projects the highest allowable concentration at the Compliance Boundary that would naturally attenuate before reaching residential wells.
- Scenario B estimates the highest concentration at well P-342L that would attenuate before reaching residential wells.
- Scenario C predicts how far vinyl chloride will travel before decreasing below regulatory limits.

The report's methodology has key limitations. Scenarios A and C rely on wells that are too close to the landfill boundary and do not account for higher vinyl chloride concentrations farther downgradient, making their projections misleading. Additionally, using average concentrations in what is essentially a Human Health Risk Assessment (HHRA) may be inappropriate, and an upper 95% confidence interval should be considered instead.

Scenario B is currently irrelevant, because no vinyl chloride had been detected at P-342L as of August 2023. The source of the concentration values used in Table H3 is unclear, and if the scenario were rerun using

upgradient wells that have vinyl chloride concentrations, it shows that contamination above regulatory limits will reach residential wells. Revised scenarios using more appropriate wells indicate a greater risk to drinking water supplies than initially projected.

Issue #3: Revised bulk attenuation projections give very different results

The third issue addresses how revised bulk attenuation projections produce different results compared to the original report. When recent vinyl chloride concentrations from mid-plume wells and appropriate well distances were used, it became apparent that the original projections may have underestimated the extent and persistence of vinyl chloride contamination. In revised Scenario A, mid-plume wells (P-325L, P-326L P-338L, and P-334L) failed the test, with predicted concentrations 1.5 to 3x higher than those in the original scenario. In revised Scenario C, additional wells, including P-323L, were included due to previous detections of cis-DCE and TCE. Their concentrations were converted to vinyl chloride molar equivalents. All wells failed the revised test for the Intervention Limit (IL), and two wells exceeded even the higher Health Risk Limit (HRL). The projected travel distances to drop below the IL extend 750 to 4,284 feet past the first residential well, potentially affecting six to seven additional residential wells.

Other Vinyl Chloride-related Issues

Several related issues have been identified regarding vinyl chloride contamination at ERL. First, increasing vinyl chloride trends have been observed in some downgradient wells (P-694477, P-338L and P-334L), which supports the conceptual release model predicting that higher concentrations originated from past releases over 30 years ago. Additionally, no effort has been made to estimate the loss rate of vinyl chloride due to physical processes such as dilution and dispersion, which are important components of monitored natural attenuation (MNA). The low estimated attenuation rate at ERL suggests that most of the observed reduction in contamination is due to physical processes rather than biodegradation. Furthermore, there is a significant need for better plume delineation, particularly on the south side where contamination could potentially impact private wells. The current monitoring wells primarily define the plume along its centerline, leaving gaps in data on both the southern and northern edges. Additional monitoring wells are needed to clarify the full extent of contamination, especially in areas where vinyl chloride concentrations exceed health risk limits, but data is currently insufficient.

Other Groundwater Contaminants

In addition to vinyl chloride, other groundwater contaminants such as Freon and PFAS have been detected at ERL. Freon 21 has been found in multiple monitoring wells, often exceeding an estimated IL of 5 µg/L. Regarding PFAS, MPCA requested for groundwater samples to be collected from nineteen wells downgradient of ERL as part of a statewide landfill screening effort. Six of these wells were outside of the delineated vinyl chloride plume. No PFAS was detected in the wells outside of the vinyl chloride plume. Eleven different PFAS compounds were detected in samples from wells within the plume, with three exceeding the MDH HRL in at least three wells. Sulfate contamination from the landfill is also a concern due to its proximity to Rice Lake, a wild rice water with a sulfate standard of 10 mg/L. Groundwater flows toward Tibbetts Creek, with sulfate levels in monitoring wells reaching up to 132 mg/L, suggesting a potential plume moving toward Rice Lake. However, monitoring is difficult in the wetland area, and limited data exist on groundwater-surface water interactions. If groundwater discharges directly into Rice Lake, sulfate

contamination could be an issue, but if upwelling occurs in the wetland, sulfate may be converted into immobile compounds, reducing the risk of contamination.

2. BACKGROUND

Elk River Landfill (ERL) is a municipal solid waste facility, owned and operated by Waste Management (WM). Portions of the landfill, including cells 1 through 5, 7, 9, and the northern portion of cell 6 (6N), were constructed without liners between 1972 through the mid-1980s. The unlined area is approximately 28 acres and contains roughly 5 million cubic yards of waste, placed between 1972 and 1990. Subtitle D, which regulated landfill standards, was enacted in 1991. Certain situations which involved modifications to current Municipal Solid Waste Landfills, held extensions until 1997 to reach compliance. The unlined areas have since been capped (last 5 cells in 1997, doc #998) or covered with lined construction and demolition (C&D) debris for cells DC-1 through DC-3.

The groundwater contamination issue of greatest concern at ERL is the plume of vinyl chloride that exists in the lower sandy aquifer to the southwest of the landfill. Trichloroethene (TCE) and cis 1,2-dichloroethene (cis-DCE) have also been detected in the contaminant plume. Through biodegradation (removal of chlorines, Figure 1), TCE can be transformed to cis-DCE and vinyl chloride, which is more toxic than TCE. Elevated sulfate concentrations are found ion the groundwater as well.

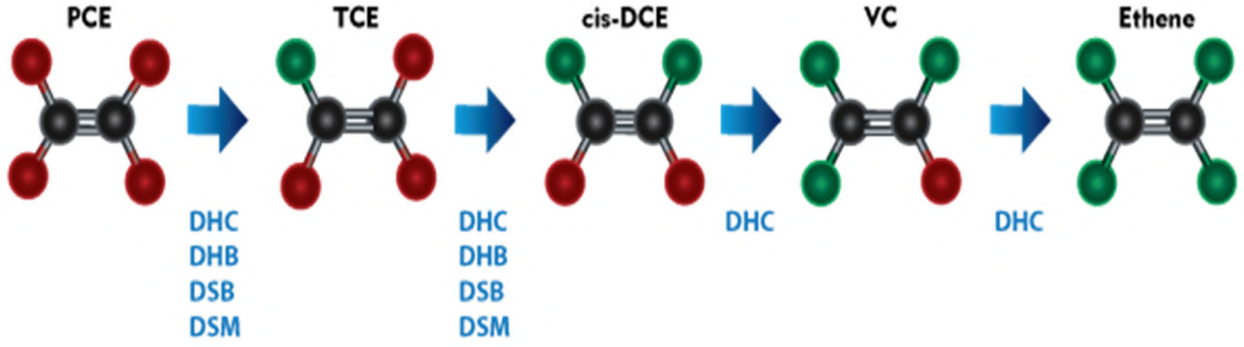


Figure 1. Chloroethene Degradation.

ERL is currently in a state implemented groundwater corrective action plan, initiated in April, 2021. The five (5) year Groundwater Corrective Action Performance Evaluation report is due in Quarter 1 of 2027. ERL's current form of ground water corrective action involves monitored natural attenuation (MNA) of the groundwater plume ("ERL contaminant plume") and residential water supply replacement with new, deeper wells. MNA was evaluated and selected in accordance with an MPCA Natural Attenuation guidance document (MPCA 2006) and a Corrective Action Alternatives Screening (Barr 2019, doc #969). The selected actions appear to have been reasonable at the time. Note that only very low vinyl chloride concentrations had been detected at the time in well P-334L, and well P-338L was not yet installed.

Sherburne County requested that EOR review documents related to the ongoing MNA remedy to determine if it has been and will be effective in remediating groundwater contamination downgradient from ERL. The following documents (all by Barr Engineering) were received from Sherburne County and reviewed:

- Work Plan for 2014 Groundwater Monitoring Network Augmentation Elk River Landfill Elk River, Minnesota Prepared for Elk River Landfill, Inc. February 2014 (Document #732)

- Groundwater Corrective Actions Screening Report Elk River Landfill (SW-74) Elk River, Minnesota Prepared for Elk River Landfill, Inc. July 2019 (Document #969)
- Groundwater Natural Attenuation Evaluation Report Elk River Landfill (SW-74) Elk River, Minnesota Prepared for Elk River Landfill, Inc. February 2020 (Document #998)
- Groundwater Corrective Action Evaluation Report Elk River Landfill (SW-74) Elk River, Minnesota Prepared for Elk River Landfill, Inc. June 2020 (Document #1002)
- Sampling and Analysis Plan Elk River Landfill Elk River, Minnesota Prepared for Elk River Landfill, Inc. March 2021 (Document #1042)
- Groundwater Corrective Action Work Plan Elk River Landfill (SW-74) Elk River, Minnesota Prepared for Elk River Landfill, Inc. March 2021 (Document #1050)
- 2023 Summer Quarterly Report, Elk River Landfill, Elk River, Minnesota (Document #1114)
- 2023 Annual Water Quality Monitoring Report Elk River Landfill (SW-74) Prepared for Elk River Landfill, Inc. March 2024 (Document #1124)
- Groundwater Corrective Action Report - Initial Performance Evaluation Elk River Landfill (SW-74) Elk River, Minnesota Prepared for Elk River Landfill, Inc. April 2024 (Document #1126)
- Sampling and Analysis Plan Elk River Landfill Elk River, Minnesota Prepared for Elk River Landfill, Inc. April 2024 (Document #1127)
- 2024 Fall Quarterly Report, Elk River Landfill, Elk River, Minnesota (Document #1145)
- Groundwater Corrective Action – Supplemental Groundwater Investigation Work Plan Elk River Landfill (SW-74) Prepared for Elk River Landfill, Inc. Prepared by Barr Engineering Co. December 2024 (Document #1142)
- 2024 Fall Quarterly Report, Elk River Landfill, Elk River, Minnesota (Document #1146)
- 2024 Annual Water Quality Monitoring Report Elk River Landfill (SW-74) Prepared for Elk River Landfill, Inc., March 2025 (Document #1149)
- 2024 Groundwater Data Submittal, Elk River Landfill (SWF-1) (Document #1150)
- 2025 Spring Quarterly Report, Elk River Landfill (SW-74) (Document # 1159)
- Groundwater Corrective Action – Supplemental Groundwater Investigation Report Elk River Landfill (SW-74) Prepared for Elk River Landfill, Inc. Prepared by Barr Engineering Co. July 2025 (Document #1162)
- 2023-2025 PFAS Groundwater Data Elevation Report Elk River Landfill, Prepared for Elk River Landfill, Inc. Prepared by Barr Engineering Co. August 2025 (Document #1163)

Document # 1126: Groundwater Corrective Action Report - Initial Performance Evaluation, was the most relevant document and was reviewed in detail. All comments below relate to this document unless otherwise stated.

3. GEOCHEMISTRY/BIODEGRADATION CONCEPTUAL MODEL FOR ERL

3.1. Geology

The groundwater investigation area includes the South part of the Elk River Landfill and areas to the east and southeast (Figure 2). The cross sections in Figure 3 and Figure 4 show that the bedrock below the landfill

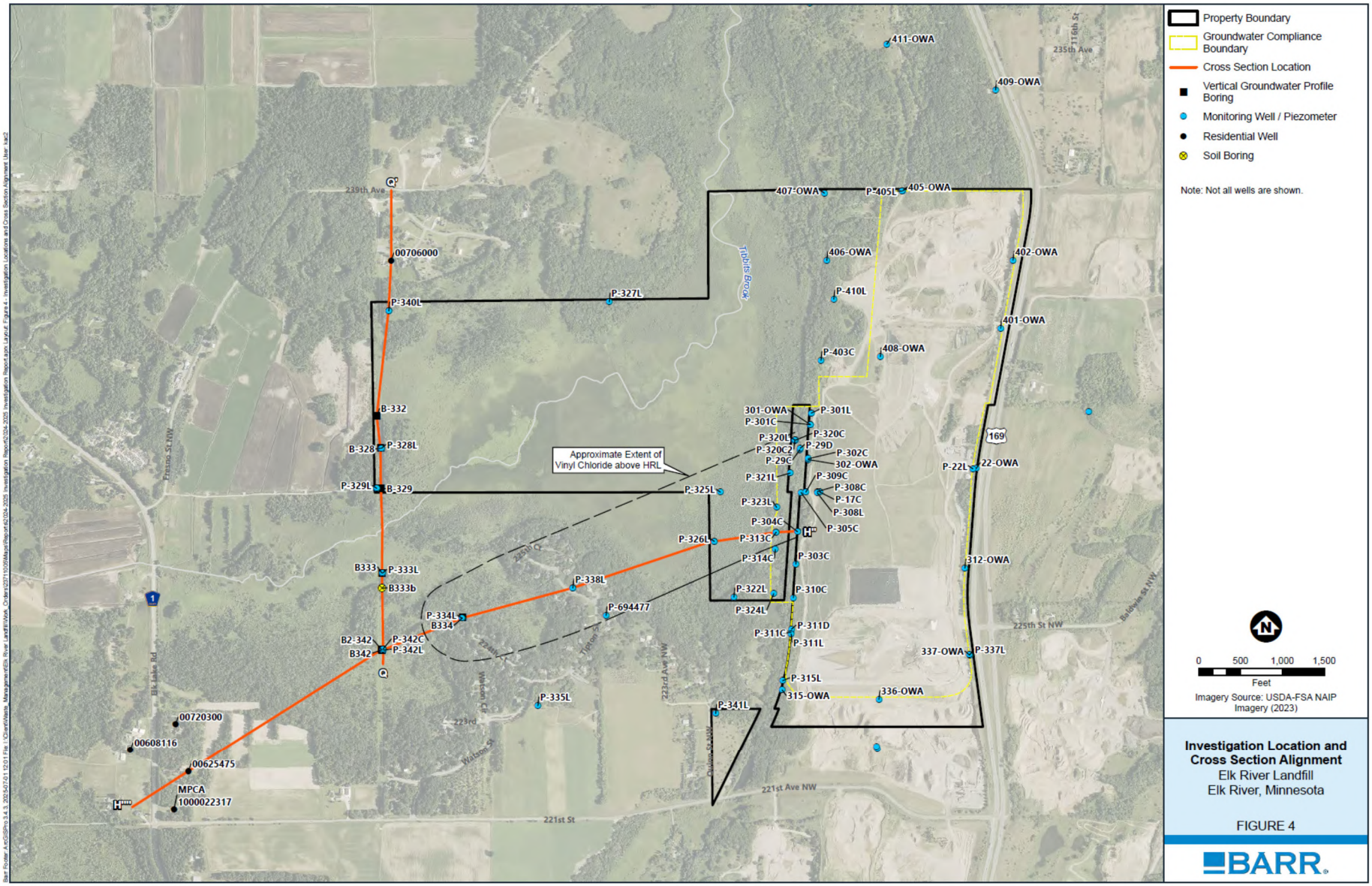


Figure 2. Investigation Area, Cross Section Locations, and Approximate Extent of Vinyl Chloride Plume above HRL (Barr Engineering, 2025)

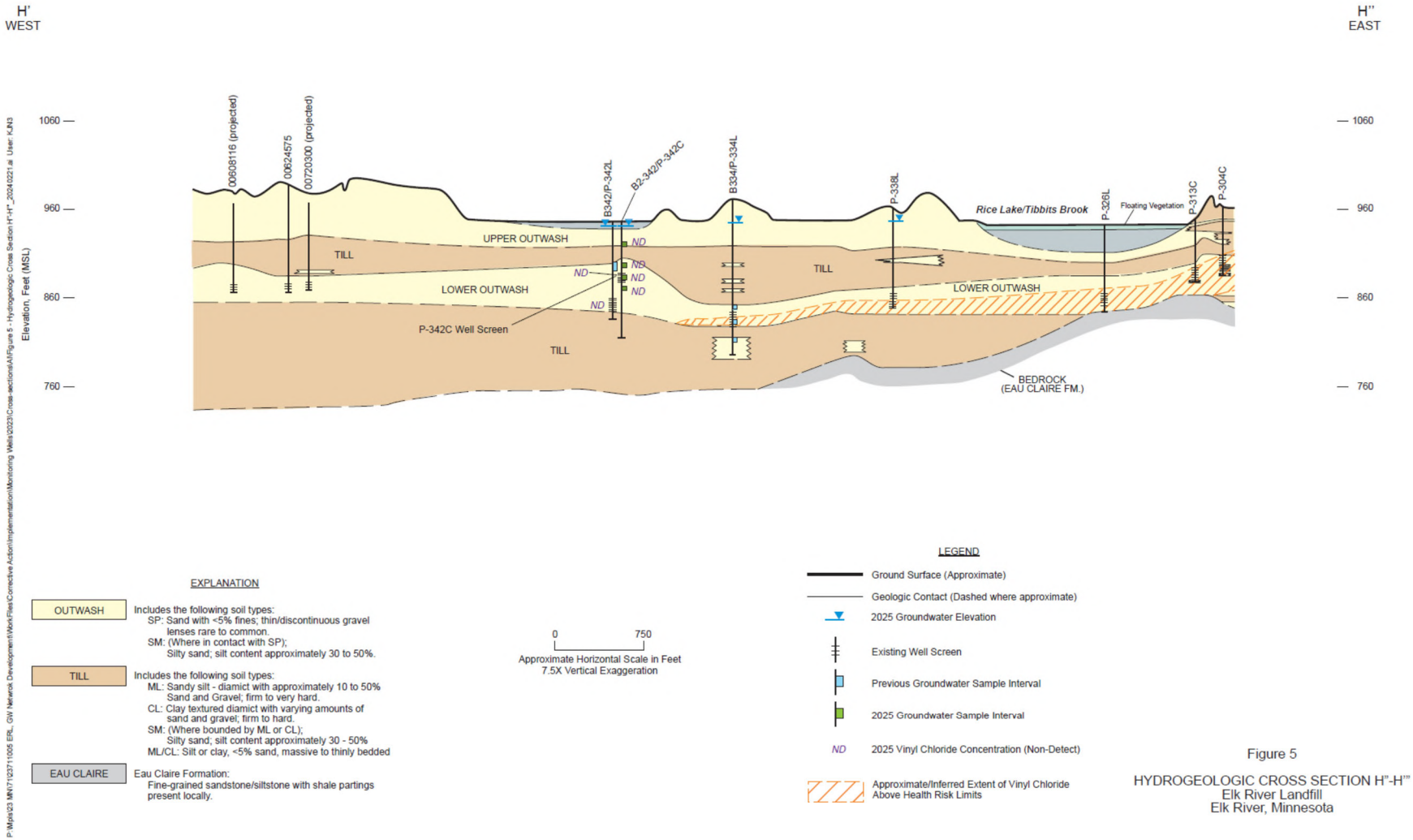


Figure 3. Cross Section H-H' (Barr Engineering, 2025)

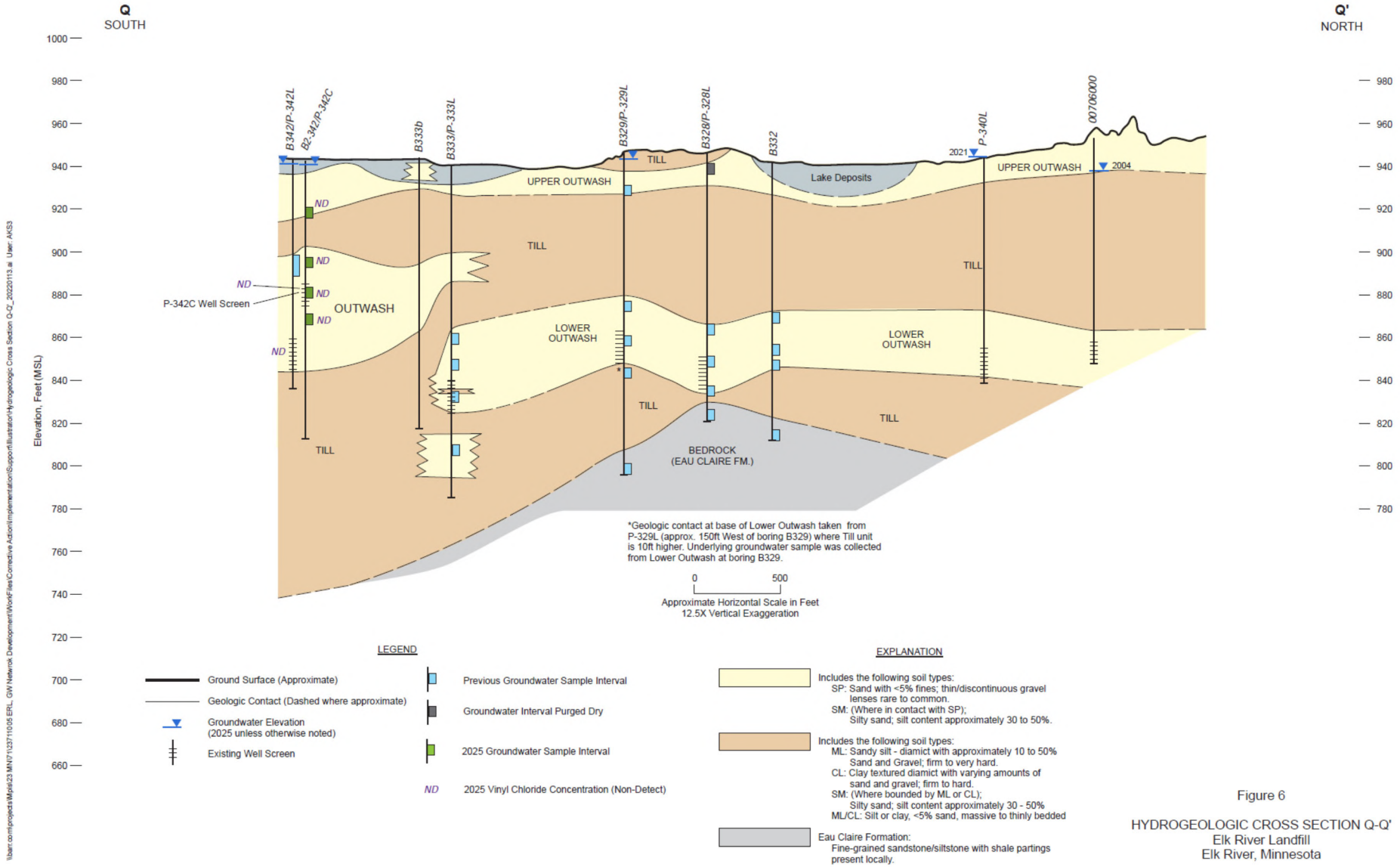


Figure 4. Cross Section Q-Q' (Barr Engineering, 2025)

generally slopes to the southwest. Above the bedrock are approximately 40 to over 100 feet of unconsolidated, primarily glacial deposits.

The unconsolidated deposits have 5 main layers, from top to bottom:

1. Recent deposits of vegetation and organic muck in wetland areas.
2. Upper outwash consisting of course sand and silty sand. This is the uppermost or water table aquifer.
3. Upper till later consisting of silt and clay. This layer acts as a confining layer between the upper and lower outwash aquifers.
4. Lower outwash consisting of coarse sand and silty sand. This is the aquifer where the bulk of the groundwater contamination is found.
5. Lower till layer consisting of silt and clay. This layer acts as a confining layer between the lower outwash and the bedrock.

Groundwater flow below the south part of the landfill is primarily to the southwest. The extent of the VC plume can be seen in Figure 2. The plume has been confined to the lower outwash aquifer. Because the volatile organic compounds illustrated in Figure 1 are denser than water, the contaminant plume is found at the bottom of the lower outwash aquifer, above the lower till confining layer, as indicated in Figure 3 .

3.2. Background geochemistry

Before evaluating the existing MNA, it is important to understand why MNA was selected over other remediation options. Section 4 (Document #1126), prepared by Barr Engineering, describes the geochemical conditions downgradient of ERL based on site data, as well as the potential biodegradation and abiotic degradation that could occur under those conditions. Dissolved oxygen (DO) is generally less than 1 mg/l near the land fill boundary and is conducive to anerobic biodegradation of chlorinated ethenes. Measured pH values are also in the range conducive to this process. Alkalinity is high compared to background likely due to production of CO_2 from microbiological degradation of landfill wastes. ORP measurements are described as erratic but clearly lower downgradient of ERL. Chloride cannot be used as an indicator of biodegradation of chlorinated ethenes because contaminant concentrations are so low. Total organic carbon (TOC) concentrations are slightly elevated near ERL (up to 40 mg/l) but decline downgradient to 1 toward the end of the vinyl chloride plume. Where detected, sulfide concentrations are very low. Terminal electron acceptors are discussed; oxygen was partially discussed above. It was suggested that oxygen is low enough for reductive dechlorination of PCE or TCE to cis-DCE, and yet possibly still high enough for aerobic biodegradation of vinyl chloride. Nitrate was ND throughout most of the plume. Elevated concentrations of reduced iron and manganese occur downgradient of the land fill and it is believed iron and manganese reduction are the predominant geochemical conditions in the plume. Sulfate is slightly depleted near ERL but is present in the downgradient plume at concentrations above 10 mg/l, suggesting minimal sulfate reduction. Significant methane concentrations were only seen near the ERL boundary.

Magnetic susceptibility testing was done to measure magnetite, an iron mineral known to be involved in abiotic degradation of chlorinated ethenes (Ferrey et al, 2004). It was concluded that these reactions could be occurring but would be limited for degradation of vinyl chloride.

To summarize, anaerobic degradation of TCE or PCE would likely occur within and immediately downgradient of ERL. Conditions for possible aerobic or anaerobic biodegradation of cis-DCE and vinyl chloride exist in downgradient areas of the plume. Abiotic degradation could be occurring.

3.3. Other conditions not discussed in reports

As stated previously, overall, the ERL has been evaluated quite thoroughly. However, an independent investigation was prompted to confirm previous evaluations. Some degradation mechanisms that may be relevant to ERL were not discussed; cometabolic biodegradation and abiotic degradation due to iron minerals other than magnetite or due to precipitated iron sulfide (FeS).

Cometabolic biodegradation often occurs downgradient of landfills due to methane production in the anaerobic portion of the landfill followed by the plume migrating into aerobic groundwater. Methane oxidizing bacteria can grow on methane and can also carry out cometabolic biodegradation of TCE, DCE and vinyl chloride (Wiedemeier et al, 1999). These reactions likely occurred early on near the ERL, especially during the diffused oxygen aeration period (2003-2008), however, aeration was not widespread and has ceased. Cometabolic biodegradation is likely not a relevant process in the plume now.

Iron minerals involved in abiotic degradation (EPA 2009) other than magnetite were not measured, including FeS which may have been produced near ERL where sulfate reduction occurred. Because degradation/loss rates appear to be low in the downgradient portion of plume, it is not likely these minerals are present or reactive. X-ray diffraction (XRD) could detect these minerals in soil boring samples.

Vinyl chloride can be degraded by a variety of mechanisms under many geochemical conditions. Long vinyl chloride plumes are quite rare. This plume is likely persisting for one of, or combination of, the following reasons. This discussion is included as a possible explanation to why sufficient vinyl chloride degradation is not occurring in the ERL plume.

- Other than municipal waste (garbage), ERL did not appear to contain large inputs of easily biodegradable organic compounds (ketones, alcohols, BTEX, other hydrocarbons) often found at other landfills, that produce a deep, long-lasting anaerobic zone. At ERL the anaerobic zone was just sufficient to transform TCE, and most of the cis-DCE produced, to vinyl chloride.
- The lower outwash is a confined deeper aquifer which likely contains minimal oxygen if any, due to the presence of municipal waste. Conflicting DO and ORP readings occur at many sites for many reasons (See frequently asked question FAQ #14, Adamson and Newell 2014). Thus, aerobic or cometabolic biodegradation reactions with vinyl chloride are likely not occurring though they may have occurred during the diffusive aeration (2003-2008).
- Anaerobic biodegradation reactions for cis-DCE and vinyl chloride have been proposed in the literature under iron and manganese reducing conditions as well as in the presence of humic acids (Bradley and Chappelle, 1996, Bradley et al 1998a, 1998b). In more recent years, those reactions have been questioned or explained by other mechanisms by the same authors who did the original studies (see Introduction section in Bradley et al., 2012).

Very low levels of oxygen as described above appear to be an explanation for what was thought to be anaerobic degradation.

- Microorganisms have regulatory mechanisms to turn on degradative pathways (induction) when compounds they can grow on are present. At some low concentration, microorganisms cannot make a living (grow) off some compounds and the pathway (even if present) will not be induced. Vinyl chloride concentrations below 1 ug/l may be in that range. See Bradley (2012) for a study on vinyl chloride biodegradation under very low oxygen conditions that are considered anoxic. The lowest vinyl chloride concentration tested was 6 ug/l (chapter 3, Fig 4). It is not clear from the figure that any degradation rate is observed at that low concentration. It is also possible that microorganisms that can grow on vinyl chloride are simply not present in the lower outwash.

In summary, very low concentrations (< 2 ug/l) of vinyl chloride at ERL have had 50+ years and 4000 feet (to well P-334L) to biodegrade and yet, degradation does not seem to be occurring at a significant (enough) rate. This may be an instance of a rare combination of circumstances: very low vinyl chloride concentrations combined with no oxygen and no abiotic degradation.

4. MONITORED NATURAL ATTENUATION REVIEW

The overall approach in the 2024 Initial Performance Evaluation appeared to follow standard analytical methods but failed to consider all aspects required for a thorough investigation. Most of the relevant technical issues in biological and abiotic degradation were addressed. Contaminant concentrations are low at the site, the source concentrations appear to be declining, and the plume is moving relatively slow considering the distance to receptors.

However, significant flaws were found in the future projections of how far the plume would travel, or if vinyl chloride concentrations would reach residential water supply wells in the path of the plume. The flaws include use of a critical assumption which appears to not be met, use of average concentrations (and distances) in what is essentially a Human Health Risk Assessment (HHRA) calculation, and no reality check calculations using additional wells within the plume. These and additional less important issues are discussed on the following page.

4.1. ISSUE #1 - A primary assumption used in the projection calculations is not met

A natural attenuation method was used that is well accepted for analyzing plumes (Newell & Rifai et. al, 2002). The problem is the conditions observed at ERL do not fit one of the primary assumptions required for using the method. In the 2024 Initial Evaluation document, calculations were done to estimate attenuation rate (how fast vinyl chloride is going away) as well as projection calculations for time (to drop below the IL) and travel distance based on those rates.

A primary assumption in applying the method is that the plume has achieved steady-state (i.e., is stable/not expanding). This assumption is stated by the authors of the method (Reference below). In the 2024 Initial Evaluation, the following 2 reasons were presented as why the authors believe this assumption was met:

"….steady state assumption is valid at ERL (based on current data), given the long operational history of the facility and non-detect concentrations at distal well P-342L…." (Document #1126, p.280, 5th paragraph of Appendix H)

The conceptual release model for the site (Section 2.5, p 10) states:

"Based on the Site history, the leading edge of the plume is anticipated to result from higher vinyl chloride concentration flux from the 1990s (or prior; Barr, 2020a), and current vinyl chloride flux appears to be substantially lower…."

Because higher concentrations left the landfill 35 to 45 years ago (prior to capping), the basic assumption that the plume is at steady state is not met. Additional assumptions in section 3.2 in MPCA (2006) are likely not met, specifically, knowledge about contaminant mass and having wells along the plume axis.

"Also, without knowing the mass entering the system from a source, a "true" biodegradation rate cannot be measured. Additional assumptions are that the contaminant plume is "stable", lateral dispersion is negligible, and monitoring well locations are positioned along the axis of ground water and contaminant flow."

In addition, well P-342L, is beyond where the terminus of the plume is predicted to be based on the conceptual release model and ground water velocity calculations, and therefore, non-detect concentrations could be expected at P-342L.

Chloride can often be used as a conservative tracer of ground water as it travels at almost the exact same velocity as the ground water itself. Chloride concentrations are elevated near ERL; chloride concentration in P-17C was > 900 mg/l in 2012 and ~ 300 mg/l in 2023. The chloride concentration at P-334L was 3.6 mg/l when first sampled in April 2018. The chloride concentration had risen to 17 mg/l by 2023. This gives a timeframe for the arrival of landfill water at P-334L which is upgradient of well P-342L. The current chloride concentration at P-342L is low (1 mg/l) indicating water from the landfill has not yet reached this well, so the vinyl chloride has not had the chance to reach here either. Therefore, stating that the "non-detect" observation at P-342L is evidence for the vinyl chloride plume being stable is inaccurate.

4.2. ISSUE #2: Bulk attenuation projections do not address the real problem

The 2024 Initial Evaluation report analyzes the degradation of organic contaminants as they move away from the landfill boundary. However, we know vinyl chloride concentrations varied in time and vary throughout the plume (based on the conceptual release model and current data), and we know what current concentrations are downgradient from the landfill. A separate analysis should have been performed starting from those points. Presented here is the analysis in the 2024 Initial Evaluation.

On p 281 (Appendix H), a summary of projections is discussed. The 3 scenarios (A, B, and C) are presented below; <u>all are direct quotes</u>. For 'Scenario A', well P-305C was used as the well at the compliance boundary.

Scenario A:

"What is the estimated highest vinyl concentration at the Compliance Boundary that would naturally attenuate below the IL or detection limit (0.05 micrograms per liter [µg/l]) before reaching nearest residential water supply user in the direct downgradient flow path of the mapped vinyl chloride extent if the groundwater flow path is complete[3].

a. *Range: 0.23 to 11 µg/l* ***b.*** *Average: 1.0 µg/l*

This scenario suggests that, on average, vinyl chloride concentrations at or below 1.0 µg/l at the Compliance Boundary will attenuate before reaching the nearest residential well downgradient of P-342L."

Scenario B:

"What is the estimated highest vinyl chloride concentration at monitoring well P-342L that would naturally attenuate below the IL or detection limit (0.05 µg/l) before reaching nearest residential water supply user in the direct downgradient flow path of the mapped vinyl chloride extent if the groundwater flow path is complete[3].

a. *Range: 0.08 to 0.32 µg/l* ***b.*** *Average: 0.14 µg/l*

This scenario suggests that, on average, vinyl chloride concentrations at or below 0.14 µg/l in groundwater at well P-342L will attenuate before reaching the nearest downgradient residential well."

Scenario C:

"How far is vinyl chloride projected to travel downgradient of the Compliance Boundary considering peak 2023 concentrations reported near Compliance Boundary (0.48 µg/l at P-321L) if the groundwater flow path is complete[3].

a. *Range: 3,200 to 11,300 feet* ***b.*** *Average: 5,900 feet*

"This scenario suggests that, based on average bulk attenuation rates, the vinyl chloride detected in groundwater at well P-321L will travel a distance of 5,900 feet before decreasing below the IL or detection limit (0.05 µg/l). For context the nearest residential water supply user in the direct downgradient flow path of the mapped vinyl chloride extent is approximately 7,700 feet downgradient of the Compliance Boundary.

The vinyl chloride concentration (or potential vinyl chloride concentration) in the vicinity of 5 wells (P-323L, P-325L, P-326L, P-338L and P-334L) is predicted to reach and go past several residential water wells (Table 2). The approximate predicted time of arrival at the first residential well is 31 years for P-334L and 65 years for P-323L. Future monitoring at P-342L would improve the arrival estimate. If left unchecked with no treatment, this could mean an exposure time above the IL of more than 30 years.

Because higher vinyl chloride concentrations exist in the plume far downgradient of the compliance boundary near the landfill, the projections in Scenario A and C are misleading since they only used wells/concentrations near the landfill boundary. It may also be inappropriate to use average concentrations

in what is essentially a Human Health Risk Assessment (HHRA) calculation. Assuming the data is accurate, any or all data points could be used in the calculations. At the minimum, perhaps an upper 95% confidence interval should be used.

Scenario B (which uses P-342L) is irrelevant at this time because no vinyl chloride had been detected there as of August 2023. Yet, in the scenario, Table H3 contains 6 concentration values and an average value that was used in the projection. It is not clear where these input values came from. If scenario B is rerun using wells upgradient of P-342L which have vinyl chloride concentrations, different results are obtained. Revised scenarios using other wells are presented below and show that concentrations of vinyl chloride above the IL will very likely reach the nearest drinking water wells.

4.3. ISSUE #3: Revised bulk attenuation projections give very different results

Bulk attenuation rates were discussed in section 4.3.2 with reference to Appendix H for detailed calculations. We were able to reproduce the predictive results obtained. Using the same calculations (Table H3, p 292) but substituting recent vinyl chloride values for mid plume wells and the appropriate well distances, different results are obtained. Boundary compliance wells used in the original scenarios were included to ensure the formulas were correct. Results for those wells agreed with the stated result in the report.

Wells P-325L, P-326L, P-338L and P-334L are approximately 890 ft, 1037 ft, 2933 ft, and 4329 ft, respectively, downgradient of well P-305L near the compliance boundary. In revised scenario A (Table 1), all the mid plume wells fail the test to be below the IL at the nearest residential well (orange highlights) and 2 wells come close to failing (red highlights) even if the higher HRL is used (calculations not shown in tables below). Predicted vinyl chloride concentrations are 1.5 to 3.8X higher than those predicted in the original scenario A.

In revised scenario C, P-323L (approximately 300 ft downgradient of P-321L) was included along with the mid plume wells in revised scenario A. P-323L was included because cis-DCE and TCE were detected there in significant concentrations in 2021. Cis-DCE concentrations were included for the other wells where present. TCE and cis-DCE concentrations were converted to vinyl chloride molar equivalents. As shown in Table 2, all wells fail this revised test for the IL and one well fails even if the higher HRL is used as the standard. The projected travel distances to drop below the IL are 750 to 4284 ft past the first residential well and could include up to 6 or 7 additional residential wells (see Figure 6).

Table 1. Natural attenuation model results – Revised Scenario A

Well	Approximate distance downgradient from P-305C (feet)	Distance (feet) from well (column A) to nearest residential water well (22275 Elk Lake Road) *	Vinyl chloride concentration (ug/l) that will drop below C IL before reaching water supply well	Vinyl chloride concentration (ug/l) that will drop below HRL before reaching water supply well	Current or highest recent (2022-2024) vinyl chloride concentration (ug/L)	GW velocity (feet/year)	k (overall attenuation rate in ug/l/year)	Notes
P-305C	LF boundary well (Example from Barr, 2024, p 281)	7966	1.00	4.02	1.00	117	0.045	
P-325L	890	7076	0.71	2.83	1.44	117	0.045	2022 vinyl chloride data
P-326L	1037	6929	0.61	2.44	0.96	117	0.045	2022 vinyl chloride data
P-338L	2933	5033	0.31	1.23	1.02	117	0.045	2023 vinyl chloride data
P-334L	4329	3637	0.18	0.73	0.69	117	0.045	2024 vinyl chloride data

Test results: Will Natural Attenuation lower the VC concentration below the HRL or C IL before this groundwater reaches the nearest drinking water well?

Yellow = Natural Attenuation will reduce concentrations below the HRL and approximately the C IL

Orange = Natural Attenuation will reduce concentrations below the HRL but above the C IL

Red = Natural Attenuation will reduce contaminants at this well to approximately the HRL and above the C IL

* Distances were observed and calculated using QGIS version 3.34.10-Prizren, and are slightly different then the Barr scenarios.

Health Risk Limit concentration (HRL) = 0.2 ug/l

Intervention Limit concentration (C IL) = 0.05 ug/l

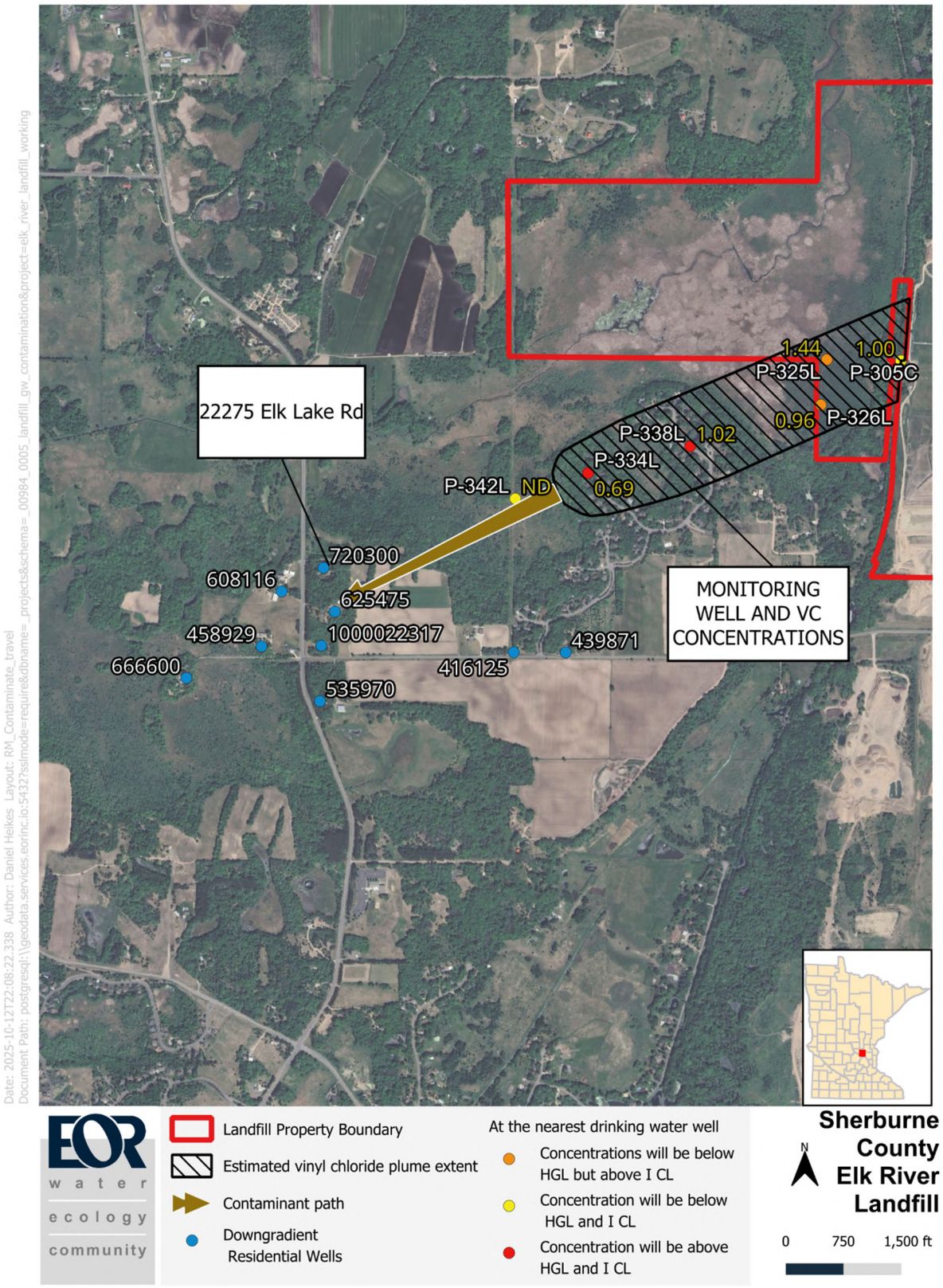


Figure 5. Results of Natural Attenuation Calculations - Revised Scenario A

Table 2. Natural attenuation model results – Revised Scenario C

Well	Current or highest recent (2021-2024) vinyl chloride concentration (ug/l)	Travel distance (feet) to drop below C IL (formula Table H3 p 292)	Travel distance (feet) to drop below C HRL	Distance (feet) from well in column A to nearest water supply well (22275 Elk Lake Rd)	GW velocity (ft/year)	k (overall attenuation rate in ug/l/year) from Barr	Notes
P-321L (Barr example well on p 281 of 2024 doc)	0.48	5881	0	7945	117	0.045	
P-323L	4.9	11921	8317	7637	117	0.045	Includes cis-DCE and TCE that could become vinyl chloride
P-325L	1.44	8737	5133	7076	117	0.045	2022 data
P-325L	1.8	9317	5713	7076	117	0.045	Includes cis-DCE that could become vinyl chloride
P-326L	0.96	7683	4078	6929	117	0.045	2022 data
P-326L	1.66	9107	5502	6929	117	0.045	Includes cis-DCE that could become vinyl chloride
P-338L	1	7789	4185	5033	117	0.045	
P-338L	1.45	8755	5151	5033	117	0.045	Includes cis-DCE that could become vinyl chloride
P-334L	0.69	6824	3220	3637	117	0.045	2024 data

Test results: Will Natural Attenuation lower the VC concentration below the HRL or C IL before this groundwater reaches the nearest drinking water well?

Yellow = Natural Attenuation will reduce concentrations below the HRL and the C IL

Orange = Natural Attenuation will reduce concentrations below the HRL but above the C IL

Red = Natural Attenuation will reduce concentrations above the HRL and the C IL

* Distances were observed and calculated using QGIS version 3.34.10-Prizren, and are slightly different then the Barr scenarios.

Health Risk Limit concentration (HRL) = 0.2 ug/l

Intervention Limit concentration (C IL) = 0.05 ug/l

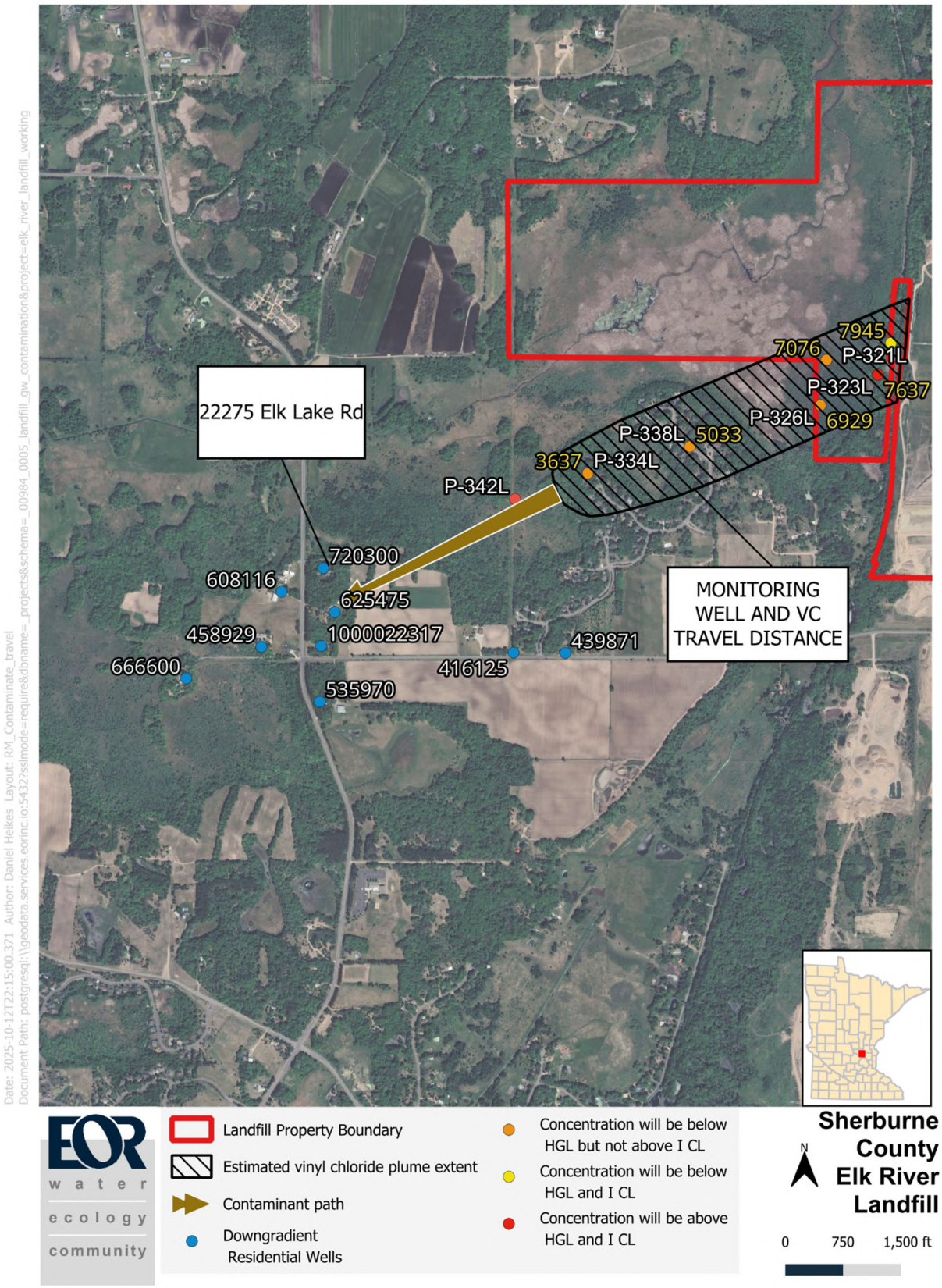


Figure 6. Results of Natural Attenuation Calculations – Revised Scenario C

The above calculations indicate MNA as a lone remedial strategy will not be sufficient to reduce vinyl chloride concentrations below acceptable health risk limits.

5. OTHER VINYL CHLORIDE-RELATED ISSUES

5.1. Vinyl chloride trends are increasing in some downgradient wells.

Figure 2 (Appendix E, Doc #1151) shows 3 distant downgradient wells (P-694477, P-334L, P-338L) have increasing vinyl chloride trends. This agrees with the release conceptual site model that has a pulse of higher concentrations leaving the ERL 30+ years ago.

5.2. No estimate for a loss rate for vinyl chloride due to physical processes alone was made.

Since physical losses (dilution, dispersion) are acceptable in an MNA remedy, this estimate would merely confirm that a "preferred" active degradation mechanism and rate (λ) exists. In section 3.2 (MPCA 2006), biodegradation rates and total loss rates are discussed. In that document, a sample calculation was done for a site with a ground water velocity of 124 ft/yr, very close to the 117 ft/yr for ERL. The total overall attenuation rate (k) was estimated to be 0.2 yr^{-1}.

> *"The biodegradation rate, l, is estimated from the overall attenuation rate with estimates of the retardation constant (for details on this derivation, see Appendix A, Equation 3) and dispersion values along the plume axis. Using the site data for Figure 5 yields a l of 0.12 yr^{-1} or approximately 60 percent of the overall attenuation rate, k , that includes attenuation due to adsorption and dilution. The biodegradation rate of 0.12 yr^{-1} is relatively low compared to many values found in the literature, which can range from 1.2 to 1.8 for microcosm studies or other field data (61)."*

By subtraction, this example site indicates a loss rate due to physical processes of 0.08 yr^{-1} or 2/3 of the biodegradation rate. The total overall attenuation rate (k) used in the calculations for the ERL plume was estimated to be 0.045 yr^{-1}. This is approximately half the loss rate due to physical processes in a plume with the same groundwater velocity, and approximately 1/3 of the low biodegradation rate described in the example above. This implies that most of the observed rate at ERL is due to physical processes only and there is minimal degradation. Since chloride concentrations leaving ERL vary over time and location and connected flow paths cannot be established with the limited number of wells, a simple calculation using chloride as a conservative tracer cannot be done.

5.3. There is a need for better plume delineation.

The downgradient plume (presented as the HRL extent in all figures) is at least 1200 feet wide and yet is primarily defined by wells believed to be along the centerline of the plume (P-326L, P-338L, P-334L). There appears to be a need for better delineation on the south side of the plume especially if the estimated extent of vinyl chloride above the IL on the south side is the same as the north side (Doc #1126, Fig. 8). Additional delineation both south and downgradient of P-694477 (see #1 above) should be done, because this well is currently greater than twice the HRL and the concentration is trending upward. The direction of groundwater flow indicates the southern side of the plume is most likely to impact downgradient private wells should it reach them. Well P-694477 is in an area where it appears more

monitoring wells could be installed. There also appears to be a need for better plume delineation along a more northern flow path downgradient of P-325L. Both P-325L and P-323L have higher vinyl chloride concentrations than P-326L and contain cis-DCE and TCE (P-323L only) that can become vinyl chloride. Currently, there are no wells downgradient on a flow path through P-325L. Doc #1126 acknowledges that the northern portion of the plume is not well characterized (Section 4.3.1 as an example). It is recognized that even though Figure 7 shows the estimated vinyl chloride concentration exceeding the IL extending a considerable distance beyond the approximate extent of the HRL, this area is inaccessible for installing monitoring wells due to Tibbet's Brook and Rice Lake.

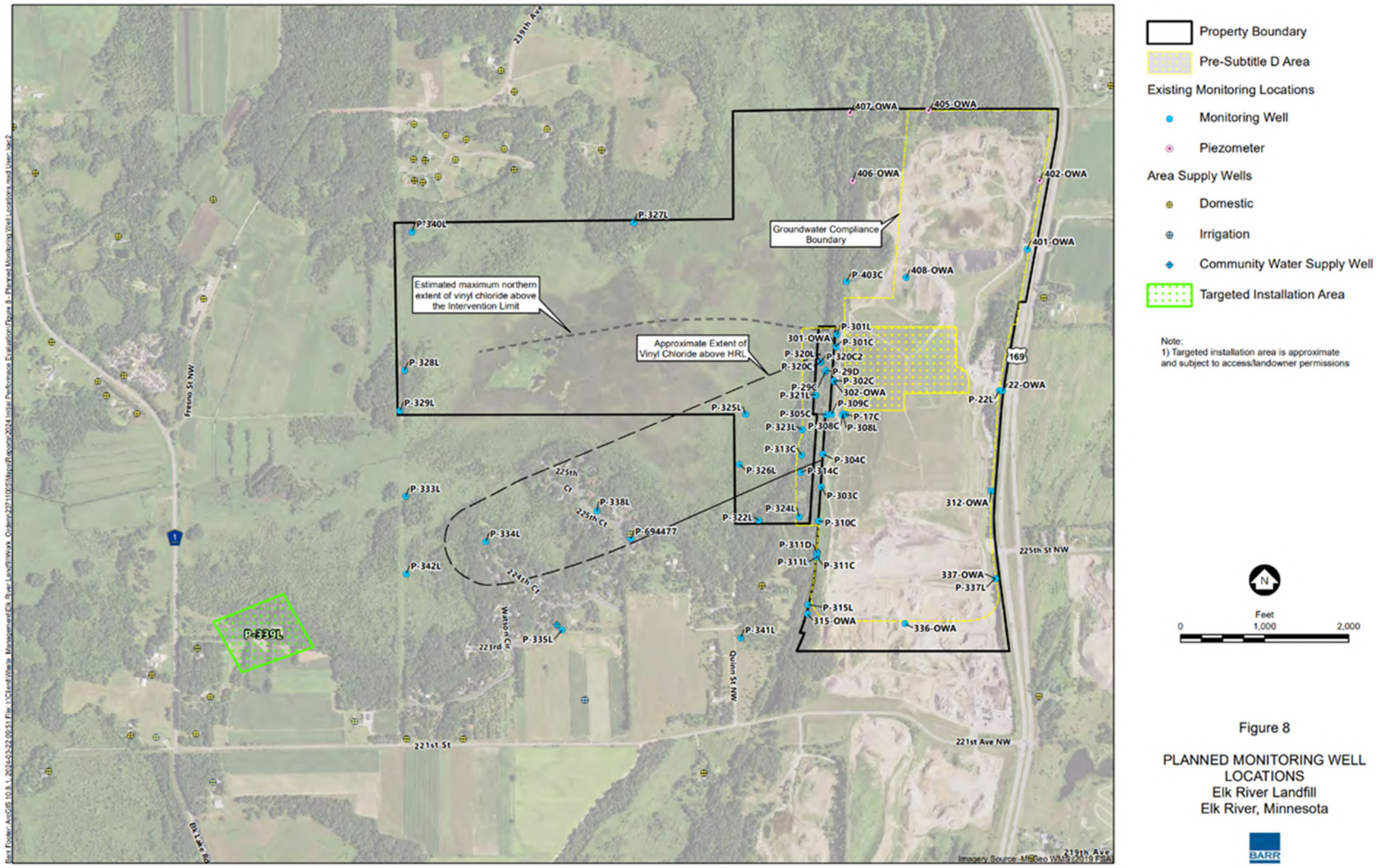


Figure 7. Planned Monitoring Well Locations (Barr Engineering, 2025)

6. OTHER GROUNDWATER CONTAMINANTS

6.1. Freon

Freon 21 (Dichlorofluoromethane) has been detected in several monitoring wells. There is no IL for Freon 21, just an "RAA17" (Remedial Action Advisory 2017) of 20 ug/l listed under HRL. Since most ILs are 0.25 of the HRL, this could imply that the IL could be approximately 5 ug/l. Freon 21 exceeded this value in several wells for many sampling events.

6.2. PFAS

Perfluoroalkyl substances (PFAS) are present in the ERL. PFAS include compounds that are highly fluorinated and sometimes contain sulfonate groups or acidic groups (ex: PFOA or perfluorooctanoic acid or its salts). PFAS compounds are generally considered to not be biodegradable. Acid or salt versions like PFOA are soluble and have a low retardation factor in ground water (ex: ~ 1.5), meaning they would travel a considerable distance like vinyl chloride. PFAS has become a serious contaminant of concern in the last 10 years. The EPA established a maximum contaminant level (MCL) of 4.0 ng/l in August 2025. The Minnesota Department of Health (MDH) set a health risk limit (HRL) level of 0.0079 ng/l (7.9 picograms/l) for PFOA in 2025.

The Minnesota Pollution Control Agency (MPCA) collected groundwater samples at several wells downgradient from ERL and analyzed for PFAS. The sampling was part of a larger effort by MPCA to screen for PFAS near landfills across the state. Samples were collected in October 2023 from 6 wells: P-22L, P-308L, P-321L, P-323L, P-325L and P-326L (Barr doc #1163). PFAS was sampled previously in 2 more downgradient wells (P-334L and P-342L) in August 2023. Well P-342-L was sampled again in April 2024.

Because of the problem described above for vinyl chloride, the County was concerned that the more downgradient wells (P-338L and P-334L) will eventually become contaminated by PFAS, and well P-694477 had never been sampled. PFAS samples were collected in a split sampling event with Sherburne County in wells P-334L, P-338L and P-694477 in April 2025.

Calculations were performed to determine whether natural attenuation could effectively remediate PFOA and PFBA to below the EPA MCL of 4 ng/l. Revised scenarios, like Table 2 above, were created for PFOA and PFBA using the highest detected concentrations at various wells. The PFOA results are summarized in Table 3 and Figure 8. The PFBA results are summarized in Table 4 and Figure 9.

The calculations assumed that groundwater would flow directly from upgradient wells to the nearest downgradient water supply well, located at 22275 Elk Lake Road. Wells P-325L and P-338L both failed the test for PFOA, all wells failed the test for PFBA. If the MDH level of 0.0079 ng/l were to be used for PFOA instead of the MCL of 4 ng/l, it is almost certain that most of the wells within the documented plume would fail.

Table 3. PFOA concentrations at sample wells and distances required for natural attenuation

Well	PFOA (perfluorooctanoic acid) 2023 or 2025 concentration (ng/l)	Distance (ft) from well to nearest water supply well (22275 Elk Lake Road) *	Calculated travel distance (ft) to drop below MCL (Formula from Barr, 2024, Table H3, p 292)	Compound's groundwater transport velocity (ft/yr)**	PFOA EPA MCL (PPT or ng/l)	k (Overall attenuation rate in ug/l/year) ***	Notes
P-325L	381	7076	7898	78	4	0.045	Sampled 6/23
P-326L	85	6929	5298	78	4	0.045	Sampled 10/23
P-338L	96	5033	5509	78	4	0.045	Sampled 4/25
P-334L	16.2	3637	2424	78	4	0.045	Sampled 4/25

Test results: Will Natural Attenuation lower the PFOA concentration below the HRL before the groundwater reaches the nearest drinking water well?

Green = Natural Attenuation will reudce the PFOA concentration below the HRL

Red = Natural Attenuation will not reudce the PFOA concentration below the HRL

* Distances were observed and calculated using QGIS version 3.34.10-Prizren, and are slightly different than the Barr Engineering reports.

** Retardation for PFOA compounds including perfluorohexanoic acid is slightly higher than for vinyl chloride, ~1.5; the GW velocity has been adjusted.

*** k for the site includes physical and degradation processes for vinyl chloride; degradation is essentially nonexistent for PFAS/PFOA, so the calculation is conservative

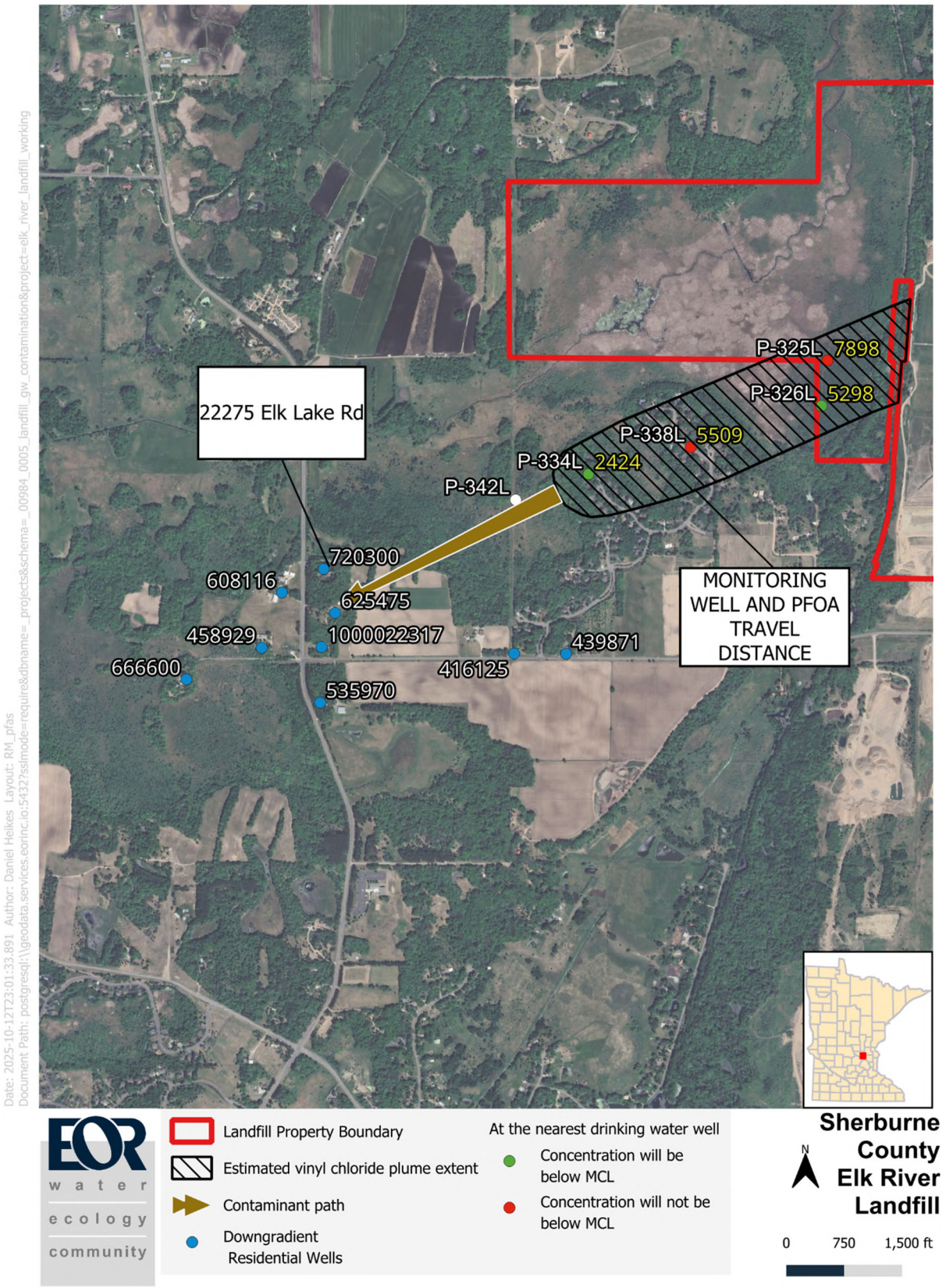


Figure 8. Results of Natural Attenuation Calculations – PFOA

Table 4. PFBA concentrations at sample wells and distances required for natural attenuation

Well	2023 or 2025 PFBA (perfluorobutanoic acid) concentration (ng/l)	Distance from well in column F to nearest water supply well (22275 Elk Lake Rd) *	Calculated travel distance to drop below MCL (Formula from Barr, 2024, Table H3 p 292)	Compound's groundwater transport velocity (ft/yr)**	PFBA EPA MCL (PPT or ng/l)	k (Overall attenuation rate in ug/l/yr)***	Notes
P-325L	639	7076	10824	96	4	0.045	Sampled 6/23
P-326L	196	6929	8303	96	4	0.045	Sampled 10/23
P-338L	105	5033	6971	96	4	0.045	Sampled 4/25
P-334L	45.5	3637	5187	96	4	0.045	Sampled 4/25

Test results: Will Natural Attenuation lower the PFBA concentration below the HRL before this groundwater reaches the nearest drinking water well?
Red = Natural Attenuatiuon will not reduce concentrations below the HRL

* Distances were observed and calculated using QGIS version 3.34.10-Prizren, and are slightly different than in the Barr Engineering reports.

** Retardation for PFBA is slightly higher than for vinyl chloride, ~1.21; the groundwater velocity has been adjusted.

*** k for the site includes physical and degradation processes for vinyl chloride; degradation is essentially nonexistent for PFBA, so the calculation is conservative

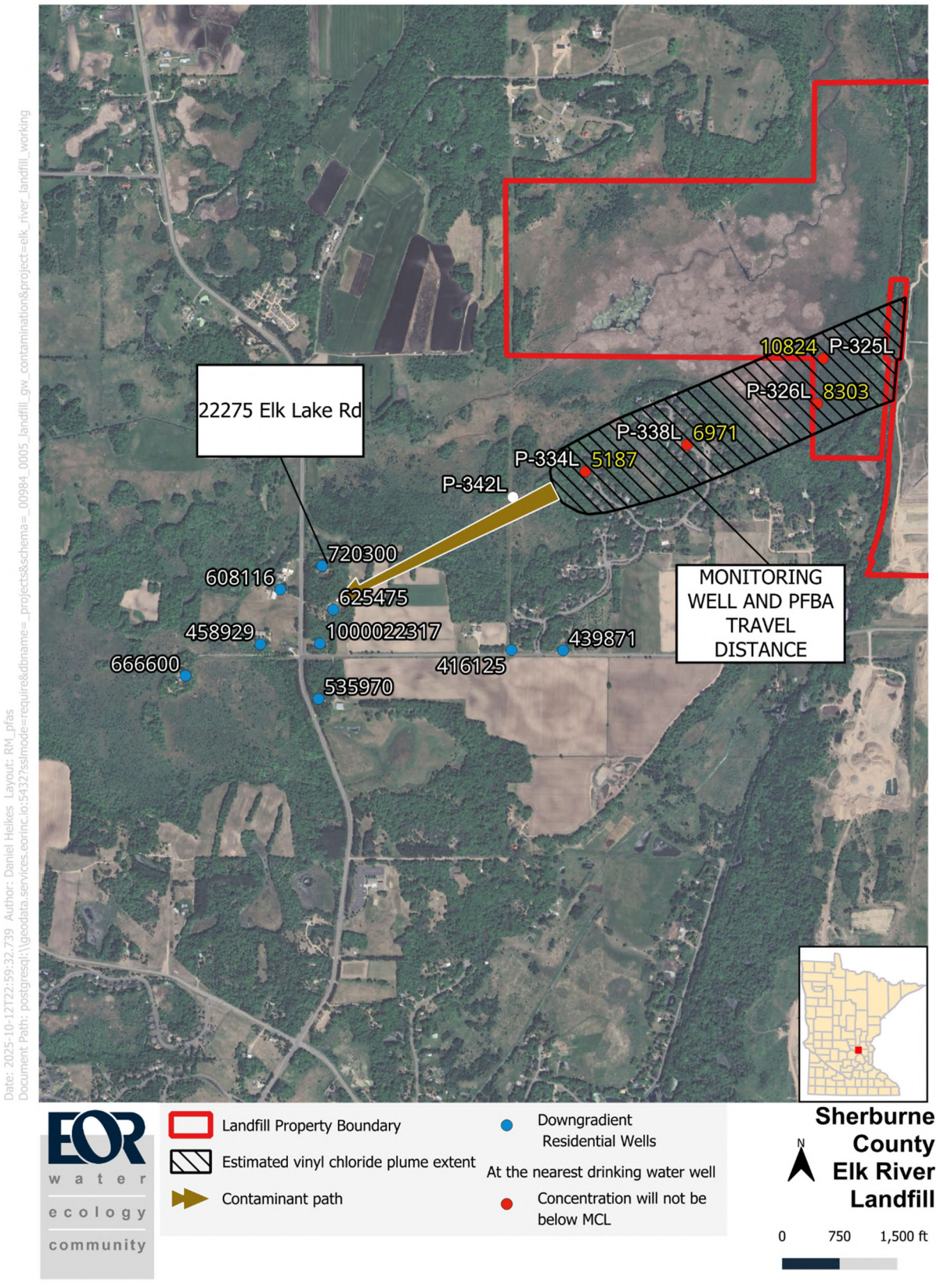


Figure 9. Results of Natural Attenuation Calculations – PFBA

6.3. Sulfate

Sulfate is a potential contaminant of concern because of the proximity of Rice Lake and Tibbetts Creek to the landfill. Rice Lake is classified as a wild rice water. The sulfate standard for wild rice waters is 10 mg/l.

Shallow groundwater generally flows from east to west, toward Tibbetts Creek as shown on Figure 10. Sulfate concentrations in shallow aquifer monitoring wells near the landfill are as high as 132 mg/l (Figure 11). A plume of high sulfate groundwater is likely to develop away from the landfill in the direction of groundwater flow. If the plume were to extend as far as Rice Lake, the landfill could be cited as a cause of high sulfate concentrations in the lake.

Groundwater transport of sulfate from the landfill to Rice Lake would occur through the upper sandy aquifer. The current extent of high sulfate groundwater is not known because groundwater monitoring is very difficult in the wetland area west of the landfill. Previous attempts to install monitoring wells in the wetland have not been successful. There is also a lack of data about the groundwater/surface water interactions in the landfill due to upwelling groundwater.

If shallow groundwater is discharging only to Rice Lake and Tibbetts Creek, then sulfide contamination is a potential problem. If upward groundwater gradients exist in the wetland, and if groundwater is coming to the surface through the bottom of the wetland, then sulfate contamination will be less of a potential problem. The bottom of the wetland is a reducing environment, so sulfate in the groundwater would be reduced to ferric sulfide or magnesium sulfide. Both compounds are relatively immobile, so the sulfate/sulfide would not reach Rice Lake in significant concentrations.

7. REMEDIAL ALTERNATIVES

Remedial alternatives for vinyl chloride in the ERL and groundwater were evaluated in the Corrective Action Alternatives Screening Report (CAAR 2019, Doc #969) and are listed below.

1. No action
2. Monitored natural attenuation (MNA)
3. Enhanced natural attenuation via air sparging or aerobic/anaerobic in situ injections
4. Permeable Reactive Barrier (PRB) via injections
5. Hydraulic capture with consideration to onsite and offsite treatment and discharge
6. Establishment of treatment or alternative water supply via point of entry system (POE) or well replacement.

MNA was selected as the primary remedy along with #6 (alternative water supply/well replacement) as the contingency remedy. Given this was 2019 and very little MNA data had been collected (which could rule MNA out), this selection was not unreasonable. However, recent data suggests that MNA alone may not reduce concentrations of vinyl chloride fast enough to be protective of nearby drinking water supplies.

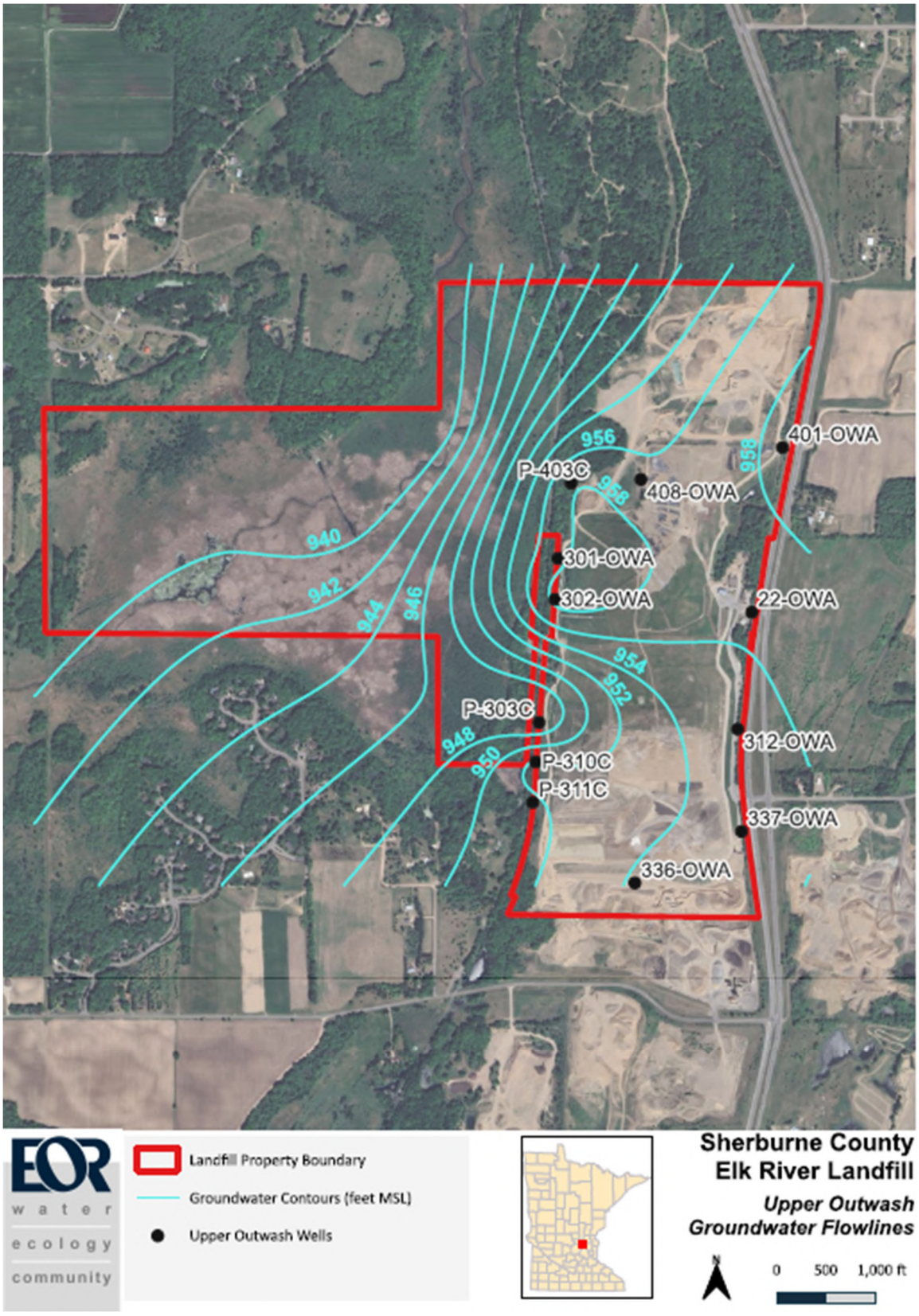


Figure 10. Upper Outwash Aquifer Groundwater Contours (2024)

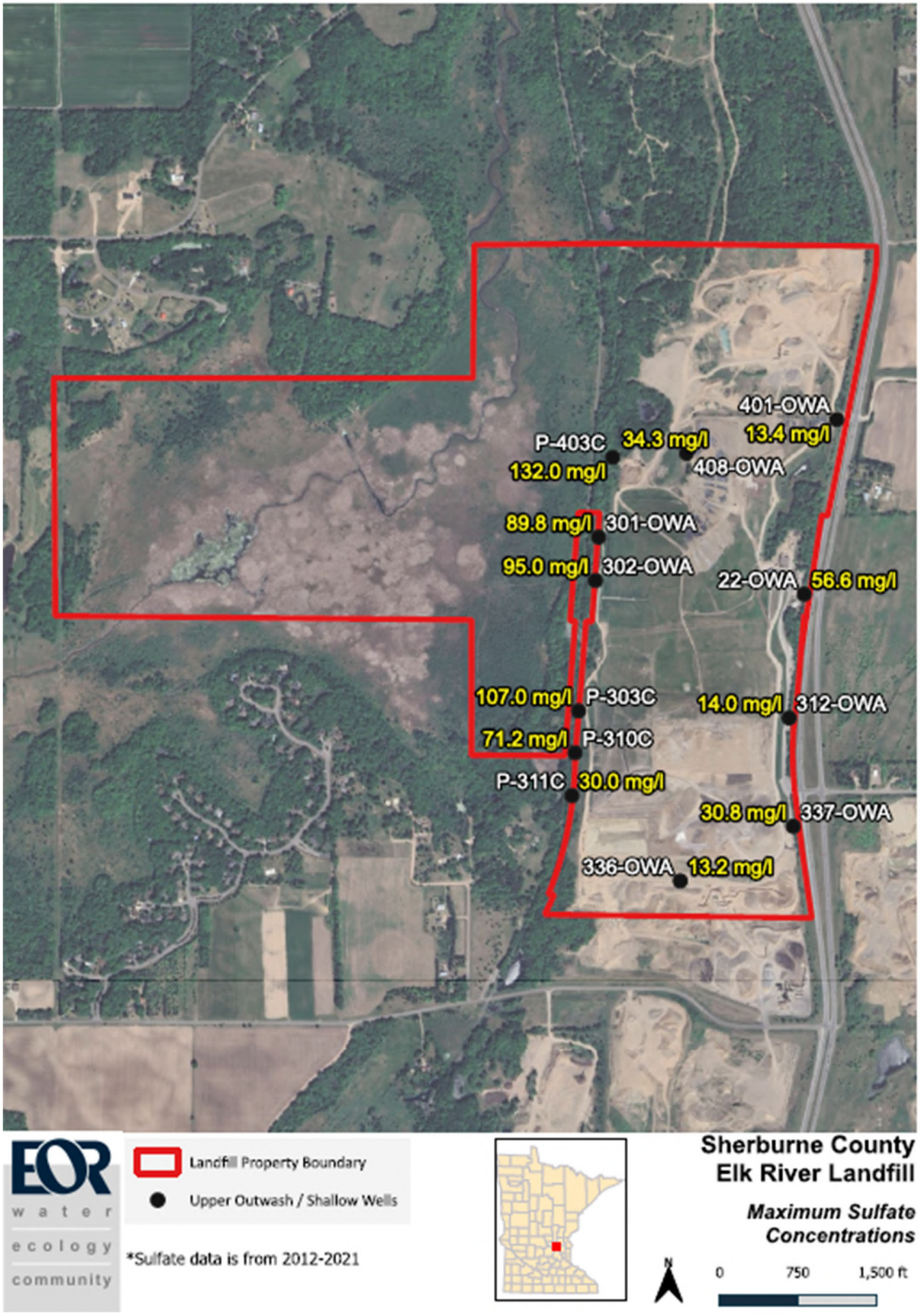


Figure 11. Maximum Sulfate Concentrations in Groundwater

The current most downgradient monitoring well that is non-detect for vinyl chloride, P-342L, is ~ 8.7 years in ground water travel time downgradient of P-334L. Vinyl chloride was detected above the HRL in 2021 when P-334L was first sampled. The arrival of vinyl chloride above the IL at P-342L is thus expected to be in approximately 2030. The arrival of vinyl chloride should be preceded by a rise in the chloride concentration a year or two earlier. P-342L is also the last monitoring well before the residential wells and appears to be in an area where a corrective measure such as #5 above (hydraulic capture and treatment) might be implemented. A short transect of borings north and south of P-342L could be installed and sampled at the time of chloride arrival at P-342L. Depending on the sampling results from those borings, a short transect of monitoring wells can then be installed north and south of P-342L to define the lateral extent of the plume.

8. CONCLUSION

In conclusion, this report highlights several key concerns regarding the migration and attenuation of contaminants at the Elk River Landfill. Vinyl chloride concentrations vary throughout the plume, with revised bulk attenuation projections indicating that natural attenuation may not be sufficient to prevent contamination of residential wells. Additionally, increasing vinyl chloride trends in some downgradient wells, the need for better plume delineation, and uncertainties in physical loss rates further complicate risk assessments. Other contaminants, including Freon 21, PFAS, and sulfate, pose additional concerns. PFAS compounds were detected in multiple wells within the plume. The current health risk limits are not clear. If the EPA's MCL of 4 ng/l is used, a number of wells in the plume will fail the test of reaching down gradient drinking water wells. Sulfate contamination, if transported through groundwater, could impact Rice Lake, though wetland conditions may mitigate its mobility. Overall, the findings suggest that natural attenuation alone may not be a reliable long-term solution, emphasizing the need for continued monitoring, improved plume characterization, and potential remediation efforts to protect water quality.

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EXHIBIT 6

#1126

Groundwater Corrective Action Report - Initial Performance Evaluation

Elk River Landfill (SW-74)
Elk River, Minnesota

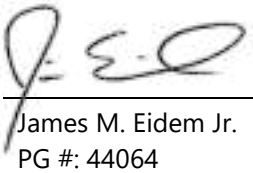
Prepared for
Elk River Landfill, Inc.

April 2024

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Certification

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Geologist under the laws of the State of Minnesota.



April 1, 2024

James M. Eidem Jr.
PG #: 44064

Date

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



April 1, 2024

Anthony D. Neuens
PE #: 50822

Date

Groundwater Corrective Action Report - Initial Performance Evaluation

April 2024

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Abbreviations

Barr	Barr Engineering Co.
bgs	below ground surface
C&D	construction and demolition
CAER	Groundwater Corrective Action Evaluation Report
cDCE	cis-1,2-dichloroethene
CVOC	chlorinated volatile organic compound
DCE	dichloroethylene
ERL	Elk River Landfill
HRL	Health Risk Limit
IL	intervention limit
MDH	Minnesota Department of Health
MNA	monitored natural attenuation
molar tCVOC	total chlorinated ethene molar concentrations
MPCA	Minnesota Pollution Control Agency
MSL	mean sea level
NDA	North Development Area
ORP	oxidation-reduction potential
PCE	tetrachloroethylene
RCRA	Resource Conservation and Recovery Act
RL/TB	Rice Lake/Tibbits Brook
SAP	Sampling and Analysis Plan
SDA	South Development Area
TCE	trichloroethylene
VOC	volatile organic compound

1 Introduction

On behalf of Elk River Landfill, Inc., Barr Engineering Co. (Barr) has prepared this Groundwater Corrective Action Report-Initial Performance Evaluation (Initial Performance Evaluation) to summarize the corrective actions completed to date at the Elk River Landfill (ERL or Site; Figure 1) per the Groundwater Corrective Action Work Plan (Work Plan; Barr, 2021). This Initial Performance Evaluation also includes an assessment of the corrective action protectiveness to human health and the environment based on the approved potable well replacements and the initial three years of monitored natural attenuation (MNA) data collected at and downgradient of the Elk River Landfill per the Work Plan.

Consistent with Minnesota Pollution Control Agency's (MPCA) process for evaluating corrective actions at solid waste facilities, ERL has evaluated the physical setting and hydrogeologic framework at and in the vicinity of the Site (Barr, 2015a), the extent and magnitude of vinyl chloride in groundwater (Barr, 2016 and 2018), groundwater geochemical conditions and organics concentration trends (Barr, 2020a, 2020b, 2023), and the feasibility of implementing various groundwater corrective action alternatives (Barr, 2019 and 2020b). As a result of this process, monitored natural attenuation (MNA) and residential water supply replacement (Alternative #1; Barr 2020b) was selected as the most cost-effective alternative that achieves the best balance of the feasibility criteria (assuming MNA is sufficient).

The primary and near-term goal for implementing corrective action at ERL is to protect human health by preventing exposure to organic compounds in water supply wells. The secondary, longer-term corrective action goal is to increase the certainty of protectiveness by meeting appropriate groundwater criteria at the facility. Vinyl chloride and trichloroethylene (TCE) are the constituents of concern (COCs) and the drivers for consideration of corrective actions at the Site (Barr, 2020b). Based on TCE's limited extent (and overlap with vinyl chloride) in groundwater at ERL, the Initial Performance Evaluation primarily focuses on vinyl chloride.

The Initial Performance Evaluation is organized into the following sections:

- Section 2, Background, describes the facility, the existing groundwater monitoring program, area water supply wells, and the hydrogeologic conceptual site model.
- Section 3, Corrective Action Implementation, describes actions taken to protect human health by replacing water supply wells, augmenting the groundwater monitoring network, and conducting initial performance monitoring.
- Section 4, Natural Attenuation Evaluation, provides an evaluation of the initial three years of natural attenuation data collected, including a review of geochemical conditions, plume stability, concentration trend analyses, and estimated attenuation rates.
- Section 5, Initial Protectiveness Evaluation, provides an evaluation of the corrective action approach based on the primary and secondary corrective action goals.
- Section 6, Next Steps, describes the planned actions, sequencing, and schedule for upcoming work.

2 Background

The following sections provide an overview of the Site background.

2.1 Facility Description

ERL is authorized for operation as a solid waste disposal facility by the MPCA under Solid Waste Permit SW-74 and licenses and permits from Sherburne County and the City of Elk River. ERL was initially permitted for waste disposal in 1972. A portion of the landfill, including cells 1 through 5, 7, 9, and the northern portion of cell 6 (6N), was constructed prior to the effective date of Resource Conservation and Recovery Act (RCRA) Subtitle D regulations. This Pre-Subtitle D area consists of 28.1 acres of unlined landfill cells which contain approximately 5 million cubic yards of waste that was placed between 1972 and 1990 (approximately). Waste Management acquired ERL in 1995 after unlined filling had ceased. Unlined landfill cells 1 through 5, 7, and 9 are capped (closed) with final cover or covered with lined construction and demolition (C&D) debris disposal cells DC-1 through DC-3. Cell 6N was constructed with a Pre-Subtitle D liner consisting of 80-millimeter-thick, high-density polyethylene and a leachate collection system. All landfill cells other than those described previously in this Section 2.1, including C&D debris disposal cells DC-4A and DC-5A, were constructed with composite liners and leachate collection systems. The leachate collected from the lined cells is disposed off-site at publicly owned treatment facilities. Figure 2 shows the Site layout and groundwater monitoring locations. MPCA Permit SW-74 provides additional details on ERL's construction and operating history.

2.2 Groundwater Monitoring Program

The ERL established the current monitoring program in accordance with the requirements of Minnesota State Rules 7035.2815, subpart 14 and Solid Waste Permit SW-74 (MPCA, 2015). Routine monitoring events are based on Permit SW-74 as reflected in the Sampling and Analysis Plan (SAP) dated November 2021 and subsequent updates (Barr, 2022), annual reports, and recommendations made under separate covers. Groundwater sampling is conducted by Alliance Technical Group of Circle Pines, Minnesota (Alliance). Alliance works in a similar capacity for the MPCA, including groundwater sampling at various closed landfill facilities in the State of Minnesota. Groundwater samples are analyzed by Pace Analytical National Center for Testing and Innovation in Mount Juliet, Tennessee (Pace National). Pace National is accredited by the Minnesota Department of Health (MDH) for groundwater testing.

The 2023 groundwater monitoring network includes approximately 51 monitoring wells and seven piezometers for a total of 58 monitoring locations (Figure 2). The monitoring network targets the outwash to provide early detection of potential releases and will be used for ongoing monitoring of corrective actions. The lower outwash is a sand deposit overlain (confined) by fine-grained till. The lower outwash is present from approximately 60 to 100+ feet below ground surface (bgs) west of the landfill, is laterally continuous beneath ERL and Rice Lake/Tibbits Brook (RL/TB) (Barr, 2018), and is the focus of the corrective actions based on the presence of organics in groundwater. Most wells identified with a "C" suffix are screened at the top or middle of the lower outwash. Most wells identified with an "L" are constructed at the bottom of the lower outwash deposit, near the bedrock (or at comparable elevations near cell 20

where the bedrock surface drops in elevation). Monitoring wells P-29D and P-311D are screened in the uppermost bedrock aquifer, the Mt. Simon Sandstone, for vertical groundwater compliance monitoring purposes (Barr, 2022). Table 1 identifies the hydrostratigraphic unit in which each well is completed and well construction details are provided in Table 2.

2.3 Area Water Supplies

The ERL and surrounding area are not serviced by public water. Water at the ERL office is provided by a 360-foot well (unique ID #420558) referred to as the ERL Shop Well (Barr, 2020b). With the exception of the Ridges of Rice Lake Development community supply well (unique well ID #626766) and the seven replacement water supply wells located immediately southwest of the Site[1], residences downgradient of the Site have individual domestic water supply wells that are known or assumed to be completed in the lower outwash unit. The Ridges of Rice Lake Development well is completed in an outwash near the base of buried bedrock valley between 294 and 325 feet bgs (approximate elevations 699-668 feet relative to mean sea level [MSL]), and the water supply wells located within a half mile of the Site are completed to total depths of 299 feet or more in the Mt. Simon Aquifer or deep sand (similar to the Ridges of Rice Lake Development well).

The ERL samples (i.e., offers to sample) nine domestic wells, the Ridges of Rice Lake community supply well, and the ERL Shop well annually per Permit SW-74. Nine additional residential wells have been sampled as part of past hydrogeologic investigations (Barr, 2018); four of these wells are subject to ongoing sampling (contingent on owner's permission) as part of Work Plan implementation. No organics have been detected in the residential wells. Appendix A provides a summary of the water supply wells located west of the Site (Table A1) and includes water supply well sampling results from 2011 – 2023 (Table A2). The locations of the area residential wells are shown on Figure 3.

2.4 Hydrogeologic Conceptual Model

Detailed hydrogeologic studies have been completed at ERL (Geomatrix, 1998, 1999, and 2000), the North Development Area (NDA; Geomatrix, 2003), the South Development Area (SDA; Geomatrix, 2005a), and in/near RL/TB (Geomatrix, 2004a, 2005b, and 2007; Barr, 2016 and 2018). These investigations have included geologic core logging, installation of monitoring wells, and collection of hydrogeologic data. The hydrogeologic investigation report for the NDA was submitted as part of the facility permitting process (Geomatrix, 2003). The NDA is permitted and partially developed for the disposal of C&D debris and approved industrial waste. A revised hydrogeologic investigation report for the SDA was submitted in 2005 (Geomatrix, 2005a). The investigation of groundwater flow and water quality west of the landfill in the vicinity of RL/TB began in 2003 and was completed in 2018. The findings from these investigations were incorporated into site-wide hydrogeologic evaluation reports (Barr, 2015a, 2016, and 2018) and are incorporated into the following hydrogeologic conceptual model.

[1] Six residential wells were replaced per the Work Plan. One residential well was replaced in 2015.

The geology at ERL includes 100 to 200 feet of glacial deposits overlying Paleozoic bedrock (Figure 4). The predominant glacial deposits include two outwash units, referred to as the upper and lower outwash, and sandy-silt textured till that is the result of ice advances from the northeast (i.e., Cromwell and older Pre-Wisconsinan tills). The upper outwash consists primarily of fine-to-medium sand and varies in thickness from 130 feet (the bottom 10 to 40 feet of which is saturated) on the east side of the Site to less than 10 feet in some areas west of the Site where the unit is confined by a surficial till deposit (Cromwell and/or New Ulm locally). Farther west of the Site, the upper outwash merges into RL/TB. The lower outwash generally grades downward from fine-to-medium sand to coarse sand with discontinuous gravel lenses near the base of the unit. The lower outwash extends west of the Site beneath and beyond the RL/TB (Barr, 2016 and 2018) (Figure 5). The till is present approximately 80 feet bgs east of the Site and at the ground surface to the west, largely due to ground surface elevation changes. The till is inferred to be discontinuous under the central (Pre-Subtitle D) portion of ERL (Barr, 2015b). The Eau Claire Formation, a regional confining unit, is the uppermost continuous bedrock unit at the Site. The Eau Claire Formation forms a local bedrock high in the southwestern portion of the Site and, in places, is capped by clayey, Pre-Wisconsinan till and/or a thin mantle of fine sandstone/siltstone from the basal Wonewoc Formation (Barr, 2015a). The Mount Simon Sandstone is the uppermost bedrock aquifer in the area and is underlain by crystalline Pre-Cambrian bedrock.

The upper and lower outwash units constitute the uppermost permeable groundwater flow pathways at the Site. The groundwater flow direction in the lower outwash unit is east-to-west in the central portion of the Site and transitions to the southwest in the southern portion of the Site (Figure 6). Groundwater at the base of the lower outwash flows to the west-southwest beneath RL/TB and is likely somewhat constrained near the Site by the local bedrock high. Vertical hydraulic gradients are downward between the upper and lower outwash units in the east, central, and southern portions of the Site, indicating the potential for downward flow/recharge in these areas. Upward vertical gradients are present between the lower outwash and RL/TB. Based on the magnitude of the upward gradient, the potential for groundwater discharge from the lower outwash through the till to RL/TB exists.

2.5 Conceptual Release Model

ERL has been the subject of numerous hydrogeologic investigations and more than 40 years of groundwater monitoring. The evidence from these activities points to both leachate and landfill gas from the Pre-Subtitle D area as the source area for organic impacts to groundwater at ERL (Barr, 2020b and 2015a; Geomatrix, 1998).

Past corrective actions, including final cover placement and the installation of an active gas extraction system, appear to have significantly reduced the magnitude of the release from the Pre-Subtitle D area. Additionally, in response to a slug of leachate that affected groundwater observed at well P-17C, ERL installed and operated a diffusive oxygen system to degrade non-chlorinated organics via cometabolic degradation between 2003 and 2008. As a result of the past corrective actions, the Pre-Subtitle D portion of the facility appears to have diminished as a source, and the high organics concentrations documented in groundwater at wells P-17C and P-43B in the early to mid-1990s are no longer present in groundwater near/southwest of the Pre-Subtitle D portion of the facility (Barr, 2020b).

West-southwest of the facility, low concentrations of vinyl chloride and other organics in groundwater are limited to the base of the lower outwash (Barr, 2018). Water quality data from 2023 indicate the western (distal) fringe of the vinyl chloride plume is between wells P-334L and P-342L (Figure 2). Vinyl chloride and other volatile organic compounds (VOCs) were not detected in 2023 samples from well P-342L; however, vinyl chloride was detected above the Health Risk Limit (HRL) in 2023 at well P-334L and P-694477 (Barr, 2024). Based on the Site history, the leading edge of the plume is anticipated to result from higher vinyl chloride concentration flux from the 1990s (or prior; Barr, 2020a), and current vinyl chloride flux appears to be substantially lower, likely as a result of past groundwater corrective actions (i.e., final cover, active gas extraction, and the P-17C Area diffusive oxygen system). The groundwater velocity in the lower outwash unit (where organics mass transport is occurring) is estimated to be approximately 117 feet/year, based on the observed extent of organics downgradient of the landfill.

2.6 Corrective Action Approach

The corrective action approach involves preventing vinyl chloride exposure to downgradient residents by replacing residential water supply wells with deeper wells and the development of a groundwater monitoring network and program to evaluate and document the effects of natural attenuation (Barr, 2021). Corrective action activities completed to date are summarized in Section 3.

A framework to manage monitoring-triggered contingencies in a timely fashion was also established (Barr, 2021). Scenarios that would trigger contingency actions include:

1. Organic compound detection in a water supply well sample; and
2. Confirmed organic compound detection in a sentinel well sample.

Table 3 summarizes the contingency scenarios, actions, and approximate implementation timing. Each scenario relates to the detection of an organic compound(s) in groundwater that is attributable to ERL at a water supply well or a monitoring well. No contingencies have been triggered by monitoring results to date.

3 Corrective Action Implementation

The following sections describe corrective actions completed since the Work Plan was published (Barr, 2021).

3.1 Water Supply Well Actions

The Work Plan presented an evaluation of water supply wells in the context of plume location combined with other factors to determine well replacements. Based on the evaluation presented in the Work Plan, ERL replaced selected four residential wells for replacement (Unique Well IDs 00626780 and 00655131 and MPCA well IDs ZW00214 and ZW00215). ERL also voluntarily replaced the residential wells to the two southernmost residences in the neighborhood southwest of the landfill (Unique Well IDs 00527979 and 00638355) despite them being located beyond the evaluation criteria presented in the Work Plan. Each replacement well was installed in a deeper hydrogeologic unit that is not in communication with the lower outwash (i.e., the Mt. Simon Sandstone or outwash at the base of the bedrock valley). A summary of well replacement activities is included in Appendix B, and replacement well locations are shown on Figure 7.

Permitting, drilling, well installation, development, pump installation, and connection work were conducted by a licensed well contractor in accordance with Minnesota Rules Chapter 4725 (Well Code) and applicable rules/codes. Water samples were collected by the driller at the end of well development activities and analyzed for general parameters required by Minnesota Rule 4725.5650 (e.g., coliform bacteria, nitrate-nitrogen, and arsenic). ERL also collected a water sample for organic compounds analysis (via USEPA Method 8260) to verify the groundwater is free of organics (data are included in Appendix A). In 2023, after the wells were connected to the residences, water samples were collected from the kitchen spigots for lead and manganese analysis per MDH guidance (MDH, 2022). Organics were not detected in any of the replacement wells and other analyte concentrations met applicable groundwater criteria. After the connections were completed and the new well was operational, the original water supply wells (plus an additional well encountered at 12163 223rd Avenue NW) were sealed by the licensed well contractor. The southernmost replacement well (22130 Quinn St. NW) has not yet been connected to the residence due to owner non-responsiveness. The Well Construction Records and Well Sealing Records are included in Appendix B.

Four additional wells (Unique Well IDs 00625475, 00720300, 00608116, and 1000022317) are sampled per the Work Plan (see Figure 7 for locations). Sample results are included in Appendix A. Organics were not detected in any of the samples collected at these locations and other analyte concentrations met applicable groundwater criteria.

3.2 Monitoring Network Enhancements

Four monitoring wells were installed to supplement the groundwater network downgradient of ERL per the Work Plan. Monitoring well locations are shown on Figure 2, construction details are summarized in Table 2, and well logs are included in Appendix C.

- Well P-338L was installed between wells P-325L/P-326L and well P-334L to monitor organics concentrations along the plume centerline. The groundwater data from this location is used to assess the stability of the organics plume, refine the degradation rate estimates, and assess in-plume groundwater geochemical conditions.

- Well P-340L was installed along the northwestern corner of the ERL property, north of P-328L and west of P-327L, as requested by Sherburne County. Data from this location is used for sentinel monitoring, better constraining the plume delineation west-northwest of the Pre-Subtitle D area, and for providing additional hydraulic head data near the northern edge of RL/TB.

- Well P-341L was installed south of the plume and used for sentinel monitoring, better constraining the plume delineation to the southwest, assessing geochemical conditions and groundwater flow direction south of the plume. Data from this well is also considered in groundwater contingency monitoring.

- P-342L was installed at the base of the lower outwash aquifer downgradient of well P-334L (i.e., beyond the current delineated plume extent) to assess plume stability and geochemical conditions near/beyond the plume terminus. A groundwater sample was collected from a temporary well screened at the top of the lower outwash aquifer due to the greater-than-anticipated thickness of the lower outwash aquifer observed during the installation of P-342L. The observed thickness of the lower outwash at P-342L (58 feet) was 34 feet greater than the lower outwash at upgradient location P-334L (24 feet). Vinyl chloride was not detected in P-342L or the temporary well.

As detailed in Appendix C, drilling and monitoring well construction were conducted by a licensed well contractor in accordance with Minnesota Well Code. Drilling was conducted using rotasonic techniques using field methods that were largely consistent with previous well installation efforts at the Site.

One well, P-339L, was planned for installation downgradient of well P-334L for sentinel MNA monitoring purposes; however, this well has not been installed because the property owner has not granted access for well installation[2]. As a result, P-342L was installed in an accessible area and the installation of P-339L further downgradient (Figure 8) is delayed until access is granted by the landowner.

3.3 Initial Performance Monitoring (2021-2023)

The MNA network includes the following wells located in and outside of the vinyl chloride plume.

- Near source (landfill edge): P-17C, P-302C, P-304C, and P-308L
- Downgradient (compliance boundary): P-313C, P-321L, and P-323L
- Mid-plume (property boundary): P-325L, P-326L, P-338L

[2] The property owner provided (and continues to provide) access to install and monitor wells P-333L and P-342L.

- Distal Plume: P-334L, P-342L
- Sentinel: P-339L (planned location – see Section 3.2 for details)
- Upgradient: P-22L
- Sidegradient: P-340L and P-341L

The locations of existing and planned monitoring wells are shown on Figure 8. The MNA network provides spatial coverage in the plume and achieves the criteria for verification and long-term monitoring phases for natural attenuation remedies (USEPA, 1998; MPCA, 2006). The parameters analyzed as part of the natural attenuation monitoring program are based on USEPA (1998) and MPCA (2006) technical protocols for evaluating natural attenuation and include:

- Vinyl chloride and other organic compounds on the USEPA Method 8260 list. The vinyl chloride and organics concentration data which are used to assess point-specific concentration trends, organics degradation rates, precursor-daughter product ratios, and plume stability;

- Field parameter data (e.g., dissolved oxygen, oxidation-reduction potential, conductivity, pH, temperature) which are used to assess geochemical conditions in and around the plume; and

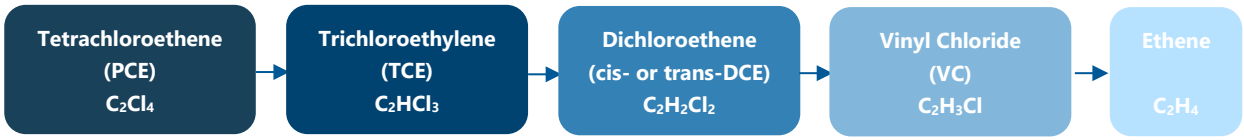
- Natural attenuation indicator parameter data (i.e., methane, ethane, ethene, total organic carbon, sulfate, sulfide, manganese species, and iron species) which are used to assess groundwater redox state and support the evaluation of natural attenuation pathways, mechanisms, and/or limitations.

MNA monitoring was conducted in conjunction with routine triannual groundwater monitoring events (i.e., spring, summer, and fall quarterly events) over the period of 2021 to 2023. MNA monitoring results are tabulated in Appendix D and evaluated in Section 4.0. The MNA monitoring results have undergone quality assurance review as described in ERL quarterly monitoring reports published since 2021.

4 Natural Attenuation Evaluation

Natural attenuation includes destructive processes (biodegradation and abiotic degradation) and nondestructive processes (dispersion, sorption, and volatilization) that affect the fate and transport of organic compounds in groundwater systems (USEPA, 1998). Biodegradation is generally considered the most important destructive attenuation mechanism and commonly occurs under strongly reducing groundwater conditions near source areas and under less reducing or aerobic conditions farther away from source areas. In areas with lower organic compound concentrations, non-destructive processes can be more significant than destructive processes. The rates at which these non-destructive processes reduce concentrations are a function of groundwater flow, aquifer, and chemical parameters.

One process for biodegradation of chlorinated ethenes is reductive dechlorination, which occurs under anaerobic/reducing groundwater conditions typically found near source areas. In this process, electron donors (typically hydrogen atoms) sequentially replace chlorine atoms, transforming highly chlorinated compounds (e.g., tetrachloroethylene [PCE] and TCE) into lesser chlorinated compounds and ultimately to ethene, as depicted below.



PCE and TCE are degraded under anaerobic conditions. Vinyl chloride and DCE may be degraded under aerobic or anaerobic conditions. Dechlorination of vinyl chloride is a slower process compared to the biodegradation of more highly chlorinated compounds. Vinyl chloride can also be degraded under less reducing conditions (with the formation of CO_2 and/or methane), under aerobic conditions (aerobic direct metabolism or co-metabolism), or with other abiotic processes in the presence of certain minerals such as magnetite.

The following sections present an evaluation of the initial three years of natural attenuation data at ERL.

4.1 Geochemical Conditions

The following sections present the findings of geochemical analyses performed during Initial Performance Monitoring.

4.1.1 General Indicator Parameters of Reductive Dechlorination

Natural attenuation indicator parameters were monitored at MNA network wells per the Work Plan to better understand subsurface processes influencing the reductive dechlorination downgradient of ERL. The results are included in Appendix D. Summer 2023 data for several parameters presented below are displayed on maps included as Appendix E. The discussion below summarizes the general indicator parameter concentrations in groundwater at ERL.

- Dissolved Oxygen (Figure E1): Dissolved oxygen is routinely measured with a field probe during groundwater sampling at ERL. Past results have been somewhat erratic due in part to suspected groundwater interferences (especially at well P-17C); however, more recent data have been collected with a newer probe and/or field titration kit to improve data quality. Dissolved oxygen concentrations in the lower outwash aquifer along the western edge of ERL are generally around or less than 1 mg/l. These low oxygen conditions are consistent with the confined outwash setting and are conducive to anaerobic biodegradation of chlorinated compounds.
- pH: pH values downgradient of ERL are consistently near neutral (pH 6 to 8) and do not pose issues to the progression of biodegradation.
- Alkalinity (Figure E2): Increasing carbon dioxide concentrations from microorganism activity can increase alkalinity in groundwater through reactions with aquifer materials (NJDEP, 2022). Alkalinity concentrations within the extents of the vinyl chloride distribution are generally 2x to 5x greater than upgradient of ERL at well P-22L, at sidegradient locations wells P-340L and P-341L, and downgradient well P-342L. The alkalinity concentration at well P-334L, located at the distal end of the plume, is comparable to upgradient/background conditions. The increased alkalinity near the western edge of the landfill is conducive to and can be indicative of biological activity in this region of the aquifer with an apparent reduction in activity beyond the property boundary. Alkalinity concentrations (increases) may also be affected by leachate or landfill gas effects.
- Oxidation-Reduction Potential (ORP, Figure E3): ORP is routinely measured with a field probe during groundwater sampling at ERL. Attaining an accurate measurement of ORP can be difficult due to the in-situ heterogeneity in aquifers and redox conditions. Results have been somewhat erratic (especially at well P-17C); however, ORP values indicate an overall reduction in groundwater conditions downgradient of ERL.
- Chloride: Many MNA studies typically utilize chloride concentrations as an indicator of reductive dechlorination as it is released into groundwater during the biodegradation process so that chloride is elevated compared to background conditions. Chloride is not an effective MNA indicator at ERL due to the comparatively low concentrations of chlorinated solvents in groundwater at ERL, the high chloride concentrations in leachate, and the chloride concentrations related to road deicing in the area (e.g., 100s ppm upgradient of ERL). It is noted that chloride concentrations drop from approximately 17 mg/L to 1 mg/L between wells P-334L and P-342L (Appendix D, Table D1).
- Total Organic Carbon (Figure E4): Organic carbon serves as an energy source for microorganisms that drive reductive dechlorination. Organic carbon concentrations greater than 20 mg/l are desired in an area with anaerobic biodegradation. Organic carbon concentrations are greatest along the western facility edge downgradient from the Pre-Subtitle D Area (18 - 41 mg/l) and lower (~2 - 10 mg/L), extending through the plume to P-338L. Low organic carbon concentrations near the detection limit (~1 mg/L) are present along the fringe of the vinyl chloride extents at P-334L. The low organic carbon may be a limiting factor for reductive dechlorination at locations downgradient of the western edge of the landfill but do not prohibit other potential degradation pathways.

- Sulfide: Sulfide can be toxic to dechlorinating microorganisms at concentrations greater than 20 mg/L. Where detected, sulfide concentrations were below 1 mg/L in collected samples; therefore, sulfide toxicity does not appear to be a limiting factor to biodegradation.

4.1.2 Terminal Electron Acceptors

Chlorinated ethenes act as electronic acceptors under anaerobic conditions, and organic carbon or other co-mingled organics in groundwater act as electron donors. The progression of terminal electron acceptors (TEA) under groundwater conditions with active biodegradation is well documented and provides additional information regarding prevailing geochemical conditions and attenuation processes. After depletion of dissolved oxygen, nitrate (NO_3^-) is utilized as the preferred TEA followed by reduction of manganese (Mn^{4+}) and iron (Fe^{3+}). Strongly reducing conditions can facilitate use of sulfate (which produces sulfide), and under even stronger reducing conditions, methanogens can use carbon dioxide as an electron acceptor to produce methane. The initial TEA data is discussed below and shown on the referenced figures.

- Dissolved Oxygen (Figure E1): Dissolved oxygen concentrations are generally around or less than 1.0 mg/L in groundwater in the lower outwash downgradient of ERL. These low oxygen conditions are consistent with the confined outwash setting and are conducive to anaerobic biodegradation of chlorinated compounds. While anaerobic settings are necessary to degrade highly chlorinated compounds via reductive dechlorination (PCE and TCE), lesser chlorinated compounds (DCE and vinyl chloride) may also degrade under aerobic settings (i.e., aerobic respiration where vinyl chloride is metabolized by bacteria or mineralization through direct oxidation).

- Nitrate (NO_3^-; Figure E5): Nitrate is the first TEA utilized for respiration by microorganisms in anaerobic conditions. Nitrate was non-detect at all well locations (where analyzed) over the period of 2021-2023 except for one sample at P-341L located sidegradient of the vinyl chloride extents; therefore, nitrate is either not present or rapidly utilized where present. Based on the absence of nitrate upgradient of ERL, nitrate is not anticipated to be a significant TEA for the groundwater system downgradient of the facility.

- Reduced Iron (Fe^{2+}; Figure D6) and Manganese (Mn^{2+}; Figure E6): Ferric iron (Fe^{3+}) and manganese (Mn^{4+}) are utilized as TEAs following exhaustion of nitrate. Compared to background conditions, elevated concentrations of reduced iron ((Fe^{2+}) and manganese (Mn^{2+}) are present along the western edge of the landfill. Generally, concentrations of reduced iron above 1 mg/L is indicative of microbial degradation of organic compounds. Reduced iron concentrations are greatest along the western edge of the landfill. The presence of significantly reduced iron and manganese suggests that iron/manganese reduction is the dominant reducing geochemical condition downgradient of ERL.

- Sulfate (SO_4^{2-}; Figure E7): The absence of sulfate can be used as a TEA to identify strongly reducing conditions. Sulfate is depleted after nitrate, iron, and manganese have been depleted. Sulfate concentrations below 20 mg/L, and lower than background conditions, are generally indicative of active anaerobic biodegradation. P-17C and P-308L have lower concentrations of

sulfate than upgradient well P-22L. Based on the sulfate concentrations (and the presence of dissolved iron and manganese), some sulfate reduction may be occurring in/upgradient of the P-17C/P-308L area; however, sulfate reduction does not appear to be occurring to a significant degree further downgradient of ERL.

- Methane (CH_4, Figure E8): Methane concentrations greater than 0.5 mg/L can signal organics degradation by methanogenesis under strongly reducing conditions. Concentrations at/greater than 0.5 mg/L are present along the western edge of the landfill and the methane distribution generally aligns with the vinyl chloride in groundwater. Strongly reducing conditions are generally not observed farther downgradient of ERL in RL/TB; therefore, methanogenesis is not anticipated to be a significant TEA downgradient of ERL. It is noted that methane concentrations in groundwater at P-302C have been greater than 20 mg/L in most samples collected in recent years. These P-302C methane concentrations are one to two orders of magnitude greater than concentrations at other locations, which may indicate strongly reducing conditions beneath the Pre-Subtitle D portion of the facility and landfill gas effects (although P-302C is completed as a submerged screen in the top of the lower outwash).

4.1.3 Aquifer Matrix – Magnetic Susceptibility Testing

The presence of certain reactive iron-bearing soil minerals such as mackinawite, pyrite, siderite, magnetite, green rust, and goethite with adsorbed Fe (II) in the aquifer can substantially contribute to the overall attenuation of chlorinated compounds in groundwater via abiotic degradation on the mineral surfaces (Hu et al., 2009). These minerals are typically found in iron and/or sulfate-reducing environments. As indicated in the previous section, elevated concentrations of reduced iron are present in the lower outwash aquifer downgradient of ERL. Additionally, abiotic degradation of cis-DCE has been well-studied at another Minnesota site where the primary reactive mineral was magnetite (Ferrey et al., 2004).

Magnetite is the most abundant mineral in natural sediment that exhibits magnetic behavior, but no direct chemical test is available for quantification of magnetite; however, magnetite and the potential for abiotic degradation at/downgradient of ERL was assessed by performing magnetic susceptibility analyses on aquifer materials. The magnetic susceptibility analysis results can then be compared to surface area and degradation rate constant data from microcosms and other sites to assess the potential for abiotic degradation. If there is sufficient magnetic susceptibility in aquifer sediment, magnetic materials may facilitate additional degradation of chlorinated compounds at ERL (i.e., via abiotic processes).

Nine samples of saturated till and outwash units were collected during well installation activities at wells P-342L and P-410L in 2023 for magnetic susceptibility testing by Microbial Insights. The testing results are presented in Appendix F. The magnetic susceptibility values (average = 1.3×10^{-6} m^3/kg) are consistent with published values at other sites where abiotic degradation of chlorinated compounds is occurring (He et al., 2009), but the associated first-order rate constants for vinyl chloride at ERL are lower than anticipated when compared to the published values. Based on the magnetic susceptibility testing of lower outwash and till samples collected from P-342L and P-410L, it appears that abiotic degradation is a potential attenuation mechanism at ERL, but the overall contribution to the attenuation of vinyl chloride may be limited.

4.1.4 Summary of Geochemical Conditions

Based on the geochemical data described above, conditions are generally suitable for reductive dechlorination near the western edge of ERL, particularly in and downgradient of the P-17C Area. The decrease in concentrations of chlorinated compounds over time in this area and the sparsity of vinyl chloride precursors in groundwater support this finding. The dominant reducing environment in the groundwater system downgradient of the landfill appears to be iron/manganese reduction (which is favorable for reductive dechlorination). Some sulfate reduction may be occurring in the P-17C/P-308L area or beneath the Pre-Subtitle D portion of the facility; however, sulfate reduction does not appear to be significant downgradient of ERL. Near and beyond the property boundary, conditions for reductive dechlorination become less suitable as organic carbon levels are lower. Farther downgradient, corresponding with generally lower vinyl chloride mass, groundwater conditions are more amenable to limited attenuation of vinyl chloride via other mechanisms such as aerobic or abiotic degradation processes.

4.2 Plume Stability

The following sections provide an assessment of the stability of the vinyl chloride plume at ERL.

4.2.1 Vinyl Chloride Plume Extent Delineation

The overall extent of the vinyl chloride plume remains consistent with the delineation provided in the Work Plan (Barr, 2021). No organics (including vinyl chloride) have been detected in samples collected from sentinel wells P-327L, P-340L, P-328L, P-329L, P-333L, P-335L, and P-341L or at well P-342L. The absence of vinyl chloride (and other organics) and low chloride concentrations (~1 mg/L) in groundwater at well P-342L supports the distal extent of vinyl chloride is defined at the base of the lower outwash.

The thickness of the lower outwash encountered during the installation of well P-342L was greater than observed elsewhere in the study area. For comparison, the lower outwash is approximate 58 feet thick at well P-342L and approximately 24 feet thick at well P-334L, which is located approximately 1,000 feet to the east-northeast (upgradient). Due to the increased thickness of the outwash, a temporary well was placed in soil boring B-342, which was placed approximately 21 feet west of well P-342L and screened from 45 to 55 feet below ground surface (i.e., near the top of the outwash deposit). No organics were detected in the groundwater sample from B342. Further discussion of the monitoring well installations, boring B-342, and the thickness of the lower outwash near P-342L are provided in Appendix C.

Given the thickness of the outwash at P-342L, additional groundwater investigation is recommended in the well P-342L area to further evaluate hydrogeologic conditions in the lower outwash within this area.

4.2.2 Well Concentration Trend Analysis

Vinyl chloride concentrations were evaluated using graphical and statistical methods as described below. Concentration plots and the Mann-Kendall statistical analysis are included in Appendix G.

4.2.2.1 Vinyl Chloride Trend Analysis

Overall vinyl chloride trends are summarized below. For wells with sufficient datasets[3], a statistical analysis (Mann-Kendall) was performed as a general assessment of the vinyl chloride concentration trends since 2015 (when low-level analysis for vinyl chloride began and the reporting limit was reduced to 0.05 µg/L). The results of the Mann-Kendall statistical analysis are provided in Appendix G and are discussed below by relative area in the vinyl chloride plume. Figure 9 illustrates the well locations with statistically increasing and decreasing vinyl chloride concentration trends (and well locations of stable/no trend). Vinyl chloride concentration trend plots for individual wells are provided on Figure G1.

- Southern two-thirds of the vinyl chloride plume: vinyl chloride concentrations continue to decrease or are stable in groundwater in the central and southern portions of the plume (i.e., approximately the southern two-thirds of the plume) along the western edge of the landfill.
    - A statistically significant (>95% confidence level) decreasing trend was observed at six locations (wells P-304C, P-313C, P-314C, P-321L, P-323L, and P-326L) in this area of the plume.
    - A stable or no statistically significant trend was observed at two locations (wells P-308L and P-309C).
    - No statistically significant increasing trends were observed in this area of the plume.
    - At several wells located near the compliance boundary (P-313C, P-314C, P-321L, P-323L), vinyl chloride concentrations have decreased to near or below the HRL (and periodically are not detected).

- Northern one-third of the vinyl chloride plume: vinyl chloride concentrations in the northern portion of the plume along the western edge of the landfill have generally been stable except for P-302C, which has shown an increasing trend.

    - No statistically significant decreasing trends were observed in this area of the plume.
    - A stable or no statistically significant trend was observed at six locations (P-29C, P-301C, P-320C, P-320C2, P-320L, and P-325L).
    - A statistically significant increasing vinyl chloride trend was observed at one location (P-302C).
    - Vinyl chloride concentrations at well P-321L, located upgradient of P-325L, peaked around 2016 and have since decreased. The observed increase in concentrations during 2020-2021 at P-325L may be related to the downgradient migration of groundwater previously observed at P-321L. Vinyl chloride concentrations at P-325L subsequently decreased in 2022-2023.

- Vinyl chloride concentrations in the distal (western) portion of the plume generally show increasing trends; however, vinyl chloride was not detected downgradient of P-334L.

[3] Eighteen wells did not have enough data above the reporting limits for vinyl chloride to complete the trend analysis. See Appendix G for details.

- A statistically significant increasing trend was observed at two locations (P-334L and P-694477). Vinyl chloride concentrations at these locations have been increasing since approximately 2020.
- Consistent with previous results, no vinyl chloride was detected at distal wells P-333L, P-335L, or P-342L located downgradient of the plume.
- There is insufficient data above reporting limits to complete the trend analysis at the other locations where vinyl chloride has been detected in the distal part of the plume (P-338L).
- Based on historic organics concentration data at ERL and estimated groundwater flow velocities, it is possible that the remnants of the slug of elevated organics concentrations observed at P-17C in 1994 may be reaching the distal portion of the plume (Barr, 2020a)

It is noted that the statistical trend analysis of vinyl chloride concentrations can be complicated/misleading where higher chlorinated precursor compounds are present and sequential dechlorination is occurring due to variable reaction rates that degrade precursor compounds (such as TCE and DCE) to produce daughter compounds (such as vinyl chloride). In such cases, stable or increasing concentration trends for daughter products, such as vinyl chloride, may be the result of more rapid precursor product degradation that results in increased daughter product concentrations, which results in masking the actual degradation rate of the daughter product (which occurs at a slower rate).

4.2.2.2 Vinyl Chloride Precursors and Molar Mass Concentrations

Chlorinated ethene precursors to vinyl chloride in the reductive dechlorination attenuation process, including TCE and cis-1,2-dichloroethene (cDCE), are present in groundwater along and downgradient of the western edge of the landfill in the vicinity of the P-17C Area (Figure E10). Over the period of 2021 to 2023, TCE was detected in groundwater at three wells P-304C, P-313C, and P-323L). cDCE was also detected in groundwater at each of the three locations where TCE was detected but also extended further downgradient to wells P-338L and P-694477 (Figure E10). Time series plots for these compounds, in addition to total chlorinated ethene molar concentrations (molar tCVOC), at these wells are included in Appendix G (Figure G2). Concentrations of TCE, cDCE, and molar tCVOCs at these wells show stable or declining trends.

As described in Section 4.0, vinyl chloride is produced as a daughter product via reductive dechlorination from cDCE. The sequential dechlorination pathway (stepwise removal of a chlorine atom and replacement with hydrogen atom), which includes cDCE and vinyl chloride, is commonly from more highly chlorinated compounds tetrachloroethylene (PCE) and TCE. Because vinyl chloride is a daughter product of cDCE dechlorination, the extent of vinyl chloride in groundwater can be directly related to where cDCE degrades to vinyl chloride along the flowpath. For example, 1 µg/L of cDCE degrades to an equivalent micromolar mass of vinyl chloride with a concentration 0.6 µg/L[4] (lower concentration because the molecular weight of vinyl chloride is lower than cDCE); therefore, the low concentrations of cDCE that are observed in

[4] Similarly, 0.083 µg/L of cDCE degrades to an equivalent micromolar mass of vinyl chloride with a concentration 0.05 µg/L (Intervention Limit).

groundwater can degrade to vinyl chloride concentrations well above the reporting limit (0.05 µg/L). This process can mask the overall magnitude of vinyl chloride degradation. To further explore the relationship of cDCE to vinyl chloride downgradient of ERL, a low-level analysis of cDCE was implemented for 2023 to achieve a lower reporting limit (the reporting limit reduced from 1.0 µg/L to 0.1 µg/L). The low-level analysis results show that cDCE is present in groundwater at P-338L and absent at P-334L where vinyl chloride concentrations have demonstrated an increasing trend recently. As a result, it appears that the degradation of cDCE to vinyl chloride in the P-338L area is contributing to the vinyl chloride concentrations in the groundwater system, thereby extending the vinyl chloride plume downgradient (i.e., to well P-334L). The absence of cDCE in groundwater at well P-334L suggests that vinyl chloride isn't being produced in groundwater at P-334L, which in turn supports a plume terminus downgradient of well P-334L as a result of vinyl chloride attenuation.

4.2.3 Vinyl Chloride Mass Flux

The estimated current mass flux of vinyl chloride from ERL through the cross-sectional plane along the western edge of the landfill is 0.017 lbs/year, which is approximately 70% lower than the estimated vinyl chloride mass flux from 2019 and 82% lower than April 2010 (Appendix H). These low total mass and mass flux estimates reflect the decreasing vinyl chloride concentrations observed along the compliance boundary and are anticipated to result in lower downgradient concentrations at the distal end of the plume. The vinyl chloride mass flux estimates/calculation details are included in Appendix H.

4.3 Estimated Attenuation Rates

Well location specific (k_{POINT}) and overall bulk (k_{BULK}) attenuation rates were calculated to further assess vinyl chloride attenuation rates and develop projections of vinyl chloride travel distance based on the initial performance data. Details on attenuation rate calculations and projections are included in Appendix H.

The attenuation rates and the resulting travel distance projections below should be considered approximations based on existing data (at this time) and the stated assumptions (i.e., not definitive estimates). Further long-term monitoring at current vinyl chloride reporting limits and at recently installed wells is necessary to improve confidence in these estimates and refine them as appropriate. Furthermore, downgradient effects of the previously referenced slug of organics observed from 1992-1994 at monitoring well P-17C may influence the calculated attenuation rates (Barr, 2020a).

4.3.1 Well Location Specific Attenuation Rates and Projections

Location-specific vinyl chloride attenuation rates (k_{POINT}) are useful in assessing trends and projecting time until concentrations reach a certain level (e.g., Intervention Limits) at well locations showing decreasing trends. This evaluation was only applied to vinyl chloride in the central and southern portions of the plume (where decreasing vinyl chloride trends are occurring near the compliance boundary and Property Boundary) and not the northern third of the plume (i.e., north of well P-321L) due to the uncertainty stemming from mixed concentration trends.

Using first-order kinetics and k_{POINT} values, projections for when each of these wells may approach Intervention Limits were calculated. The projections range from approximately one year (i.e., 2025 at P-314C and P-323L) to 12 years (i.e., 2036 at P-321L) and are shown in Appendix H (Table H2). Note that the location-specific attenuation rates may be biased low as they do not account for the conversion of precursor compounds (PCE, TCE, and DCE) to vinyl chloride, which is discussed earlier in this report (i.e., the presence of precursor compounds cDCE (and TCE at P-323L) adds a higher degree of uncertainty to the projections for individual wells and the downgradient wells).

4.3.2 Overall Bulk Attenuation Rates and Projections

Overall bulk vinyl chloride attenuation rates (k_{BULK}) from near the source area (P-308L) to the distal well (P-342L) were estimated using trend line analysis methods outlined in MPCA guidance (MPCA, 2006). A primary assumption in applying this method is that the vinyl chloride and other organics have achieved a steady state (i.e., the plume is not expanding). Despite some year-to-year variability in concentrations, it is reasonable to assume a steady-state extent given the long operational history of the facility and non-detect concentrations at distal well P-342L. This assumption is subject to change based on the results of the proposed investigation referenced in Section 4.2.1. The investigation results and continued monitoring at wells along the fringes of the plume will provide further insight into the overall stability of the organics downgradient of ERL. The steady-state assumption was applied to conduct overall vinyl chloride attenuation rate calculations using data from the Summer 2019, 2021, and 2023 monitoring events and the resulting bulk overall vinyl chloride attenuation rate based on vinyl chloride data and total molar concentrations (which incorporate vinyl chloride precursor products) ranged from 0.023 to 0.103/yr (Appendix H). Theoretical projections based on these overall bulk attenuation rates are included in Appendix H.

4.4 Summary

The initial three years of natural attenuation data at ERL provide the following lines of evidence that support the biodegradation of vinyl chloride (and other organics) in groundwater at the ERL.

- Geochemical conditions are conducive to natural attenuation: The dominant reducing environment in the groundwater system downgradient of the landfill appears to be iron/manganese reduction with limited evidence of sulfate reduction in the P-17C/P-308L area. These conditions are favorable for reductive dechlorination near the landfill. Farther downgradient, corresponding with generally lower vinyl chloride mass, groundwater conditions are more amenable to limited attenuation of vinyl chloride via other mechanisms such as aerobic or abiotic degradation processes.

- The vinyl chloride plume has been delineated at the base of the lower outwash: The absence of vinyl chloride (and other organics) and low chloride concentrations (~1 mg/L) in groundwater at well P-342L supports the distal extent of vinyl chloride at the base of the lower outwash is defined.

- Vinyl chloride and precursor concentrations are predominantly decreasing/stable along the western edge of the landfill: Vinyl chloride concentration trends in wells positions along the western side of the landfill continue to show decreasing or stable concentrations over the majority of the plume with limited exceptions.
- The estimated mass flux of vinyl chloride from ERL has significantly decreased over recent years: the mass flux of vinyl chloride from the landfill since 2010 indicates a reduction of organics to groundwater (akin to source reduction) or an increase in degradation in groundwater beneath the Pre-Subtitle D portion of the landfill.

5 Initial Protectiveness Evaluation

Considering the water supply well replacement activities identified in the Work Plan have been completed (Section 3.1), no organics have been detected in the residential water supply wells downgradient of ERL (Appendix A), no new water supply wells have been identified in locations that necessitate monitoring or replacement (Appendix A), no groundwater contingencies have been triggered over the last three (and prior) years (Section 2.6), and the distal extent of vinyl chloride is defined at the base of the lower outwash (Section 4.2.1) the groundwater corrective actions are judged to be protective of human health by preventing exposure to organic compounds in water supply wells. As such, aside from continued monitoring per Permit SW-74 and the Work Plan (Barr, 2021) as updated in this report, no additional actions regarding water supply wells are warranted at this time.

Per the Work Plan, MNA monitoring will continue, and a performance evaluation report (5-Year Evaluation) will be prepared as a standalone report after completing additional MNA monitoring data. The 5-Year Evaluation will include updates of evaluations performed in this Initial Performance Evaluation. If appropriate, the report will include proposed alternative compliance criteria that are developed from Site data and refined attenuation rates[5]. The general concept for developing alternative criteria involves back-calculating alternative criteria concentrations at specific wells using the refined attenuation rates[6]. If the performance evaluation demonstrates that the corrective actions are not protective, ERL will provide a schedule and details for designing and implementing supplemental corrective actions described in the Groundwater Corrective Actions Evaluation Report (CAER; Barr, 2020b) to address vinyl chloride in the groundwater.

The five-year protectiveness determination will be based on professional judgment of multiple lines of evidence from the additional data collected over the next two years. As part of this evaluation, organics trends along the downgradient edge of ERL will be considered. If areas where increasing organic concentration trends persist at levels above the demonstrated natural attenuation capacity, ERL will provide a recommendation regarding the need to implement focused corrective actions presented in the CAER (e.g., in-situ injections, groundwater extraction) to address those areas.

[5] The attenuation rates that alternative criteria will be refined as additional data are collected from the MNA well network; therefore, proposal of alternative criteria may not be appropriate in the first 5-Year Evaluation.
[6] Examples of calculations that may be used to develop proposed alternative criteria are included in Appendix H.

6 Next Steps

The proposed next steps with planned implementation sequencing are summarized below.

- Continue monitoring for MNA parameters (2024-2026; Table 4 and Table 5) and collect concentration data to establish trends at recently installed wells in the vicinity of the delineated plume (e.g., wells P-338L and P-342L).
- Scope and implement a groundwater investigation in the vicinity of well P-342L to further characterize the nature and geometry of the lower outwash and further evaluate hydrogeologic conditions in the lower outwash. A work plan will be submitted in October 2024 (approximate) with the intent to implement the work plan during the 2024-2025 winter season (assuming access is provided by the landowners and field conditions support the safe completion of the work).
- Install monitoring well P-339L if access is granted by the landowner. If access is granted, the MPCA and others will be notified at least two weeks prior to mobilization.
- Prepare the 5-Year Groundwater Corrective Action Performance Evaluation as described in the work plan. The report will be submitted near the end of the first quarter of 2027.

MNA data collected during the routine groundwater monitoring events will continue to be included in quarterly monitoring reports, summarized in Annual Water Quality Monitoring Reports, and reviewed in the context of historical data and the contingency action triggers in the Work Plan. The annual report summaries will include logs for newly installed wells, trend plots of chlorinated organics concentrations, statistical evaluation of vinyl chloride concentrations, discussion of geochemical conditions, and updates to the MNA monitoring plan for the ensuing year.

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Tables

Table 1
2023 Groundwater Monitoring Summary
Elk River Landfill
Elk River, Minnesota

Monitoring Point	Unique Well ID[1]	Annual Sampling Frequency in SAP[2]	2023 Sampling and Analysis Summary[3]	2023 Well Status	Unit Monitored	Well Screen Placement
Monitoring Wells						
P-17C	496278	1x	VOCs (1), Inorganics (1)	In Network (NC), GWCAM	Till/Lower outwash	S
22-OWA	420729	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-22L	801470	1x	VOCs (1), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-29C	496289	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-29D	496294	3x	VOCs (3), Inorganics (1)	In Network	Bedrock	S
36-OWA	498324	--	Depth to water	WL only	Upper outwash	WT
301-OWA	598567	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-301C	598562	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-301L	767989	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
302-OWA	598568	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-302C	598563	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash	S
P-303C	598532	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	S
P-304C	598565	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash	S
P-305C	598566	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-308C	621858	1x	VOCs (1), Inorganics (1)	In Network (NC)	Lower outwash	S
P-308L	836661	--	VOCs (2), Inorganics (1)	GWCAM (NC)	Lower outwash	S
P-309C	635420	1x	VOCs (1), Inorganics (1)	In Network (NC)	Lower outwash	S
P-310C	646855	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	S
P-311C	646854	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	S
P-311L	801471	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-311D	650145	3x	VOCs (3), Inorganics (1)	In Network	Bedrock	S
312-OWA	646853	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-313C	969668	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash	S
P-314C	969669	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
315-OWA	696663	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-315L	722063	3x	VOCs (2), Inorganics (1)	In Network	Lower outwash	S
317-OWA	696666	--	Depth to water	WL only	Upper outwash	WT
P-317L	722092	--	Depth to water	WL only	Lower outwash	S
P-320C	737638	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-320C2	756593	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-320L	737637	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-321L	767990	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-322L	767991	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-323L	786203	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-324L	786202	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-325L	804281	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-326L	804282	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S

Table 1
2023 Groundwater Monitoring Summary
Elk River Landfill
Elk River, Minnesota

Monitoring Point	Unique Well ID[1]	Annual Sampling Frequency in SAP[2]	2023 Sampling and Analysis Summary[3]	2023 Well Status	Unit Monitored	Well Screen Placement
P-327L	812996	1x	VOCs (1), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-328L	812994	1x	VOCs (1), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-329L	812995	3x	VOCs (3), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-333L	828060	2x	VOCs (2), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-334L	828061	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-335L	828062	3x	VOCs (3), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
336-OWA	853108	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
337-OWA	853109	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-337L	853110	1x	VOCs (1), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-338L	853139	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-340L	953140	1x	VOCs (1), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-341L[4]	877298	1x[5]	VOCs (2), Inorganics (2)	Baseline, GWCAS	Lower outwash (bottom)	S
P-342L[4]	871179	2x[5]	VOCs (2), Inorganics (2)	Baseline, GWCAM	Lower outwash (bottom)	S
401-OWA	683321	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
402-OWA	683320	--	Depth to water	WL only	Upper outwash	WT
P-403C	683318	2x	VOCs (1), Inorganics (2)	In Network	Upper outwash	S
405-OWA	683316	--	Depth to water	WL only	Upper outwash	WT
406-OWA	683317	--	Depth to water	WL only	Surficial outwash	WT
407-OWA	683315	--	Depth to water	WL only	Surficial outwash	WT
408-OWA	717920	2x	VOCs (1), Inorganics (2)	In Network	Upper outwash	WT
P-694477[6]	694477	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
Residential Wells						
22447 Tipton St	813437	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12163 223rd Ave	876409	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12269 223rd St	876410	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12265 223rd Ave[7]	876411	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12183 223rd Ave	846412	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
22272 Quinn St	876413	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
22130 Quinn St[8]	638355	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
ERL Shop Well	420558	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
Ridges Develop.	626766	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
22205 Elk Lake Rd	625475	--	VOCs (1), inorganics (1)	GWCAWP	--	--
22275 Elk Lake Rd	720300	--	VOCs (1), inorganics (1)	GWCAWP	--	--

Table 2
Well Information Index
Elk River Landfill
Elk River, Minnesota

Well I.D.	MN Unique Number	Year Installed	Altered or Sealed	Approx. Depth [1]	Screen Interval (ft MSL)	Top of Casing Elevation (ft MSL)	Const Material
1 OW		1979	S/1988	44		974.32	St
1 OWR	443420	1988	S/1999	33	943 - 953	976.69	St
2 OW		1979	S/1988	30		969.80	St
4 OW	420714	1983	S/1999	35	951 - 956	986.40	PVC
5 OW	420715	1983	S/1987	44		984.50	PVC
5 OWA	420721	1985	S/1987	35		984.20	PVC
5 OWR	443421	1988	S/1996	36	948 - 958	983.85	St
6 OW	420716	1983	S/1988	64		1016.15	PVC
7 OW	420717	1983	S/1985	50		988.60	PVC
8 OW	420718	1983	S/1985	45		985.60	PVC
9 OW	420719	1983	S/1985	30		978.00	PVC
10 OW	420720	1984	S/1999	60	922 - 932	981.99	PVC
11 OWA	420722	1985	S/1997	58	951 - 961	1008.64	PVC
12 OWA	420723	1985	S/1996	41	958 - 968	998.50	PVC
P 12A	420724	1985	S/1996	61	937 - 947	997.94	PVC
13 OWA	420725	1985	S/1999	20	952 - 962	971.82	PVC
15 OWA	420726	1985	S/2012	32	961 - 971	993.08	PVC
16 OWA	420728	1985	S/1999	14	944 - 954	958.31	PVC
P 16A	420727	1985	S/1999	31	927 - 937	958.01	PVC
17 OWA	420730	1985	S/2001	32	950 - 960	982.43	PVC
P 17C	496278	1991	Altered: '01, '08; resurveyed	66	917 - 922	982.62	St
18 OWA	420731	1985	S/1997	32	951 - 961	982.50	PVC
19 OWA	420732	1985	S/1997	33	946 - 956	978.70	PVC
P 19A	420733	1985	S/1997	57	922 - 927	978.63	PVC
20 OWA	420734	1985	S/1991	57	994 - 1004	1051.46	PVC
21 OWA	420735	1985	S/1999	16	937 - 947	952.47	PVC
22 OWA	420729	1985		91	949 - 959	1039.68	PVC
P 22L	801470	2013		197	846 - 856	1043.45	St
23 OWA	433112	1987	S/2001	49	938 - 948	987.02	St
24 OWA	433159	1987	S/1997	26	949 - 959	975.24	St
25 OWA	420741	1987	S/1997	23	948 - 958	970.53	St
26 OWA	420743	1987	S/2007	20	946 - 956	966.16	St
P 26A	420742	1987	S/2007	27	940 - 945	967.01	St
27 OWA	420745	1987	S/1999	18	941 - 951	959.04	St
P 27A	420744	1987	S/1999	33	927 - 932	960.08	St
28 OWA	420746	1987	S/2001	36	949 - 959	985.04	St
29 OWA	420747	1987	S/1999	18	941 - 951	959.03	St
P 29A	420748	1987	S/1999	33	925 - 930	958.34	St
P 29C	496289	1991		108	849 - 854	957.16	St
P 29D	496294	1991		265	692 - 702	957.35	St
30 OWA	433149	1987	S/1999	23	933 - 943	956.05	St
P 30C	496291	1991	S/1999	74	882 - 887	955.04	St
31 OWA	433150	1987	S/1992	50	949 - 959	999.31	St
32 OWA	433147	1987	S/1998	47	944 - 954	991.29	St
33 OWA	433151	1987	S/1998	52	951 - 961	1003.08	St
34 OWA	443422	1988	S/1989	984		983.74	PVC
35 OWA	443424	1988	S/1993	37	945 - 955	982.88	PVC
P 35B	443423	1988	S/1993	51	932 - 937	983.75	PVC
36 OWA	498324	1991		75	946 - 956	1021.61	St
37 OWA	496290	1991	S/2003	58	949 - 959	1007.44	St
38 OWA	496295	1991	S/2003	40	951 - 961	990.61	St
39 OWA	496283	1991	S/2004	26	960 - 970	985.65	St
40 OWA	496282	1991	S/1999	28	927 - 937	955.07	St
P 40B	496292	1991	S/1999	58	898 - 904	956.27	St
41 OWA	496280	1991	S/1999	36	937 - 947	972.95	St
P 41B	496293	1991	S/2001	60	912 - 917	971.69	St
42 OWA	496296	1991	S/1996	89	954 - 964	1043.24	St

Table 2
Well Information Index
Elk River Landfill
Elk River, Minnesota

Well I.D.	MN Unique Number	Year Installed	Altered or Sealed	Approx. Depth [1]	Screen Interval (ft MSL)	Top of Casing Elevation (ft MSL)	Const Material
43 OWA	496279	1991	S/1999	30	944 - 954	973.41	
P 43B	496277	1991	S/1999	72	902 - 907	973.55	St
P 43C	496281	1991	S/1999	287	686 - 696	973.38	St
101 OWA	433160	1987	S/1997	33	944 - 949	977.43	St
102 OWA	433165	1987	S/1997	30	946 - 951	975.73	St
103 OWA	433161	1987	S/1997	58	950 - 955	1008.26	St
104 OWA	433162	1987	S/1996	28	943 - 948	970.74	St
105 OWA	433163	1987	S/1997	58	945 - 950	1002.32	St
106 OWA	433164	1987	S/1997	83	918 - 923	1000.88	St
108 OWA	433166	1987	S/1996	57	946 - 951	1002.72	St
110 OWA	433167	1987	S/1996	88	951 - 956	1038.84	St
201 OWA	443223	1988	S/1999	26	946 - 956	972.27	St
P 201B	443224	1988	S/1999	46	926 - 931	971.96	St
202 OWA	443219	1988	S/1992	86	946 - 956	1031.62	St
203 OWA	443218	1988	S/1992	103	945 - 955	1047.65	St
204 OWA	443221	1988	S/1995	53	945 - 955	998.26	St
205 OWA	443220	1988	S/1994	87	947 - 957	1033.51	St
206 OWA	443217	1988	S/1997	48	947 - 957	994.01	St
207 OWA	443216	1988	S/1999	104	947 - 957	1050.99	St
208 OWA	443215	1988	S/1997	43	953 - 963	996.86	St
209 OWA	443214	1988	S/2012	57	946 - 956	1002.50	St
210 OWA	443211	1988	S/2007	38	943 - 953	981.19	St
P 210B	443212	1988	S/2012	58	923 - 928	981.25	St
211 OWA	443222	1988	S/1999	36	943 - 953	979.03	St
212 OWA	443213	1988	S/1997	70	945 - 955	1014.64	St
213 OWA	443209	1988	S/2012	47	946 - 956	993.35	St
P 213A	443210	1988	S/2007	67	926 - 931	992.20	St
301 OWA	598567	1997		17	950 - 960	966.54	PVC
P 301C	598562	1997		73	895 - 905	967.50	St
P301L	767989	2009		123	847 - 857	970.11	St
302 OWA	598568	1997		17	953 - 963	970.47	PVC
P 302C	598563	1997		72	898 - 908	970.63	St.
303 OWA	598569	1997	S/2012	17	946 - 956	963.71	PVC
P 303C	598532	1997		53	911 - 921	963.77	St.
P 304C	598565	1997		62	898 - 908	959.89	St.
P 305C	598566	1997		80	884 - 894	963.26	St.
306 OWA	621863	1998	S/2004	40	951 - 961	990.88	St.
307 OWA	621862	1998	S/2003	55	951 - 961	1005.59	St.
P 308C	621858	1998	Altered: 2008; resurveyed	77	903 - 913	979.83	St.
P 308L	836661	2019		130	848 - 863	979.94	St.
P 309C	635420	1999		85	883 - 893	967.71	St.
P 310C	646855	2000		42	933 - 948	975.33	St.
P 311C	646854	2000		33	933 - 943	965.54	St.
P 311L	801471	2013		114	852 - 862	965.76	St.
P 311D	650145	2000		253	711 - 779	963.80	St.
312 OWA	646853	2000		70	946 - 956	1016.20	St.
P 313C	969668	2003	reduced: 2004; resurveyed	68	880 - 895	948.15	St.
P 314C	969669	2003		75	877 - 892	952.02	St.
315 OWA	696663	2003		35	937 - 952	972.41	St.
P 315L	722063	2005		100	872 - 882	972.27	St.
316 OWA	696664	2003	S/2015	107	939 - 954	1046.43	St.
P 316L	722093	2005	S/2015	163	884 - 894	1046.82	St.
317 OWA	696666	2003	to be sealed in 2024	73	937 - 952	1009.73	St.
P 317L	722092	2005	to be sealed in 2024	157	852 - 862	1008.65	St.
P 318C	696665	2003	S/2012	57	936 - 946	993.41	St.
P 318L	722091	2005	S/2012	139	853 - 863	991.06	St.
319 OWA	696667	2003	S/2012	72	943 - 953	1014.59	St.

Table 2
Well Information Index
Elk River Landfill
Elk River, Minnesota

Well I.D.	MN Unique Number	Year Installed	Altered or Sealed	Approx. Depth [1]	Screen Interval (ft MSL)	Top of Casing Elevation (ft MSL)	Const Material
P 320C	737638	2006		63	888 - 898	951.19	St.
P 320C2	756593	2007		90	862 - 872	951.21	St.
P 320L	737637	2006		110	851 - 856	951.37	St.
P 321L	767990	2009		118	855 - 865	972.56	St.
P 322L	767991	2009		87	862 - 872	948.75	St.
P 323L	786203	2011		96	872 - 883	967.20	St.
P 324L	786202	2011		103	857 - 865	960.40	St.
P 325L	804281	2014		82	856 - 866	942.11	St.
P 326L	804282	2014		85	854 - 864	942.62	St.
P 327L	812996	2016		119	833 - 848	952.35	St.
P 328L	812994	2016		112	836 - 851	948.20	St.
P 329L	812995	2016		98	850 - 865	947.99	St.
P 333L	828060	2018		116	828 - 843	943.72	St.
P 334L	828061	2018		143	829 - 844	972.22	St.
P 335L	828062	2018		148	848 - 863	995.98	St.
336-OWA	853108	2020		22	942 - 957	963.17	St.
337-OWA	853109	2020		99	932 - 947	1031.70	St.
P-337L	853110	2020		186	846 - 856	1031.68	St.
P-338L	853139	2021		115	98 - 113	961.13	St.
P-340L	953140	2021		105	88 - 103	946.43	St.
P-341L	877298	2023		143	128 - 143	988.58	St.
P-342L	871179	2023		100	85 - 100	947.27	St.
401 OWA	683321	2002		66	945 - 955	1010.97	St.
402 OWA	683320	2002		79	945 - 960	1023.56	St.
P 403C	683318	2002		60	938 - 948	998.46	St.
404 OWA	683319	2002	S/2006	57	944 - 954	1001.12	St.
405 OWA	683316	2002	extended: 2004; resurveyed	41	947 - 957	987.17	St.
406 OWA	683317	2002		15	939 - 944	953.71	St.
407 OWA	683315	2002		40	934 - 944	973.87	St.
408 OWA	717920	2004		42	947 - 957	986.55	PVC
P-694477	694477	2003	Surveyed 2015	145	842 - 846	987.86	St.
T1	643948	2002	extended: 2008; resurveyed	85	896 - 911	980.85	St.
T2	643949	2002	extended: 2008; resurveyed	88	892 - 907	979.85	St.
T3	643950	2002	extended: 2008; resurveyed	91	889 - 904	980.39	St.
T4	673801	2002	extended: 2008; resurveyed	93	887 - 902	980.47	St.
T5	733223	2006		83	883 - 898	965.11	St.
T6	733222	2006		84	882 - 897	964.77	St.

Notes:

PVC - polyvinyl chloride

St - stainless steel & low carbon steel

S - sealed/date of well sealing

MSL - Mean Sea Level

[1] Approx. depth in feet from top of riser to bottom of screen

Table 3
Groundwater Corrective Action Contingency Plan Summary
Elk River Landfill

	Scenario	Description	Applicable Wells	Actions	Approximate Timing
1	Organics detection in a water supply well sample	A detection of an organic compound[1] in a sample from a downgradient water supply well will trigger data review and follow-up sampling[2] (to confirm/verify the initial result) and action to protect the health of the well users.	Downgradient monitored water supply wells.	Review the data to assess quality control/quality assurance results (including field and laboratory control sample) and potential of alternate sources[3].	As soon as feasible (but within two weeks of receiving sample results).
				Notify the owner/resident and MPCA (and others) and coordinate/collect/analyze a confirmation sample.	Within 48 hours of identifying the organics detection. Confirmation sample analysis will be expedited if possible.
				If the detected concentration is above Minnesota drinking water criteria, provide bottled water to the resident until the detection is resolved through confirmation sampling/analysis or addressed by further action.	Within 48 hours of identifying the organics detection.
				If confirmed[4], address the detected organic to prevent exposure to groundwater users[5].	As soon as feasible (after confirmation).
				Evaluate the need for additional or alternate correction action.	To be determined.
2	Organics detection at sentinel well	A first-time detection of an organic compound[1,4] at a concentration greater than the IL will trigger rapid notification (i.e., within 48 hours of identification) and resampling unless obvious sampling or laboratory QA/QC issues are evident.	Sentinel monitoring wells: P-327L, P-328L, P-329L, P-333L, P-335L, P-339L (contingent on final location), P-340L, and P-341L .	Notify the MPCA (and others) and coordinate/collect/analyze a verification sample.	Notify within 48 hours of identifying the organics detection above the IL. Verification resample will be conducted as soon as feasible.
				Review the evaluation criteria for nearby water supply wells in context of the detection (see Table 4) and determine if additional water supply well actions are appropriate.	Annual Water Quality Monitoring Report (or separate submittal).
				Review monitoring results from the following three triannual events and determine if additional investigation and/or well installation activities are appropriate.	Subsequent Annual Water Quality Monitoring Report.
				If appropriate, prepare plans for additional investigation activities and/or evaluate the need for additional or alternate corrective action.	To be determined.

Notes:

[1] Attributed to the landfill.

[2] Sampling and additional actions require permission of the well owner.

[3] Common sources of low level organics not attributed to the landfill include sample cross contamination (during sample collection, transport, or analysis), well disinfection byproducts (e.g., new/serviced well disinfection), water pumping/transmission/storage system components, separate sources.

[4] A confirmed detection is defined as comparable detections for at least two consecutive sampling events that are not attributed to sampling, handling, or laboratory cross contamination.

[5] May include installation of a point of entry water treatment system, installation of a replacement water supply well, providing a long-term water delivery, or other options/combined approaches as needed.

Table 4
Natural Attenuation Monitoring Plan
Elk River Landfill
Elk River, Minnesota

Relative Position to Source / Plume		Well ID	Natural Attenuation Monitoring Schedule								
			2024			2025			2026		
			Spring[1]	Summer[1,2]	Fall[1]	Spring[1]	Summer[1,2]	Fall[1,2]	Spring[1]	Summer[1,2]	Fall[1]
Within Plume	Near Source (Landfill Edge)	P-302C		X	X	X	X	X	X	X	X
		P-17C		X			X			X	
		P-308L		X			X			X	
		P-304C		X	X	X	X	X	X	X	X
	Downgradient (Compliance Boundary)	P-321L		X	X	X	X	X	X	X	X
		P-323L		X	X	X	X	X	X	X	X
		P-313C		X	X	X	X	X	X	X	X
	Mid-Plume (Property Boundary)	P-325L		X	X	X	X	X	X	X	X
		P-326L		X	X	X	X	X	X	X	X
		P-338L		X	X	X	X	X	X	X	X
	Distal Plume	P-334L		X	X	X	X	X	X	X	X
Outside Plume	Downgradient	P-342L		X		X	X		X	X	
	Sentinel	P-339L*		X	X	X	X	X	X	X	X
	Upgradient	P-22L		X			X			X	
	Sidegradient	P-340L		X			X			X	
		P-341L		X			X			X	

Notes:

* To be installed if landowner grant permission.

[1] Samples will be analyzed for List 1 parameters shown on Table 5.

[2] Samples will be analyzed for List 2 parameters shown on Table 5.

The anticipated schedule is subject to change. The monitoring plan will be reviewed annually as part of Annual Water Quality Monitoring Reports.

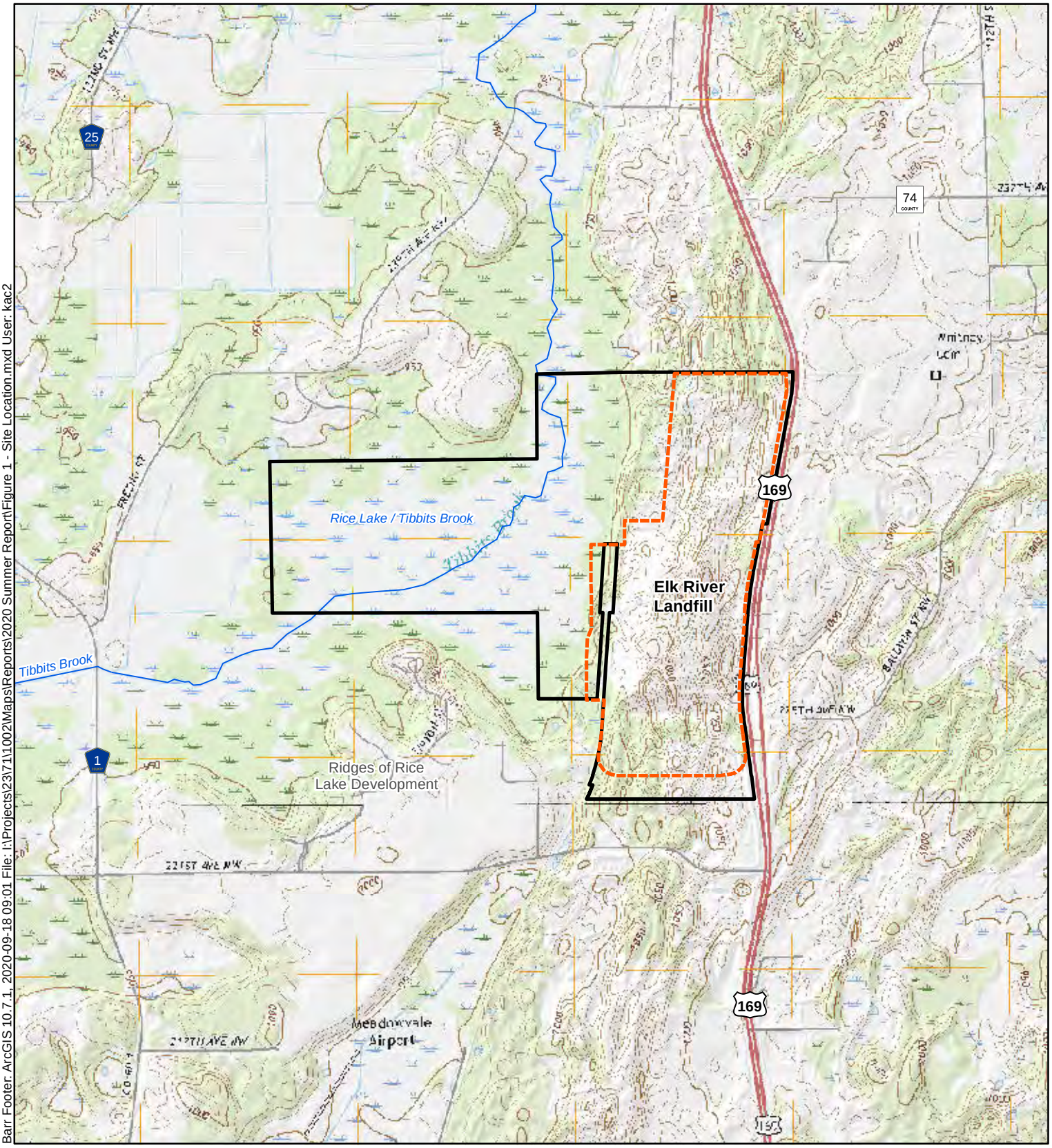
Table 5
Natural Attenuation Monitoring Parameters
Elk River Landfill

Parameter List[1]	Analyte Group	Parameters	Analytical Method
List 1	Organics	Vinyl Chloride (and additional organic compounds included on the EPA Method list)	EPA Method 8260D
	Field Parameters	Conductivity	Field Water Quality Meter Measurement
		Dissolved Oxygen	
		Temperature	
		Oxidation-Reduction Potential	
		pH	
List 2	Natural Attenuation Indicator Parameters	Sulfate	EPA Method 300.0
		Nitrate	EPA Method 300.0
		Chloride	EPA Method 300.0
		Total organic carbon	EPA Method 9060A
		Alkalinity	EPA Method 310.2
		Reduced Iron [Fe (II)]	Field Test Kit Measurement
		Reduced Manganese [Mn (II)]	
		Sulfide	
		Dissolved Oxygen	
		Methane/Ethane/Ethene	AM20 GAX

Notes:

[1] See Table 4 for schedule of analyses.

Figures



Property Boundary

Groundwater Compliance Boundary

N

Feet

0 2,000 4,000

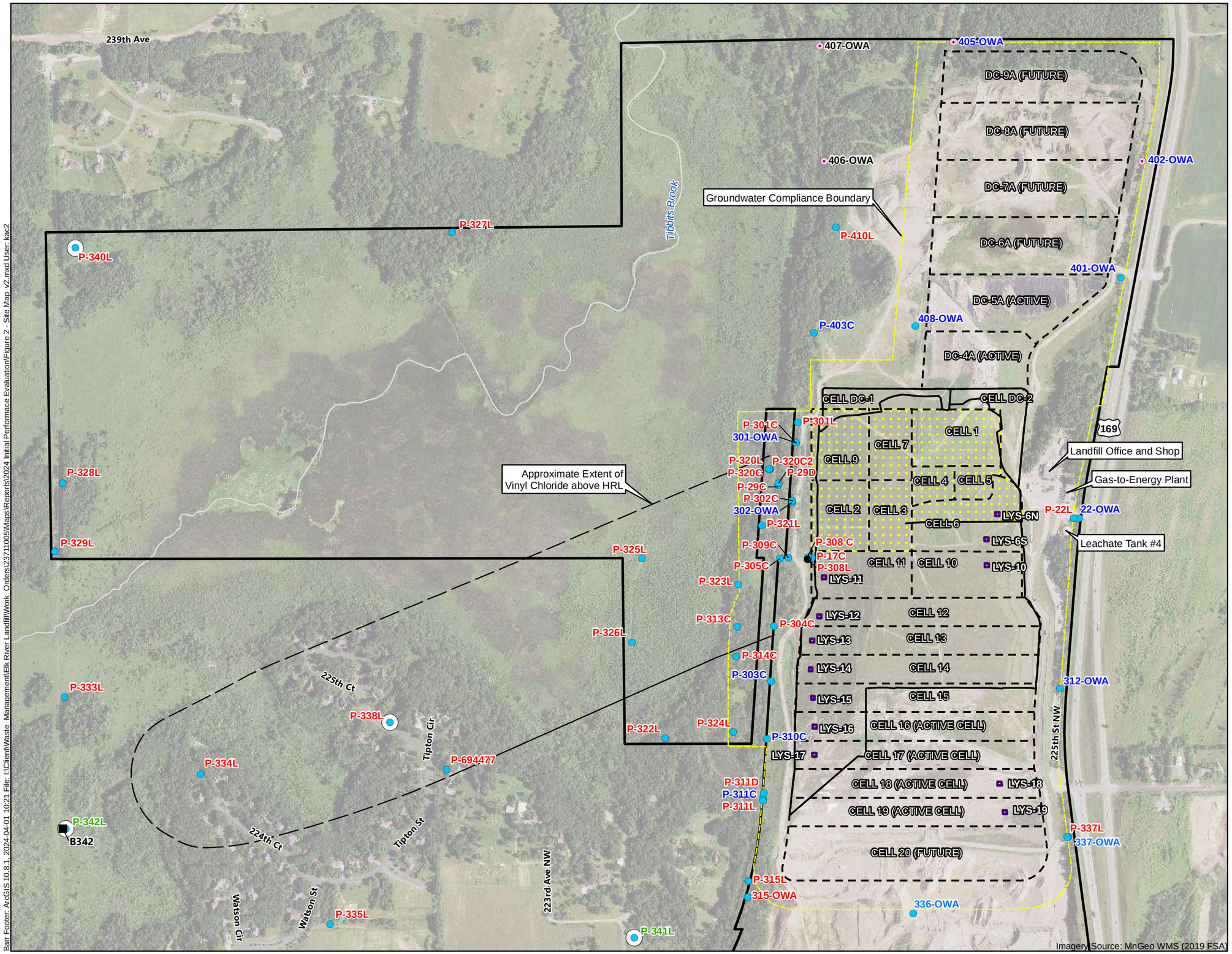
Figure 1

SITE LOCATION
Elk River Landfill
Elk River, Minnesota

Background Source: USGS 7.5 Minute Quadrangle
Data Source: Barr, Wenck, MNDOT, MNDNR

BARR

Barr Footer: ArcGIS 10.7.1, 2020-09-18 09:01 File: I:\Projects\23\71\1002\Maps\Reports\2020 Summer Report\Figure 1 - Site Location.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Cell Boundary

Lysimeter

Monitoring Well

Piezometer

Test Well

Vertical Groundwater Profile Boring

Monitoring Wells Completed Following 2021 GWCA Work Plan

P320C Blue ID indicates well has surface water-based intervention limits

P320L Red ID indicates well has groundwater-based intervention limits

P337L Green ID indicates well is currently undergoing baseline monitoring

Notes:
(1) Piezometers 36-OWA (east) and 317-OWA/P-317L (south) are not shown.

Feet
0 650 1,300

Figure 2

SITE MAP
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-04-01 10:21 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711005\Maps\Reports\2024 Initial Performace Evaluation\Figure 2 - Site Map_v2.mxd User: kac2

Property Boundary

Pre-Subtitle D Area

Existing Monitoring Locations

- Monitoring Well
- Piezometer
- Vertical Groundwater Profile Boring

Area Supply Wells

- Domestic
- Residential Well Location (Sampled Annually)
- Community Water Supply Well
- Residential Well Location (Sampled Previously)

Cross Section Location

Notes:
1) Vertical groundwater profile borings completed to site monitoring wells are not shown.

2) * No well record available.

3) ** Replacement well 00876414 has been installed but is not connected to the residence.

N

Feet
0 1,000 2,000

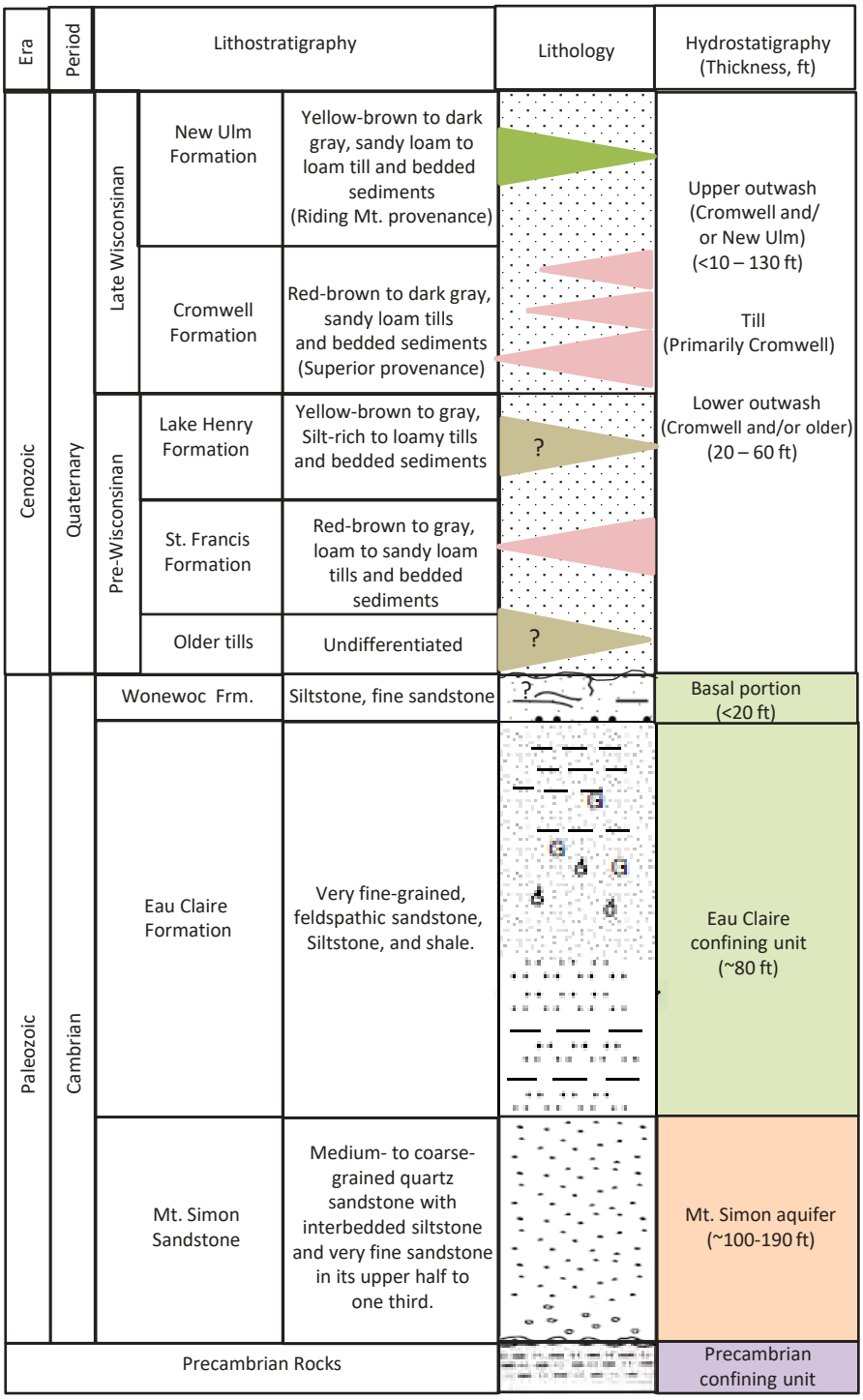
Figure 3

AREA WATER SUPPLY WELLS
Elk River Landfill
Elk River, Minnesota

BARR

Imagery Source: MnGeo WMS (2019 FSA)

Barr Footer: ArcGIS 10.8.1, 2024-03-22 09:43 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711005\Maps\Reports\2024 Initial Performace Evaluation\Figure 3 - Area Water Supply Wells.mxd User: kac2



Modified from Berg (2017), Chandler and Mossler (2013); Lusardi (2013); Mossler (1992).

Figure 4

General Hydrostratigraphic Section
Elk River Landfill
Elk River, Minnesota

H'
WEST

H''
EAST

Elevation (ft MSL)

Distance (ft)

666600

B-330

B-331

J. Thompson

M. Barnier (625475)
Thompson (720300)

B342/P-342L

B334/P-334L

Rice Lake/Tibbits Brook

Floating Vegetation

UPPER OUTWASH

LOWER OUTWASH

TILL

lk
ow
tl
ow
ow
tl

BEDROCK
(EAU CLAIRE FM.)

EXPLANATION

OUTWASH — Includes the following soil types:
SP: Sand with <5% fines; thin/discontinuous gravel lenses rare to common.
SM: (Where in contact with SP);
Silty sand; silt content approximately 30 to 50%.

TILL — Includes the following soil types:
ML: Sandy silt - diamict with approximately 10 to 50% Sand and Gravel; firm to very hard.
CL: Clay textured diamict with varying amounts of sand and gravel; firm to hard.
SM: (Where bounded by ML or CL);
Silty sand; silt content approximately 30 to 50%
ML/CL: Silt or clay; <5% sand; massive to thinly bedded

EAU CLAIRE — Eau Claire Formation:
Fine-grained sandstone/siltstone with shale partings present locally.

0 750
Approximate Horizontal Scale in Feet
7.5X Vertical Exaggeration

LEGEND

Ground Surface (Approximate)

Geologic Contact (Dashed where approximate)

October 2023 Groundwater Elevation
(Measured in deepest nested well shown on figure)

Existing Well Screen

Groundwater Sample Locations

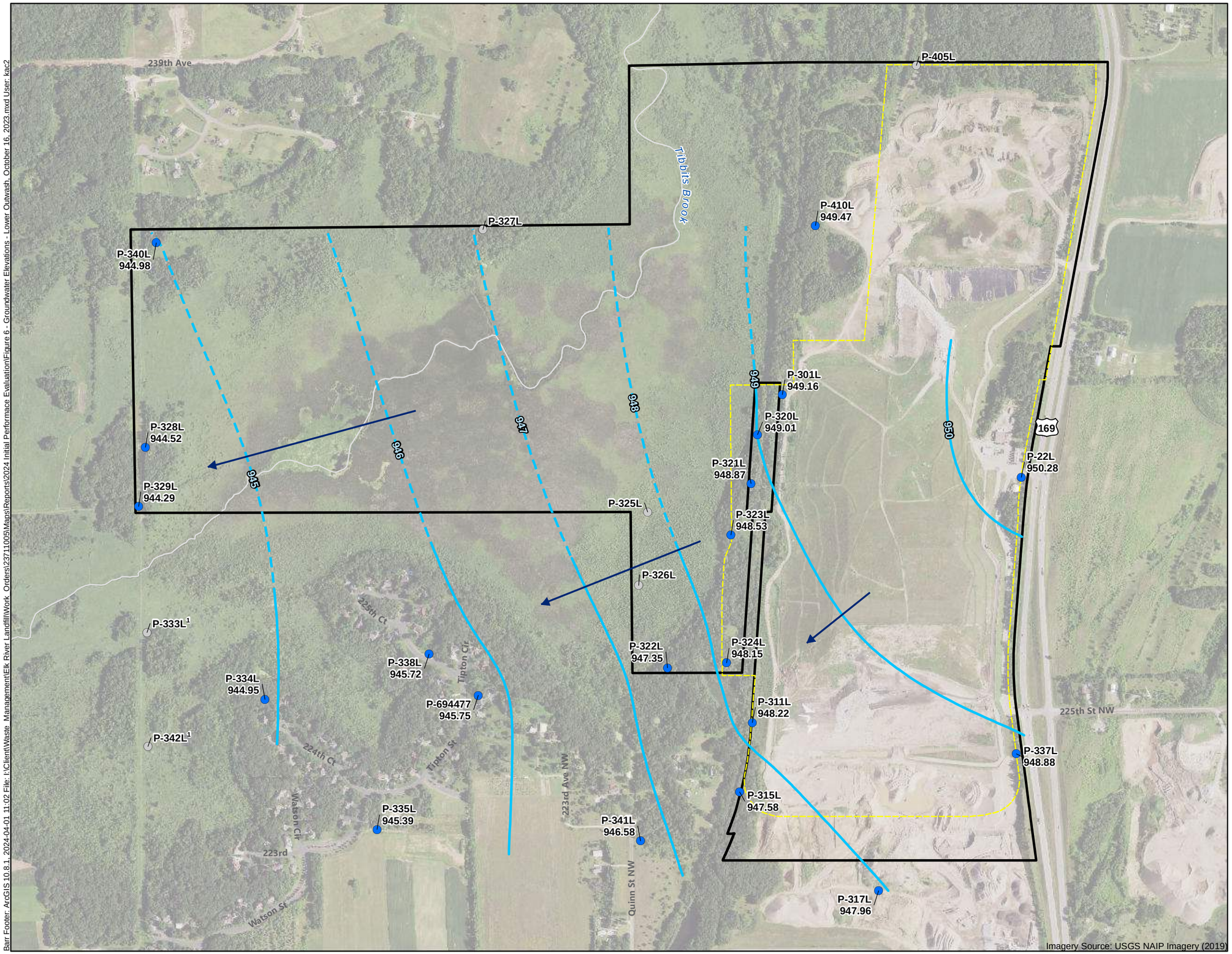
Approximate/Inferred Extent of Vinyl Chloride Above Health Risk Limits

BARR

Figure 5

HYDROGEOLOGIC CROSS SECTION H"-H'"
Elk River Landfill
Elk River, Minnesota

Barr Footer: ArcGIS 10.4, 2018-03-27 16:18 File: I:\Projects\23\71\11005\Users\kac2\20180102_WP_Cross_Sections\Cross Section H_20180327.mxd User: kac2
P:\Mpls\23 MN\71\123711005 ERL - GW Network Development\Work Files\Corrective Action\Implementation\Monitoring Wells\2023\Cross-sections\AI\Figure 5 - Hydrogeologic Cross Section H-H'_20240702.ai User: CNS



Property Boundary

Groundwater Compliance Boundary

Lower Outwash Monitoring Well

Lower Outwash Monitoring Well (Not Used for Groundwater Contours)

Groundwater Contour (feet MSL)

Flow Line

Note:
[1] Access to wells P-333L and P-342L is not provided during fall monitoring events.

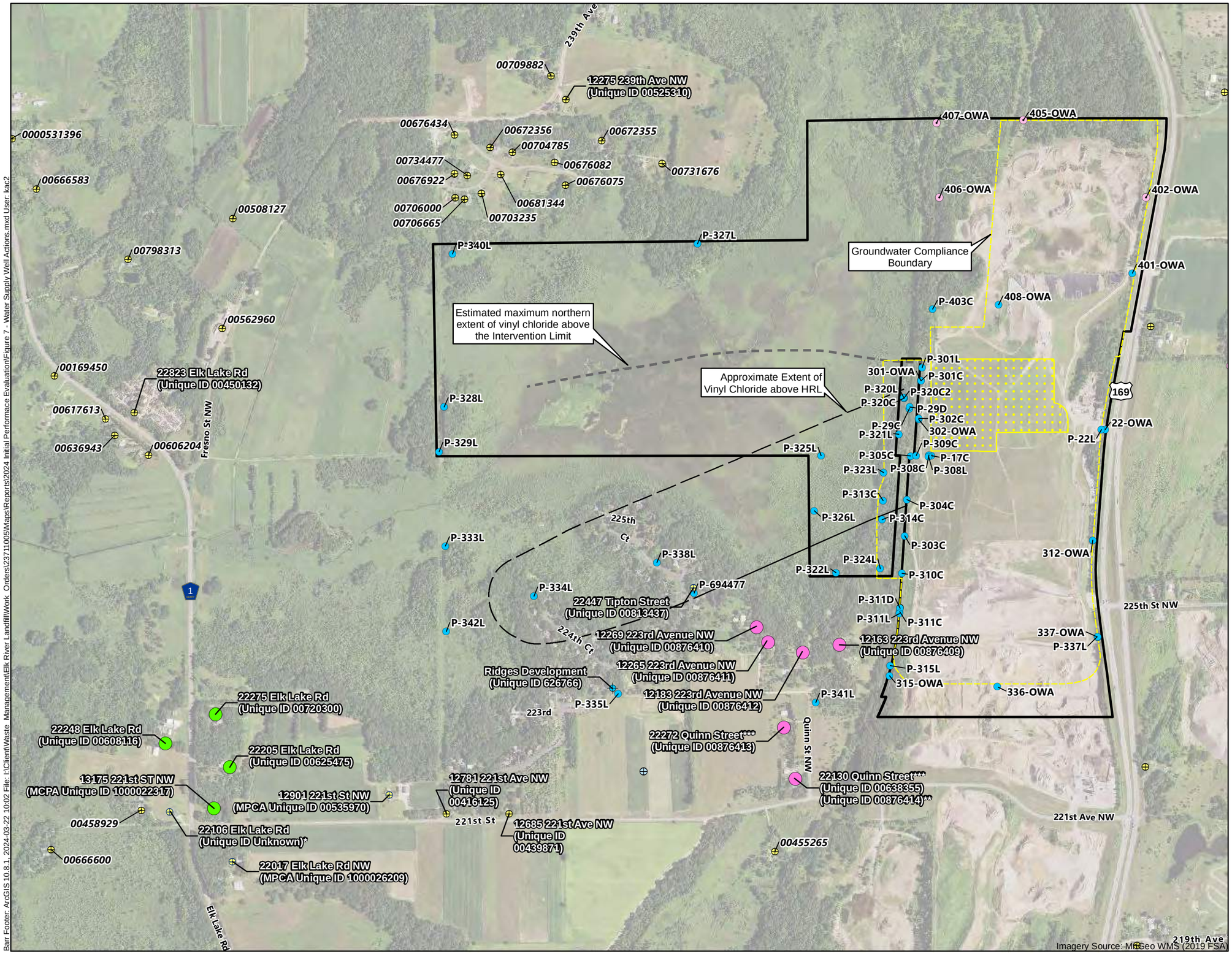
Feet
0 750 1,500

Figure 6

GROUNDWATER ELEVATIONS - LOWER OUTWASH
October 16, 2023
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1 2024-04-01 11:02 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711005\Maps\Reports\2024 Initial Performance Evaluation\Figure 6 - Groundwater Elevations - Lower Outwash, October 16, 2023.mxd User: kac2



Property Boundary

Pre-Subtitle D

Existing Monitoring Locations

- Monitoring Well
- Piezometer

Area Supply Wells

- Domestic
- Irrigation
- Community Water Supply Well
- Replacement well installed per Groundwater Corrective Action Work Plan (Barr, 2021)
- Sampled per Groundwater Corrective Action Work Plan (Barr, 2021)

Notes:
1) * No well record available.

2) ** Replacement well 00876414 has been installed but is not connected to the residence.

3) *** Replacement well was installed voluntarily by ERL (i.e., not proposed in Groundwater Corrective Action Work Plan).

N

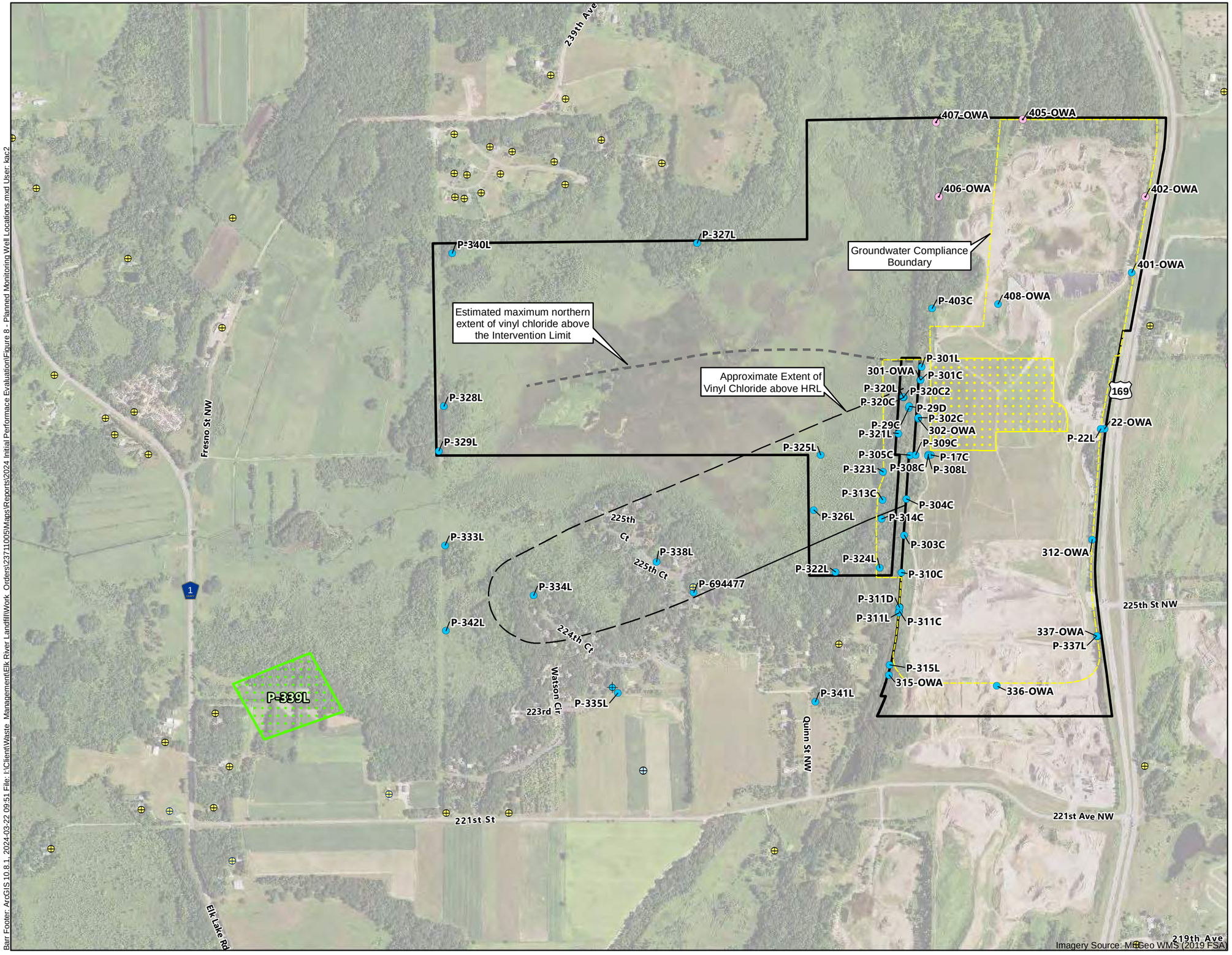
Feet
0 1,000 2,000

Figure 7

WATER SUPPLY WELL ACTIONS
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-22 10:02 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711005\Maps\Reports\2024 Initial Performace Evaluation\Figure 7 - Water Supply Well Actions.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Existing Monitoring Locations

- Monitoring Well
- Piezometer

Area Supply Wells

- Domestic
- Irrigation
- Community Water Supply Well

Targeted Installation Area

Note:
1) Targeted installation area is approximate and subject to access/landowner permissions

N

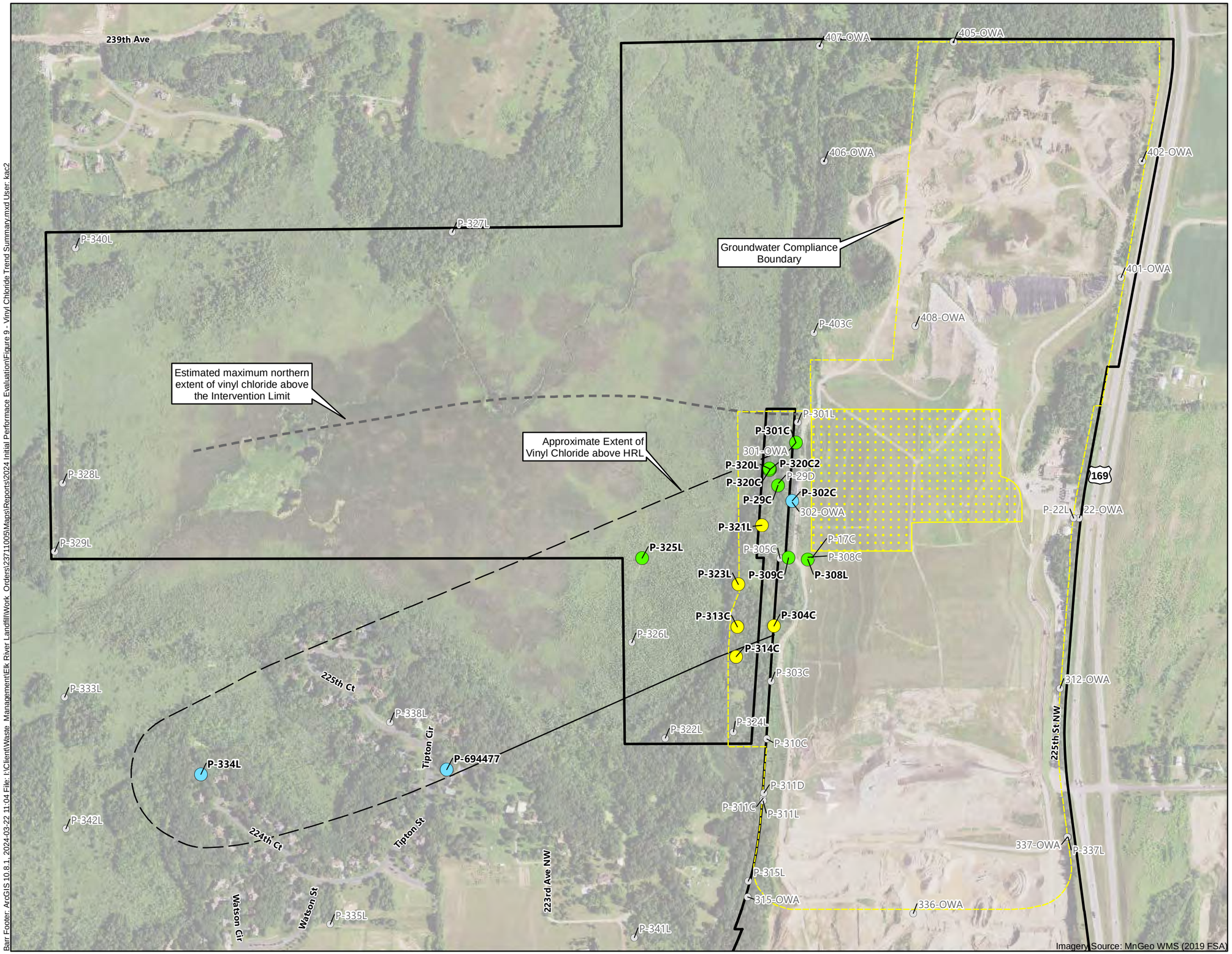
Feet
0 1,000 2,000

Figure 8

PLANNED MONITORING WELL LOCATIONS
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-22 09:51 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711005\Mapsl\Reports\2024 Initial Performace Evaluation\Figure 8 - Planned Monitoring Well Locations.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Existing Monitoring Locations

- Monitoring Well
- Piezometer
- Statistically significant decreasing vinyl chloride concentration trend identified.
- Stable or no statistically significant vinyl chloride concentration trend identified.
- Statistically significant increasing vinyl chloride concentration trend identified.

Note:
1) Gray wells do not have sufficient data to evaluate trends (due to no or less than eight vinyl chloride detections)

N

Feet
0 650 1,300

Figure 9

VINYL CHLORIDE TREND SUMMARY
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-22 11:04 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711005\Maps\Reports\2024 Initial Performace Evaluation\Figure 9 - Vinyl Chloride Trend Summary.mxd User: kac2

Appendices

Appendix A

Area Water Supply Well Data

Table A1
Residential Well Construction Summary
Elk River Landfill
Elk River, Minnesota

Approximate Distance (feet) and Direction from ERL		MN Unique Number (or MPCA ID)	Address	Years Sampled	Use	Approximate Elevation (feet MSL)	Well Depth (feet bgs)	Base of Casing (feet bgs)	Aquifer	Estimated Completion Interval (feet MSL)
5000'	SW	00416125	12781 221st Ave NW	2015-16, 2020	Domestic	989	135	131	Quaternary	858 - 854
4300'	SW	00439871	12685 221st Ave NW	2015-16, +	Domestic	990	137	133	Quaternary	857 - 853
2800'	SW	00455265	see unique ID# on figure (12210 221st Ave NW)	--	Domestic	957	101	88	Quaternary	869 - 856
8400'	SW	00458929	see unique ID # on figure (22112 Elk Lake Rd)	--	Domestic	951	92	81	Quaternary	870 - 859
1200'	SW	00876413	22272 Quinn St	2022-23	Domestic	995	379	333	Mt. Simon	662 - 616
8000'	SW	1000026209	22017 Elk Lake Rd NW	2016	Domestic	979	170	160	Quaternary	819 - 809
8000'	SW	00608116	22248 Elk Lake Rd	2017, 2021	Domestic	961	94	85	Quaternary	876 - 867
7000'	SW	00625475	22205 Elk Lake Rd	2015-16,2021-22 +	Domestic	981	113	104	Quaternary	877 - 868
3000'	SW	00626766	Ridges Development	2011-2023	Community	987	325	294	Quaternary	693 - 662
1800'	SW	00876410	12269 223rd Ave NW (St.)	2022-23	Domestic	990	299	255	Mt. Simon	735 - 691
600'	SW	00876409	12163 223rd Ave NW	2022-23	Domestic	985	299	233	Mt. Simon	752 - 686
7400'	SW	00720300	22275 Elk Lake Rd	2017,2021,2023 +	Domestic	960	91	82	Quaternary	878 - 869
2000'	SW	00813437	22447 Tipton Ave	2016-2023	Domestic	1000	300	254	Mt. Simon	746 700
1500'	SW	00638355*	22130 Quinn St	2011-2023	Domestic	991	105	95	Quaternary	896 - 886
1500'	SW	00876414	22130 Quinn St	2022	Domestic	990	319	293	Quaternary	697 - 671
9400'	SW	00666600	13410 221st Av NW	--	Domestic	952	96	87	Quaternary	865 856
1400'	SW	00876411	12265 223rd Ave (formerly listed as 11265 223rd Ave)	2022-23	Domestic	990	296	290	Mt. Simon	700 - 694
1100'	SW	00876412	12183 223rd Ave	2022-23	Domestic	985	310	254	Mt. Simon	731 - 675
8000'	SW	1000022317	13175 221st Ave NW	2016, 2020-21	Domestic	--	--	--	Quat.(assumed)	-- - --
5300'	SW	00535970	12901 221st Ave NW	2016, 2020	Domestic	--	--	--	Quat.(assumed)	-- - --
8500'	SW	--	22106 Elk Lake Rd NW (assumed)	--	Domestic	--	--	--	Quat.(assumed)	-- - --
9200'	W	00169450	22878 Elk Lake Rd	--	Domestic	945	95	91	Quaternary	854 - 850
8400'	W	00450132	22824 Elk Lake Rd	2015	Domestic	961	127	113	Quaternary	848 - 834
7500'	W	00508127	see unique ID# on figure	--	Undefined	948	210	135	Mt. Simon	813 - 738
7500'	W	00562960	see unique ID# on figure (13000 238th Ave NW)	--	Domestic	949	130	123	Quaternary	826 - 819
8200'	W	00606204	22722 Elk Lake Rd	--	Domestic	955	89	84	Quaternary	871 - 866
8700'	W	00617613	22826 Elk Lake Rd	--	Domestic	942	85	80	Quaternary	862 - 857
8700'	W	00636943	22774 Elk Lake Rd	--	Domestic	950	88	84	Quaternary	866 - 862
8500'	W	00798313	23015 1 CR, Elk River	--	Domestic	949	105	95	Quat.(assumed)	854 - 844
9500'	W	00666583	23191 1 CR, Elk River	--	Domestic	950	93	84	Quaternary	866 - 857

Table A1
Residential Well Construction Summary
Elk River Landfill
Elk River, Minnesota

Approximate Distance (feet) and Direction from ERL		MN Unique Number (or MPCA ID)	Address	Years Sampled	Use	Approximate Elevation (feet MSL)	Well Depth (feet bgs)	Base of Casing (feet bgs)	Aquifer	Estimated Completion Interval (feet MSL)
4600'	NW	00525310	1227 239th Ave NW	2011-2020, 2022	Domestic	984	110	105	Quaternary	879 - 874
4200'	NW	00672355	23115 128th St	--	Domestic	948	89	89	Quaternary	859 - 859
5200'	NW	00672356	23255 128th St	--	Domestic	961	89	84	Quaternary	877 - 872
4200'	NW	00676075	23128 128th St	--	Domestic	949	100	91	Quaternary	858 - 849
4500'	NW	00676082	--	--	Domestic	951	93	84	Quaternary	867 - 858
5600'	NW	00676434	23282 128th St NW	--	Domestic	957	210	141	CMTS	816 - 747
5500'	NW	00676922	12876 232nd Ave NW	--	Domestic	951	104	99	Quaternary	852 - 847
5000'	NW	00681344	12821 232nd Ave	--	Domestic	958	90	86	Quaternary	872 - 868
5100'	NW	00703235	12845 232nd Ave	--	Domestic	953	94	90	Quaternary	863 - 859
5000'	NW	00704785	23195 128th St NW	--	Domestic	951	105	95	Quaternary	856 - 846
5300'	NW	00706000	12875 232nd Av NW	--	Domestic	953	105	95	Quaternary	858 - 848
5200'	NW	00706665	12861 232nd Ave	--	Domestic	953	103	99	Quaternary	854 - 850
4850'	NW	00709882	12280 239th Av NW	--	Domestic	963	97	87	Quaternary	876 - 866
3500'	NW	00731676	23105 128th St NW	--	Domestic	958	104	94	Quaternary	864 - 854
5400'	NW	00734477	12818 232nd Av NW	--	Domestic	954	110	100	Quaternary	854 - 844

Notes:

Well construction and elevations from Minnesota Well Index.

-- not available

bgs - below ground surface

MSL - Mean sea level

* Noted as sealed in County Well Index. Residential well at 22130 Quinn St. is included in ERL residential well monitoring network.

+ Requested owner permission to sample in 2020. No response at time of report preparation.

Not included in table: monitoring wells 696665-696667, 770880, 770881; irrigation well 126512; scientific boring 272081; ERL monitoring wells.

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	11265 223rd Ave 10/20/2011 (ZW00214)	11265 223rd Ave 10/18/2012 (ZW00214)	11265 223rd Ave 10/15/2013 (ZW00214)	11265 223rd Ave 10/20/2014 (ZW00214)	11265 223rd Ave 4/23/2015 (ZW00214)	11265 223rd Ave 10/23/2015 (ZW00214)	11265 223rd Ave 4/25/2016 (ZW00214)	11265 223rd Ave 10/20/2016 (ZW00214)	12265 223rd Ave 10/18/2017 ZW00214	12265 223rd Ave 10/16/2018 ZW00214	12265 223rd Ave 10/24/2019 ZW00214	12265 223rd Ave 10/15/2020 ZW00214	12265 223rd Ave 10/19/2021 ZW00214	12265 223rd Ave New 9/26/2022 876411
Effective Date		11/13/2023														
Exceedance Key		No Exceed														
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.500 U Q	< 1.00 U
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75	< 1.0	< 0.750 U	< 0.750 U Q	--
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,1-Dichloropropene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,2,3-Trichlorobenzene	ug/l		< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U C4 Q	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U C4 Q	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.050	< 0.050	< 0.050	< 1.00 U	< 1.00 U Q	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.250 U Q	< 1.00 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,3-Dichlorobenzene	ug/l		< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,3-Dichloropropane	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.25	< 0.500 U	< 0.500 U Q	< 1.00 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
2,2-Dichloropropane	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U C3
Acetone	ug/l	3000 HRL23 (1)	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 10.0 U Q	< 10.0 U
Allyl chloride	ug/l	30 HRL94	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.500 U Q	< 1.00 U
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Bromochloromethane	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Bromoform	ug/l	40 HRL93	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Bromomethane	ug/l	10 HRL93	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U C3
Butylbenzene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Butylbenzene, sec	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Butylbenzene, tert	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.250 U Q	< 1.00 U
Chlorobenzene	ug/l	100 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Chloroethane	ug/l	ND RAA16	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Chloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Chlorotoluene, p	ug/l		< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Dibromomethane (methylene bromide)	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Ethyl benzene	ug/l	40 HRL23	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Hexachlorobutadiene	ug/l	1 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 1.4	< 0.250 U	< 0.250 U C3J4Q	< 1.00 U
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 20	< 20	< 20	< 20	< 10	< 10 ^	< 10	< 10	< 10	< 10 ^	< 10	< 10.0 U	< 10.0 U Q	< 10.0 U C3
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.00 U	< 5.00 U Q	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.00 U Q	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U J4 Q	< 1.00 U
Naphthalene	ug/l	70 HRL13	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U C3 Q	< 1.00 U
Propylbenzene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Styrene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.00 U	< 5.00 U Q	< 5.00 U
Toluene	ug/l	70 HRL23	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.10	< 0.100 U	< 0.100 U Q	< 1.00 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U C3 J3
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U Q	--
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.0040	< 0.050	< 0.050	< 0.050	< 0.050	< 0.0500 U	< 0.0500 U Q	< 1.00 U
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.00 U	< 2.00 U Q	< 2.00 U
General Parameters																

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	11265 223rd Ave	11265 223rd Ave	11265 223rd Ave	11265 223rd Ave	11265 223rd Ave	11265 223rd Ave	11265 223rd Ave	11265 223rd Ave	12265 223rd Ave	12265 223rd Ave	12265 223rd Ave	12265 223rd Ave	12265 223rd Ave	12265 223rd Ave New
		Date	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/23/2015	4/25/2016	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/15/2020	10/19/2021	9/26/2022
		Unique Well ID# (or MPCA ID)	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)	ZW00214	ZW00214	ZW00214	ZW00214	ZW00214	876411
Parameter	Units	MDH Human Health-Based Water Guidance Table														
Effective Date		11/13/2023														
Exceedance Key		No Exceed														
Alkalinity, total, as CaCO3	mg/l		197	158	186	206	166	169	--	165	168	166	196	153	170	--
Chemical Oxygen Demand	mg/l		18.1	< 5.0	6.1	< 5.0	--	< 10.0	--	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0 U	< 10.0 U	--
Chloride	mg/l		14.3	13.7	18.6	16.3	17.2	15.5	--	15.4	13	11.8	11.6	8.98	9.53	--
Dissolved oxygen, field	mg/l		--	--	--	--	--	--	0.3	0.6	0.4	0.7	0.8	0.2	0.4	--
Nitrogen, ammonia, as N	mg/l		0.12	0.094	0.055	0.41	--	0.061	--	0.072	0.069	0.072	0.063	< 0.100 U	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.050	< 0.050	< 0.050	< 0.050	--	< 0.050	--	< 0.050	< 0.050	< 0.050	< 0.050	< 0.100 U	< 0.100 U	--
pH, field	pH units		7.62	7.45	7.60	7.61	7.49	7.94	7.83	7.78	7.76	7.72	7.50	7.42	7.55	--
Redox (oxidation potential), field	mV		--	--	--	--	--	--	-99	-102.0	-50	-20	20	36	-89	--
Solids, total dissolved	mg/l		231	287	277	337	--	248	--	289	288	276	287	275	337	--
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	--	< 4.0	< 4.0	< 4.0	< 4.0	< 4.00 U	< 4.00 U	--
Specific conductance @ 25 ºC, field	umhos/cm		421	474	452	442	434	422	436	453	448	432	427	412	422	--
Sulfate, as SO4	mg/l		--	--	--	--	48.6	--	--	--	--	--	--	45.7	43.1	--
Temperature, field	deg C		9.7	10.7	9.6	9.4	9.7	11.0	10.0	11.3	9.7	9.6	9.5	9.9	10	--
Turbidity, field	NTU		--	--	--	--	--	--	--	--	1.7	1.1	1.3	1.5	1.3	--
Total Metals																
Calcium	mg/l		--	--	--	--	65.2	63.1	--	58.9	58.1	62.2	58.6	62.6	59.4	--
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		--	--	--	--	18.8	18.0	--	18.4	17.3	17.3	16.9	18.0	16.6	--
Manganese	ug/l	100 HRL23	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l		--	--	--	--	1.5	1.5	--	1.6	1.4	1.5	1.4	1.48	1.09	--
Sodium	mg/l		--	--	--	--	4.3	4.6	--	4.7	4.4	4.1	3.9	4.14	3.93	--

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Location: 12265 223rd Ave New	12265 223rd Ave New	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave
			Date: 11/07/2022	10/19/2023	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/22/2015	4/25/2016	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/15/2020
			Unique Well ID# (or MPCA ID): 876411	876411	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215
Effective Date		11/13/2023														
Exceedance Key		No Exceed														
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U	< 0.750 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75	< 1.0	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U
1,1-Dichloropropene	ug/l		< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2,3-Trichlorobenzene	ug/l		< 1.00 U C4	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.050	< 0.050	< 0.050	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.00 U	< 0.100 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,3-Dichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,3-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.25	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
2,2-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U	< 10.0 U	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U
Allyl chloride	ug/l	30 HRL94	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	< 0.500 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U
Bromobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Bromochloromethane	ug/l		< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Bromoform	ug/l	40 HRL93	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
Bromomethane	ug/l	10 HRL93	< 1.00 U J3	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U
Butylbenzene	ug/l		< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Butylbenzene, sec	ug/l		< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Butylbenzene, tert	ug/l		< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
Chloroethane	ug/l	ND RAA16	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U
Chloroform	ug/l	20 HRL18	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U
Chloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U
Chlorotoluene, o	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Chlorotoluene, p	ug/l		< 1.00 U	< 1.00 U	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Dibromomethane (methylene bromide)	ug/l		< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Ethyl benzene	ug/l	40 HRL23	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U	< 0.250 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 1.4	< 0.250 U
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U	< 10.0 U C3	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10 ^	< 10	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U	< 5.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
Naphthalene	ug/l	70 HRL13	< 1.00 U	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
Propylbenzene	ug/l		< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Styrene	ug/l		< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18	< 5.00 U	< 5.00 U J3	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.00 U
Toluene	ug/l	70 HRL23	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.100 U	< 0.100 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.10	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.0500 U	< 0.0500 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.0040	< 0.050	< 0.050	< 0.050	< 0.050	< 0.0500 U
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.00 U
General Parameters																

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	12265 223rd Ave New	12265 223rd Ave New	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave
		Date	11/07/2022	10/19/2023	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/22/2015	4/25/2016	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/15/2020
		Unique Well ID# (or MPCA ID)	876411	876411	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215	ZW00215
Parameter	Units	MDH Human Health-Based Water Guidance Table														
Effective Date		11/13/2023														
Exceedance Key		No Exceed														
Alkalinity, total, as CaCO3	mg/l		186	189	186	173	195	4030	219	202	--	232	227	214	246	191
Chemical Oxygen Demand	mg/l		< 10.0 U	< 10.0 U	6.4	< 5.0	7.1	5.4 B	--	< 10.0	--	< 10.0	< 10.0	11.8	< 10.0	< 10.0 U
Chloride	mg/l		< 1 U	< 1 U	2.3	3.74	4.33	5.71	6.6	5.71	--	6.04	5.5	5.32	5.8	4.67
Dissolved oxygen, field	mg/l		0.2	0.5	--	--	--	--	--	--	0.3	0.7	0.5	0.5	0.9	0.5
Nitrogen, ammonia, as N	mg/l		0.167	0.154	< 0.050	< 0.050	< 0.050	0.084	--	< 0.020	--	< 0.020	< 0.020	< 0.020	< 0.020	< 0.100 U
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.100 U	< 0.100 U	< 0.050	< 0.050	< 0.050	< 0.050	--	< 0.050	--	< 0.050	< 0.050	< 0.050	< 0.050	< 0.100 U
pH, field	pH units		8.20	7.75	7.54	7.51	7.58	7.45	7.54	7.82	7.65	7.69	7.66	7.63	7.39	7.3
Redox (oxidation potential), field	mV		-131	-69	--	--	--	--	--	--	-98	-124.0	-55	-25	11	-34
Solids, total dissolved	mg/l		194 B	191 B	163	242	222	258	--	233	--	279	285	259	289	262
Solids, total suspended	mg/l		< 4.00 U	4.20	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	--	< 4.0	< 4.0	< 4.0	< 4.0	< 4.00 U
Specific conductance @ 25 ºC, field	umhos/cm		341	342	352	395	379	431	432	413	450	502	456	454	452	448
Sulfate, as SO4	mg/l		--	--	--	--	--	--	25.6	--	--	--	--	--	--	32.9
Temperature, field	deg C		9.5	10.6	10.5	10.1	10.2	12.0	9.9	9.9	9.7	11.5	10.8	10.3	10.4	10.8
Turbidity, field	NTU		1.1	--	--	--	--	--	--	--	--	--	2.3	1.8	2.4	2.7
Total Metals																
Calcium	mg/l		48.3	46.9	--	--	--	--	62.3	61.3	--	60.4	58.9	62.7	62.1	63.2
Lead	ug/l		--	< 5.00 U	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		14.6	13.4	--	--	--	--	20.1	19.8	--	21.2	20.4	20.9	21.5	22.3
Manganese	ug/l	100 HRL23	--	< 10.0 U	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l		2.29	1.20	--	--	--	--	1.7	1.7	--	1.8	1.6	1.7	1.6	1.58
Sodium	mg/l		5.63	4.70	--	--	--	--	4.9	5.4	--	5.4	4.9	4.7	4.7	4.80

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	12183 223rd Ave 10/19/2021 ZW00215	12183 223rd Ave New 9/29/2022 876412	12183 223rd Ave 11/07/2022 ZW00215	12183 223rd Ave New 10/19/2023 876412	12269 223rd Ave 10/20/2011 626780	12269 223rd Ave 10/18/2012 626780	12269 223rd Ave 10/15/2013 626780	12269 223rd Ave 10/22/2014 626780	12269 223rd Ave 4/23/2015 626780	12269 223rd Ave 12/14/2015 626780	12269 223rd Ave 4/25/2016 626780	12269 223rd Ave 10/20/2016 626780	12269 223rd St 10/18/2017 626780	12269 223rd Ave 10/16/2018 626780
Effective Date		11/13/2023														
Exceedance Key		No Exceed														
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U Q	< 1.00 U	< 0.500 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U Q	--	< 0.750 U	< 0.750 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.00 U C4 Q	< 1.00 U C4	< 1.00 U C4	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U C4 Q	< 1.00 U C4	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.050	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.250 U Q	< 1.00 U	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 0.100 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U Q	< 1.00 U	< 0.500 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U Q	< 10.0 U C3	< 10.0 U	< 10.0 U	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 0.500 U Q	< 1.00 U	< 0.500 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50
Bromobenzene	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 1.00 U Q	< 1.00 U	< 1.00 U J3	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U Q	< 1.00 U	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25
Chlorobenzene	ug/l	100 HRL93	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HRL23	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U C3J4Q	< 1.00 U	< 0.250 U	< 0.250 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U Q	< 10.0 U	< 10.0 U	< 10.0 U C3	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10 *^	< 10 ^
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U Q	< 5.00 U	< 5.00 U	< 5.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 *^	< 5.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U J4 Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 1.00 U C3 Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.00 U Q	< 5.00 U C3	< 5.00 U	< 5.00 U J3	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.0
Toluene	ug/l	70 HRL23	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.100 U Q	< 1.00 U	< 0.100 U	< 0.100 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U Q	--	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.0500 U Q	< 1.00 U	< 0.0500 U	< 0.0500 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.0040	< 0.050	< 0.050	< 0.050
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U Q	< 2.00 U	< 2.00 U	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters																

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	12183 223rd Ave	12183 223rd Ave New	12183 223rd Ave	12183 223rd Ave New	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd St	12269 223rd Ave
		Date	10/19/2021	9/29/2022	11/07/2022	10/19/2023	10/20/2011	10/18/2012	10/15/2013	10/22/2014	4/23/2015	12/14/2015	4/25/2016	10/20/2016	10/18/2017	10/16/2018
		Unique Well ID# (or MPCA ID)	ZW00215	876412	ZW00215	876412	626780	626780	626780	626780	626780	626780	626780	626780	626780	626780
Parameter	Units	MDH Human Health-Based Water Guidance Table														
Effective Date		11/13/2023														
Exceedance Key		No Exceed														
Alkalinity, total, as CaCO3	mg/l		232	--	229	178	240	238	228	254 B	247	270	--	279	294	277
Chemical Oxygen Demand	mg/l		< 10.0 U	--	< 10.0 U	< 10.0 U	5.1	11.7 B	< 5.0	< 5.0	--	< 10.0	--	< 10.0	< 10.0	< 10.0
Chloride	mg/l		5.19	--	5.16	< 1 U	7.9	8.33	10.1	9.69	11.4	12.1	--	11.4	12	11.7
Dissolved oxygen, field	mg/l		0.9	--	0.2	0.3	--	--	--	--	--	--	1.7	2.5	3.5	2.1
Nitrogen, ammonia, as N	mg/l		< 0.100 U	--	< 0.100 U	0.175	< 0.050	< 0.050	< 0.050	< 0.050	--	< 0.020	--	< 0.020	< 0.020 F1	< 0.020
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.100 U	--	< 0.100 U	< 0.100 U	0.98	1.2	1.2	1.3	--	1.4	--	1.4	1.3	1.0
pH, field	pH units		7.68	--	7.60	7.63	7.44	6.90	7.24	7.86	7.41	7.60	7.51	7.52	7.60	7.58
Redox (oxidation potential), field	mV		-89	--	-46	-57	--	--	--	--	--	--	-84	60.0	81	99
Solids, total dissolved	mg/l		262	--	246 B	176 Q	247	297	297	304	--	316	--	349	336	343
Solids, total suspended	mg/l		< 4.00 U	--	< 4.00 U	6.30	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	--	< 4.0	< 4.0	< 4.0
Specific conductance @ 25 ºC, field	umhos/cm		463	--	469	331	471	613	487	474	523	566	550	570	567	560
Sulfate, as SO4	mg/l		25.4	--	--	--	--	--	--	--	20.8	--	--	--	--	--
Temperature, field	deg C		11	--	10.1	10	11.0	10.5	10.5	10.2	9.7	10.1	11.0	11.2	11.9	11.5
Turbidity, field	NTU		3	--	1.3	--	--	--	--	--	--	--	--	--	1.8	1.0
Total Metals																
Calcium	mg/l		64.0	--	63.3	46.9	--	--	--	--	78.7	74.3	--	74.9	75.6	80.8
Lead	ug/l		--	--	--	< 5.00 U	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		22.5	--	22.1	12.9	--	--	--	--	27.4	26.5	--	27.6	27.4	27.3
Manganese	ug/l	100 HRL23	--	--	--	60.8	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l		1.26	--	1.65	1.35	--	--	--	--	1.5	1.5	--	1.6	1.5	1.5
Sodium	mg/l		4.61	--	4.59	4.50	--	--	--	--	3.2	3.3	--	3.5	3.7	3.4

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Location	12269 223rd St	12269 223rd St	12269 223RD ST	12269 223rd St New	12269 223rd St New	12269 223rd St New	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St
			Date	10/24/2019	10/15/2020	10/19/2021	9/21/2022	11/07/2022	10/19/2023	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/22/2015	10/20/2016	10/18/2017	10/16/2018
			Unique Well ID# (or MPCA ID)	626780	626780	626780	876410	876410	876410	638355	638355	638355	638355	638355	638355	638355	638355	638355
Effective Date		11/13/2023																
Exceedance Key		No Exceed																
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.50	< 0.500 U	< 0.500 U Q	< 1.00 U	< 0.500 U	< 0.500 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 0.750 U	< 0.750 U Q	--	< 0.750 U	< 0.750 U	< 0.750 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HRL23	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 5.0	< 1.00 U	< 1.00 U C4 Q	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 5.0	< 1.00 U	< 1.00 U C4 Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 0.050	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 0.050	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.25	< 0.250 U	< 0.250 U Q	< 1.00 U	< 0.250 U	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 0.100 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.25	< 0.500 U	< 0.500 U Q	< 1.00 U	< 0.500 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HRL23 (1)	< 10	< 10.0 U	< 10.0 U Q	< 10.0 U C3	< 10.0 U	< 10.0 U	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 0.50	< 0.500 U	< 0.500 U Q	< 1.00 U	< 0.500 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50
Bromobenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U C3	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.25	< 0.250 U	< 0.250 U Q	< 1.00 U	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U C3	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HRL23	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 1.4	< 0.250 U	< 0.250 U C3J4Q	< 1.00 U	< 0.250 U	< 0.250 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10	< 10.0 U	< 10.0 U Q	< 10.0 U	< 10.0 U	< 10.0 U C3	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10 ^
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 10	< 5.00 U	< 5.00 U Q	< 5.00 U	< 5.00 U	< 5.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0 ^	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 5.0	< 1.00 U	< 1.00 U J4 Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 5.0	< 1.00 U	< 1.00 U C3 Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 10	< 5.00 U	< 5.00 U Q	< 5.00 U C3	< 5.00 U	< 5.00 U J3	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HRL23	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.10	< 0.100 U	< 0.100 U Q	< 1.00 U	< 0.100 U	< 0.100 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 2.0	< 1.00 U	< 1.00 U Q	--	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 0.0500 U	< 0.0500 U Q	< 1.00 U	< 0.0500 U	< 0.0500 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	< 0.050
Xylene, total	ug/l	300 XYL HRL23 (1)	< 3.0	< 2.00 U	< 2.00 U Q	< 2.00 U	< 2.00 U	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters																		

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	12269 223rd St	12269 223rd St	12269 223RD ST	12269 223rd St New	12269 223rd St New	12269 223rd St New	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St
		Date	10/24/2019	10/15/2020	10/19/2021	9/21/2022	11/07/2022	10/19/2023	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/22/2015	10/20/2016	10/18/2017	10/16/2018
		Unique Well ID# (or MPCA ID)	626780	626780	626780	876410	876410	876410	638355	638355	638355	638355	638355	638355	638355	638355	638355
Parameter	Units	MDH Human Health-Based Water Guidance Table															
Effective Date		11/13/2023															
Exceedance Key		No Exceed															
Alkalinity, total, as CaCO3	mg/l		312	254	285	--	179	186	238	186	173	4270	196	208	208	218	219
Chemical Oxygen Demand	mg/l		< 10.0	< 10.0 U	< 10.0 U	--	19.4	< 10.0 U	< 5.0	< 5.0	8.3	< 5.0	--	< 10.0	< 10.0	< 10.0	< 10.0
Chloride	mg/l		12.6	12.5	13.2	--	< 1 U	< 1 U	5.8	5.27	6.02	5.83	6.3	6.11	5.9	4.54	4.08
Dissolved oxygen, field	mg/l		2.5	0.7	2.3	--	3.0	0.4	--	--	--	--	--	--	0.4	0.6	0.8
Nitrogen, ammonia, as N	mg/l		< 0.020	< 0.100 U	< 0.100 U	--	0.133	0.241	< 0.050	< 0.050	< 0.050	< 0.050	--	< 0.020	0.038	< 0.020	< 0.020
Nitrogen, nitrate + nitrite, as N	mg/l		0.86	0.814	0.729	--	< 0.100 U	< 0.100 U	< 0.050	< 0.050	< 0.050	< 0.050	--	< 0.050	< 0.050	< 0.050	< 0.050
pH, field	pH units		7.50	7.35	7.5	--	7.74	7.76	7.57	7.71	7.74	7.57	7.34	7.96	7.72	7.74	7.25
Redox (oxidation potential), field	mV		111	86	-35	--	-25	-47	--	--	--	--	--	--	143.0	-35	65
Solids, total dissolved	mg/l		320	348	337	--	179 B	187 B	225	266	254	245	--	214	249	257	271
Solids, total suspended	mg/l		< 4.0	< 4.00 U	< 4.00 U	--	< 4.00 U	< 4.00 U	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	< 4.0	< 4.0	< 4.0
Specific conductance @ 25 ºC, field	umhos/cm		555	577	608	--	329	338	438	432	428	459	471	419	424	430	432
Sulfate, as SO4	mg/l		--	21.9	22.4	--	--	--	--	--	--	--	25.6	--	--	--	--
Temperature, field	deg C		11.2	10.9	11.3	--	11.1	11.8	10.0	9.8	9.9	9.9	9.3	9.9	9.9	10.2	10.0
Turbidity, field	NTU		1.3	2.1	2.3	--	3.0	--	--	--	--	--	--	--	--	1.3	1.7
Total Metals																	
Calcium	mg/l		81.8	84.6	82.8	--	45.5	46.7	--	--	--	--	57.7	57.4 4	53.8	52.3	57.3
Lead	ug/l		--	--	--	--	--	< 5.00 U	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		29.0	29.5	28.4	--	13.8	13.5	--	--	--	--	21.2	20.2	20.2	19.6	20.3
Manganese	ug/l	100 HRL23	--	--	--	--	--	< 10.0 U	--	--	--	--	--	--	--	--	--
Potassium	mg/l		1.5	1.53	1.18	--	1.51	1.25	--	--	--	--	1.5	1.5	1.5	1.4	1.5
Sodium	mg/l		3.5	3.72	3.58	--	5.13	4.96	--	--	--	--	3.7	3.8	3.8	3.7	3.5

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Location: 22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St New	22130 Quinn St	22191 Hwy 169	22191 Hwy 169	22191 Hwy 169	22191 Hwy 169	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St
			Date: 10/24/2019	10/15/2020	10/19/2021	11/07/2022	12/14/2022	10/19/2023	10/20/2011	10/18/2012	10/15/2013	10/21/2014	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/22/2015
			Unique Well ID# (or MPCA ID): 638355	638355	638355	638355	876414	638355	00437275	00437275	00437275	00437275	527979	527979	527979	527979	527979	527979
Effective Date		11/13/2023																
Exceedance Key		No Exceed																
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.50	< 0.500 U	< 0.500 U Q	< 0.500 U	< 1.00 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 0.750 U	< 0.750 U Q	< 0.750 U	< 0.750 U	< 0.750 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HRL23	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 5.0	< 1.00 U	< 1.00 U C4 Q	< 1.00 U C4	< 1.00 U C3	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 5.0	< 1.00 U	< 1.00 U C4 Q	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 0.050	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.25	< 0.250 U	< 0.250 U Q	< 0.250 U	< 1.00 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 0.100 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.25	< 0.500 U	< 0.500 U Q	< 0.500 U	< 1.00 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0
Acetone	ug/l	3000 HRL23 (1)	< 10	< 10.0 U	< 10.0 U Q	< 10.0 U	< 10.0 U	< 10.0 U	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0 *	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 0.50	< 0.500 U	< 0.500 U Q	< 0.500 U	< 1.00 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Bromobenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0
Bromoform	ug/l	40 HRL93	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0 *	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.25	< 0.250 U	< 0.250 U Q	< 0.250 U	< 1.00 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0
Chloroethane	ug/l	ND RAA16	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 4.0	< 4.0	< 4.0	< 2.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U J3	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HRL23	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 1.4	< 0.250 U	< 0.250 U C3J4Q	< 0.250 U	< 1.00 U	< 0.250 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10	< 10.0 U	< 10.0 U Q	< 10.0 U	< 10.0 U	< 10.0 U C3	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 10	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 10	< 5.00 U	< 5.00 U Q	< 5.00 U	< 5.00 U	< 5.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0 ^	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 5.0	< 1.00 U	< 1.00 U J4 Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 5.0	< 1.00 U	< 1.00 U C3 Q	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Styrene	ug/l		< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 10	< 5.00 U	< 5.00 U Q	< 5.00 U	< 5.00 U	< 5.00 U J3	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HRL23	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.10	< 0.100 U	< 0.100 U Q	< 0.100 U	< 1.00 U	< 0.100 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 0.0500 U	< 0.0500 U Q	< 0.0500 U	< 1.00 U	< 0.0500 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10
Xylene, total	ug/l	300 XYL HRL23 (1)	< 3.0	< 2.00 U	< 2.00 U Q	< 2.00 U	< 2.00 U	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters																		

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St New	22130 Quinn St	22191 Hwy 169	22191 Hwy 169	22191 Hwy 169	22191 Hwy 169	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St
		Date	10/24/2019	10/15/2020	10/19/2021	11/07/2022	12/14/2022	10/19/2023	10/20/2011	10/18/2012	10/15/2013	10/21/2014	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/22/2015
		Unique Well ID# (or MPCA ID)	638355	638355	638355	638355	876414	638355	00437275	00437275	00437275	00437275	527979	527979	527979	527979	527979	527979
Parameter	Units	MDH Human Health-Based Water Guidance Table																
Effective Date		11/13/2023																
Exceedance Key		No Exceed																
Alkalinity, total, as CaCO3	mg/l		239	202	214	219	--	229	201	182	202	206	217	218	190	3960	210	201
Chemical Oxygen Demand	mg/l		< 10.0	< 10.0 U	< 10.0 U	< 10.0 U	--	< 10.0 U	14.9	6.0	< 5.0	7.4	12.7	6.9	< 5.0	< 5.0	--	< 10.0
Chloride	mg/l		4.3	3.97	4.21	3.74	--	4.48	27.8	27.3	30.8	32.3	16.2	15.8	20.4	19.3	22.2	21.6
Dissolved oxygen, field	mg/l		0.3	0.5	1	0.3	--	0.3	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l		< 0.020	< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050 F1	--	< 0.020
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.050	< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	< 0.050	< 0.050	< 0.050	< 0.050	1.8	2.1	2.0	2.1	--	2.1
pH, field	pH units		7.08	7.2	7.71	7.44	--	7.7	7.80	7.83	7.82	8.27	7.47	7.20	7.25	7.50	7.37	7.77
Redox (oxidation potential), field	mV		85	95	-50	23	--	-45	--	--	--	--	--	--	--	--	--	--
Solids, total dissolved	mg/l		258	251	253	260 B	--	270 B	259	305	277	321	223	275	250	296	--	238
Solids, total suspended	mg/l		< 4.0	< 4.00 U	< 4.00 U	< 4.00 U	--	< 4.00 U	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0
Specific conductance @ 25 ºC, field	umhos/cm		428	432	450	443	--	451	445	497	490	455	446	496	487	467	482	443
Sulfate, as SO4	mg/l		--	20.3	20.0	--	--	--	--	--	--	--	--	--	--	--	20.1	--
Temperature, field	deg C		10.0	10	11.1	9.9	--	10	9.2	9.4	9.4	9.2	10.6	10.5	10.1	10.2	9.5	10.2
Turbidity, field	NTU		1.2	1.1	1	0.8	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals																		
Calcium	mg/l		58.3	64.6	60.2	59.9	--	62.6	--	--	--	--	--	--	--	--	62.2	61.1
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		21.4	23.1	22.5	21.6	--	21.1	--	--	--	--	--	--	--	--	21.5	20.6
Manganese	ug/l	100 HRL23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l		1.5	1.55	1.16	1.62	--	1.49	--	--	--	--	--	--	--	--	1.3	1.4
Sodium	mg/l		3.6	4.01	3.81	3.84	--	3.67	--	--	--	--	--	--	--	--	2.6	2.8

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St New	22272 Quinn St New	22715 Baldwin	22715 Baldwin	22715 Baldwin	22915 Hwy 169	22915 Hwy 169	22915 Hwy 169	22915 Hwy 169
		Date	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/15/2020	10/19/2021	11/07/2022	12/10/2022	10/19/2023	10/20/2011	10/18/2012	10/21/2014	10/20/2011	10/18/2012	10/15/2013	10/21/2014
		Unique Well ID# (or MPCA ID)	527979	527979	527979	527979	527979	527979	527979	876413	876413	(ZW00216)	(ZW00216)	(ZW00216)	545375	545375	545375	545375
Parameter	Units	MDH Human Health-Based Water Guidance Table																
Effective Date		11/13/2023																
Exceedance Key		No Exceed																
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.500 U Q	< 0.500 U	< 1.00 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 0.75	< 0.75	< 1.0	< 0.750 U	< 0.750 U Q	< 0.750 U	< 0.750 U	< 0.750 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U C4 Q	< 1.00 U C4	< 1.00 U	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U C4 Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.0	< 0.050	< 0.050	< 0.050	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.250 U Q	< 0.250 U	< 1.00 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 0.100 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 1.0	< 0.50	< 0.50	< 0.25	< 0.500 U	< 0.500 U Q	< 0.500 U	< 1.00 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
2,2-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Acetone	ug/l	3000 HRL23 (1)	< 10	< 10	< 10	< 10	< 10.0 U	< 10.0 U Q	< 10.0 U	< 10.0 U	< 10.0 U	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Allyl chloride	ug/l	30 HRL94	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 2.0
Benzene	ug/l	2 HRL09 (1)	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.500 U Q	< 0.500 U	< 1.00 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Bromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U J3	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Butylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.250 U Q	< 0.250 U	< 1.00 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Chloroethane	ug/l	ND RAA16	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 4.0	< 4.0	< 2.0	< 4.0	< 4.0	< 4.0	< 2.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethyl benzene	ug/l	40 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0	< 1.0 ^	< 1.0	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Hexachlorobutadiene	ug/l	1 HRL93	< 1.0	< 0.25	< 0.25	< 1.4	< 0.250 U	< 0.250 U C3J4Q	< 0.250 U	< 1.00 U	< 0.250 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10	< 10	< 10 ^	< 10	< 10.0 U	< 10.0 U Q	< 10.0 U	< 10.0 U	< 10.0 U C3	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0	< 5.0 ^	< 5.0	< 10	< 5.00 U	< 5.00 U Q	< 5.00 U	< 5.00 U	< 5.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0	< 1.0 ^	< 1.0	< 1.0 ^	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U J4 Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Naphthalene	ug/l	70 HRL13	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U C3 Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Propylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Styrene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 5.0 ^	< 5.0	< 10	< 5.00 U	< 5.00 U Q	< 5.00 U	< 5.00 U	< 5.00 U J3	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 1.0	< 0.10	< 0.10	< 0.10	< 0.100 U	< 0.100 U Q	< 0.100 U	< 1.00 U	< 0.100 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0 ^
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 0.050	< 0.050	< 0.050	< 0.0500 U	< 0.0500 U Q	< 0.0500 U	< 1.00 U	< 0.0500 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.0	< 2.0	< 2.0	< 3.0	< 2.00 U	< 2.00 U Q	< 2.00 U	< 2.00 U	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters																		

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St New	22272 Quinn St New	22715 Baldwin	22715 Baldwin	22715 Baldwin	22915 Hwy 169	22915 Hwy 169	22915 Hwy 169	22915 Hwy 169
		Date	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/15/2020	10/19/2021	11/07/2022	12/10/2022	10/19/2023	10/20/2011	10/18/2012	10/21/2014	10/20/2011	10/18/2012	10/15/2013	10/21/2014
		Unique Well ID# (or MPCA ID)	527979	527979	527979	527979	527979	527979	527979	876413	876413	(ZW00216)	(ZW00216)	(ZW00216)	545375	545375	545375	545375
Parameter	Units	MDH Human Health-Based Water Guidance Table																
Effective Date		11/13/2023																
Exceedance Key		No Exceed																
Alkalinity, total, as CaCO3	mg/l		195	207	209	266	229	244	241	--	182	265	216	233	247	188	213	206
Chemical Oxygen Demand	mg/l		< 10.0	< 10.0	15.1	< 10.0	< 10.0 U	< 10.0 U	< 10.0 U	--	91.4	12.7	< 5.0	< 5.0	13.0	< 5.0	< 5.0	< 5.0
Chloride	mg/l		21.9	23.5	23.9	27.3	31.3	30.6	30.4	--	< 1 U	12.5	10.9	12.7	28.4	24.3	28.9	27.1
Dissolved oxygen, field	mg/l		1.9	1.4	1.5	0.9	0.3	0.8	0.4	--	0.2	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l		< 0.020	< 0.020	< 0.020	< 0.020	< 0.100 U	< 0.100 U	< 0.100 U	--	0.203	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Nitrogen, nitrate + nitrite, as N	mg/l		2.1	2.0	2.0	1.6	1.03	0.878	1.36	--	< 0.100 U	9.6	9.6	9.8	0.19	0.49	0.81	0.93
pH, field	pH units		7.60	7.63	7.58	7.60	7.5	7.47	7.42	--	7.6	7.60	8.09	7.73	7.67	7.96	7.92	7.67
Redox (oxidation potential), field	mV		130.0	25	80	99	101	-90	89	--	-58	--	--	--	--	--	--	--
Solids, total dissolved	mg/l		259	314	308	290	323	324	328 B	--	175 Q	316	347	316	256	302	294	330
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	< 4.00 U	< 4.00 U	< 4.00 U	--	< 4.00 U	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Specific conductance @ 25 ºC, field	umhos/cm		479	482	497	520	555	590	578	--	330	562	566	495	472	518	503	479
Sulfate, as SO4	mg/l		--	--	--	--	22.0	24.3	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C		10.6	10.7	10.6	10.4	10.3	10.6	10.3	--	10.3	11.0	9.6	9.3	10.6	10.6	9.6	9.8
Turbidity, field	NTU		--	1.4	1.0	0.8	1.0	1.4	0.8	--	--	--	--	--	--	--	--	--
Total Metals																		
Calcium	mg/l		58.9	60.2	70.2	71.2	84.6	75.8	81.1	--	46.1 V	--	--	--	--	--	--	--
Lead	ug/l		--	--	--	--	--	--	--	--	< 5.00 U	--	--	--	--	--	--	--
Magnesium	mg/l		21.8	21.3	23.2	24.7	28.9	26.1	26.9	--	13.4	--	--	--	--	--	--	--
Manganese	ug/l	100 HRL23	--	--	--	--	--	--	--	--	< 10.0 U	--	--	--	--	--	--	--
Potassium	mg/l		1.5	1.3	1.5	1.4	1.53	1.09	1.67	--	1.25	--	--	--	--	--	--	--
Sodium	mg/l		2.9	2.8	3.0	3.1	4.05	3.18	3.49	--	4.85	--	--	--	--	--	--	--

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	22915 Hwy 169 10/23/2015 545375	22915 Hwy 169 10/16/2018 545375	22915 Hwy 169 10/19/2021 545375	23385 Hwy 169 10/20/2011 00531397	23385 Hwy 169 10/18/2012 00531397	23385 Hwy 169 10/15/2013 00531397	23385 Hwy 169 10/21/2014 00531397	ERL Shop Well 10/20/2011 420558	ERL Shop Well 10/18/2012 420558	ERL Shop Well 10/15/2013 420558	ERL Shop Well 10/20/2014 420558	ERL Shop Well 10/23/2015 420558	ERL Shop Well 10/20/2016 420558	ERL Shop Well 10/18/2017 420558	ERL Shop Well 10/16/2018 420558	ERL Shop Well 10/24/2019 420558	ERL Shop Well 10/15/2020 420558
Effective Date		11/13/2023																	
Exceedance Key		No Exceed																	
Volatile Organic Compounds																			
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 1.00 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 1.0	< 0.50	< 0.500 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 0.75	< 0.750 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75	< 1.0	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 1.0	< 1.00 U J3	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.00 U J3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.0	< 0.050	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 0.050	< 0.050	< 0.050	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 1.0	< 0.25	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 1.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 1.0	< 0.50	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.25	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
2,2-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U
Acetone	ug/l	3000 HRL23 (1)	< 10 ^	< 10	< 10.0 U	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10.0 U J4
Allyl chloride	ug/l	30 HRL94	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0 *	< 2.0	< 2.0	< 2.0	< 2.0 *	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	< 1.0	< 0.50	< 0.500 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Bromochloromethane	ug/l		< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.0	< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Bromoform	ug/l	40 HRL93	< 1.0	< 1.0	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
Bromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U
Butylbenzene	ug/l		< 1.0	< 1.0	< 1.00 U C3 J3	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 1.0	< 0.25	< 0.250 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
Chloroethane	ug/l	ND RAA16	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U
Chloromethane	ug/l		< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 4.0	< 2.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 1.00 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Ethyl benzene	ug/l	40 HRL23	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 2.0	< 1.00 U
Hexachlorobutadiene	ug/l	1 HRL93	< 1.0	< 0.25	< 0.250 U C3 J3	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 0.25	< 0.25	< 1.4	< 0.250 U
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10 ^	< 10 ^	< 10.0 U	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 10 ^	< 10	< 10	< 10 ^	< 10	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0	< 5.0	< 5.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0 ^	< 5.0	< 10	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0	< 1.0	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0 ^	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
Naphthalene	ug/l	70 HRL13	< 1.0	< 1.0	< 1.00 U C3 J3	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U
Propylbenzene	ug/l		< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Styrene	ug/l		< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 5.0	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.0	< 10	< 5.00 U
Toluene	ug/l	70 HRL23	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 1.0	< 0.10	< 0.100 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.10	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.10	< 0.050	< 0.0500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.050	< 0.050	< 0.050	< 0.050	< 0.0500 U
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.0	< 2.0	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.00 U
General Parameters																			

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	22915 Hwy 169	22915 Hwy 169	22915 Hwy 169	23385 Hwy 169	23385 Hwy 169	23385 Hwy 169	23385 Hwy 169	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well
		Date	10/23/2015	10/16/2018	10/19/2021	10/20/2011	10/18/2012	10/15/2013	10/21/2014	10/20/2011	10/18/2012	10/15/2013	10/20/2014	10/23/2015	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/15/2020
		Unique Well ID# (or MPCA ID)	545375	545375	545375	00531397	00531397	00531397	00531397	420558	420558	420558	420558	420558	420558	420558	420558	420558	420558
Parameter	Units	MDH Human Health-Based Water Guidance Table																	
Effective Date		11/13/2023																	
Exceedance Key		No Exceed																	
Alkalinity, total, as CaCO3	mg/l		206	205	223	217	196	170	165	214	149	148	3520	174	167	175	177	216	166
Chemical Oxygen Demand	mg/l		11.6	10.5	< 11.7 U	6.7	< 5.0	< 5.0	5.8	< 5.0	< 5.0	< 5.0	< 5.0	< 10.0 F1	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0 U
Chloride	mg/l		30.7	30.2	27.9	< 1.0	< 1	< 1	< 1 F1	< 1.0	< 1	< 1	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 1.0	< 1 U
Dissolved oxygen, field	mg/l		--	0.6	0.5	--	--	--	--	--	--	--	--	--	0.8	0.6	0.5	1.5	1.8
Nitrogen, ammonia, as N	mg/l		< 0.020	< 0.020	< 0.100 U	0.076	0.13	0.10	0.16	0.18	0.14	0.099	0.15 F1	0.13	0.13	0.13	0.13	0.15	< 0.100 U
Nitrogen, nitrate + nitrite, as N	mg/l		0.84	0.34	0.595	< 0.050	< 0.050	< 0.050	< 0.050 F1	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.100 U
pH, field	pH units		7.92	7.62	7.67	8.17	8.26	8.19	8.04	7.70	7.20	7.18	7.59	8.13	7.97	7.93	7.83	7.60	7.63
Redox (oxidation potential), field	mV		--	80	-155	--	--	--	--	--	--	--	--	--	-200.0	-180	-101	-39	-54
Solids, total dissolved	mg/l		265	318	292	159	183	169	190	157	184	158	179	164	194	202	184	165	186
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.00 U	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	4.70
Specific conductance @ 25 ºC, field	umhos/cm		450	532	550	318	347	350	330	307	418	409	356	325	328	326	326	327	327
Sulfate, as SO4	mg/l		--	--	29.8	--	--	--	--	--	--	--	--	--	--	--	--	--	< 5.00 U
Temperature, field	deg C		9.4	9.4	10.3	9.5	9.8	10.1	9.5	10.0	10.2	10.0	11.8	11.4	11.3	11.0	10.8	11.0	11.1
Turbidity, field	NTU		--	4.7	5.3	--	--	--	--	--	--	--	--	--	--	1.7	0.9	1.4	1.9
Total Metals																			
Calcium	mg/l		73.6	71.3	74.2	--	--	--	--	--	--	--	--	43.7	40.6	41.7	44.5	42.0	45.3
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		25.0	24.4	25.1	--	--	--	--	--	--	--	--	13.7	13.7	13.7	13.7	13.5	14.7
Manganese	ug/l	100 HRL23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l		1.7	1.7	3.07	--	--	--	--	--	--	--	--	1.4	1.4	1.4	1.4	1.4	1.44
Sodium	mg/l		3.2	3.1	3.87	--	--	--	--	--	--	--	--	6.4	6.4	6.5	6.1	6.0	6.79

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Location: ERL Shop Well	ERL Shop Well	ERL Shop Well	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.
			Date: 10/19/2021	11/07/2022	10/19/2023	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/23/2015	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/15/2020	10/19/2021
			Unique Well ID# (or MPCA ID): 420558	420558	420558	626766	626766	626766	626766	626766	626766	626766	626766	626766	626766	626766	626766
Effective Date		11/13/2023															
Exceedance Key		No Exceed															
Volatile Organic Compounds																	
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U J4	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U J4
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U C3	< 0.500 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.500 U C3
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U	< 0.750 U	< 0.750 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75	< 1.0	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l		< 1.00 U J3	< 1.00 U C4	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U J3
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U C3	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U C3
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U J3	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U J3
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U C3	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 0.050	< 0.050	< 0.050	< 1.00 U	< 1.00 U C3
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.00 U	< 1.00 U	< 0.100 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U	< 0.500 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.25	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U	< 10.0 U	< 10.0 U	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U J4	< 10.0 U
Allyl chloride	ug/l	30 HRL94	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0 *	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	< 0.500 U J4	< 0.500 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.500 U J4
Bromobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U J4
Bromoform	ug/l	40 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U
Bromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U J3	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U
Butylbenzene	ug/l		< 1.00 U C3 J3	< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U C3 J3
Butylbenzene, sec	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U J4	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.250 U J4
Chlorobenzene	ug/l	100 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U
Chloroethane	ug/l	ND RAA16	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U
Chloroform	ug/l	20 HRL18	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U J4
Chloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U
Chlorotoluene, o	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l		< 1.00 U J4	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U J4
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U	< 1.00 U	< 1.00 U C3	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Ethyl benzene	ug/l	40 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 2.0	< 1.00 U	< 1.00 U
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U C3 J3	< 0.250 U	< 0.250 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 1.4	< 0.250 U	< 0.250 U C3 J3
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U	< 10.0 U	< 10.0 U C3	< 20	< 20	< 20	< 20	< 10	< 10 ^	< 10	< 10	< 10 ^	< 10	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U	< 5.00 U	< 5.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.0	< 10	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0 ^	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U
Naphthalene	ug/l	70 HRL13	< 1.00 U C3 J3	< 1.00 U	< 1.00 U C3	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U C3 J3
Propylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Styrene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18	< 5.00 U	< 5.00 U	< 5.00 U J3	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.0	< 10	< 5.00 U	< 5.00 U
Toluene	ug/l	70 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.100 U J4	< 0.100 U	< 0.100 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.10	< 0.100 U	< 0.100 U J4
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	< 0.050	< 0.0500 U	< 0.0500 U
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U	< 2.00 U	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.00 U	< 2.00 U
General Parameters																	

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	ERL Shop Well	ERL Shop Well	ERL Shop Well	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.
		Date	10/19/2021	11/07/2022	10/19/2023	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/23/2015	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/15/2020	10/19/2021
		Unique Well ID# (or MPCA ID)	420558	420558	420558	626766	626766	626766	626766	626766	626766	626766	626766	626766	626766	626766	626766
Parameter	Units	MDH Human Health-Based Water Guidance Table															
Effective Date		11/13/2023															
Exceedance Key		No Exceed															
Alkalinity, total, as CaCO3	mg/l		173	173	181	202	176	182	3890	172	185	183	187	182	225	173	185
Chemical Oxygen Demand	mg/l		< 10.0 U	< 10.0 U	209	10.8	< 5.0	< 5.0	6.1 B	--	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0 U	< 10.0 U
Chloride	mg/l		< 1 U	< 1 U	< 1 U	< 1.0	< 1	< 1	< 1	< 1.0	< 0.5	< 0.5	< 0.5	< 0.5	< 1.0	< 1 U	< 1 U
Dissolved oxygen, field	mg/l		0.5	0.3	0.9	--	--	--	--	--	--	6.9	2.9	3.0	3.5	4.0	5.2
Nitrogen, ammonia, as N	mg/l		0.151	0.116	0.117	0.27	0.23	0.18	0.51	--	0.18	0.23	0.23	0.80	0.24	0.207	0.269
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.100 U	< 0.100 U	< 0.100 U	< 0.050	< 0.050	< 0.050	< 0.050 F1	--	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.100 U	< 0.100 U
pH, field	pH units		8	7.7	8.1	7.82	8.25	8.19	7.58	7.53	7.97	7.87	7.80	7.58	7.48	7.5	7.78
Redox (oxidation potential), field	mV		-185	-63	-41	--	--	--	--	--	--	-10.0	25	36	58	71	-15
Solids, total dissolved	mg/l		176	178 B	184 Q	196	202	191	209	--	168	207	232	185	210	200	190
Solids, total suspended	mg/l		< 4.00 U	< 4.00 U	8.40	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	< 4.0	< 4.0	< 4.0	5.6	< 4.00 U	< 4.00 U
Specific conductance @ 25 ºC, field	umhos/cm		337	321	325	326	350	352	344	342	319	348	344	366	352	358	360
Sulfate, as SO4	mg/l		< 5.00 U	--	--	--	--	--	--	< 4.0	--	--	--	--	--	< 5.00 U	< 5.00 U
Temperature, field	deg C		11.3	11.1	14.9	10.2	10.0	10.0	9.9	9.4	10.0	10.2	10.5	9.9	9.6	10.9	12
Turbidity, field	NTU		1.5	2.0	--	--	--	--	--	--	--	--	3.0	2.5	5.2	5.8	5
Total Metals																	
Calcium	mg/l		42.1	41.3	44.5	--	--	--	--	46.4	45.7 4	44.0	46.8	47.9	45.2	49.2	46.3
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		13.7	13.2	12.9	--	--	--	--	14.9	14.3	15.1	15.4	14.8	14.5	15.9	14.3
Manganese	ug/l	100 HRL23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l		1.14	1.45	1.33	--	--	--	--	1.2	1.2	1.3	1.3	1.2	1.2	1.22	< 1.00 U
Sodium	mg/l		6.41	6.64 O1	6.08	--	--	--	--	5.4	5.7	6.0	6.2	5.6	5.4	6.08	5.60 O1

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Location: Ridges Develop.	Ridges Develop.	12781 221st Ave NW	12781 221st Ave NW	12781 221st Ave NW	12781 221st Ave NW	22205 Elk Lake Rd	22205 Elk Lake Rd	22205 Elk Lake Rd	22205 Elk Lake Rd	22205 Elk Lake Rd	22205 Elk Lake Rd	22275 Elk Lake Rd NW
			Date: 11/07/2022	10/19/2023	5/29/2015	10/23/2015	11/07/2016	10/15/2020	5/29/2015	10/23/2015	11/07/2016	10/19/2021	11/07/2022	10/19/2023	4/10/2017
			Unique Well ID# (or MPCA ID): 626766	626766	416125	416125	416125	416125	625475	625475	625475	625475	625475	625475	720300
Effective Date		11/13/2023													
Exceedance Key		No Exceed													
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 0.500 U	< 1.0	< 1.0	< 1.0	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U	< 0.750 U	< 1.0	< 1.0	< 1.0	< 0.750 U	< 1.0	< 1.0	< 1.0	< 0.750 U	< 0.750 U	< 0.750 U	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,1-Dichloropropene	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.00 U C4	< 1.00 U C3	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.00 U J3	< 1.00 U C4	< 1.00 U	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U C3	< 1.00 U	< 1.00 U	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 0.250 U	< 1.0	< 1.0	< 1.0	< 0.250 U	< 0.250 U	< 0.250 U	< 0.25
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.00 U	< 0.100 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 0.100 U	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,3-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 0.500 U	< 1.0	< 1.0	< 1.0	< 0.500 U	< 0.500 U	< 0.500 U	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
2,2-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U	< 10.0 U	< 10	< 10	< 10	< 10.0 U J4	< 10	< 10	< 10	< 10.0 U	< 10.0 U	< 10.0 U	< 10
Allyl chloride	ug/l	30 HRL94	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 0.500 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 0.500 U	< 1.0	< 1.0	< 1.0	< 0.500 U J4	< 0.500 U	< 0.500 U	< 0.50
Bromobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Bromochloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.0
Bromoform	ug/l	40 HRL93	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Bromomethane	ug/l	10 HRL93	< 1.00 U J3	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.0
Butylbenzene	ug/l		< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U C3 J3	< 1.00 U	< 1.00 U	< 1.0
Butylbenzene, sec	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Butylbenzene, tert	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 0.250 U	< 1.0	< 1.0	< 1.0	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.25
Chlorobenzene	ug/l	100 HRL93	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U	< 1.0 ^	< 1.0	< 1.0	< 1.00 U	< 1.0 ^	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Chloroethane	ug/l	ND RAA16	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0 *
Chloroform	ug/l	20 HRL18	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.0
Chloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Chlorotoluene, o	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Chlorotoluene, p	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.00 U	< 1.00 U	< 1.0	< 1.0 ^	< 1.0	< 1.00 U	< 1.0	< 1.0 ^	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Ethyl benzene	ug/l	40 HRL23	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0 ^	< 0.250 U	< 1.0	< 1.0	< 1.0 ^	< 0.250 U C3 J3	< 0.250 U	< 0.250 U	< 0.25
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U	< 10.0 U C3	< 10	< 10 ^	< 10	< 10.0 U	< 10	< 10 ^	< 10	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Naphthalene	ug/l	70 HRL13	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U C3 J3	< 1.00 U	< 1.00 U	< 1.0
Propylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Styrene	ug/l		< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.00 U	< 5.00 U J3	< 5.0	< 5.0	< 5.0	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.00 U	< 5.00 U	< 5.00 U J3 J4	< 5.0 *
Toluene	ug/l	70 HRL23	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.100 U	< 0.100 U	< 1.0	< 1.0	< 1.0	< 0.100 U	< 1.0	< 1.0	< 1.0	< 0.100 U J4	< 0.100 U	< 0.100 U	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U	< 1.00 U	< 1.0	< 1.0 ^	< 1.0 ^	< 1.00 U	< 1.0	< 1.0 ^	< 1.0 ^	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.0500 U	< 0.0500 U C3	< 0.10	< 0.10	< 0.050	< 0.0500 U	< 0.10	< 0.10	< 0.050	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 0.050
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.00 U	< 2.00 U	< 2.00 U	< 2.0
General Parameters															

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	Ridges Develop.	Ridges Develop.	12781 221st Ave NW	12781 221st Ave NW	12781 221st Ave NW	12781 221st Ave NW	22205 Elk Lake Rd	22205 Elk Lake Rd	22205 Elk Lake Rd	22205 Elk Lake Rd	22205 Elk Lake Rd	22205 Elk Lake Rd	22275 Elk Lake Rd NW
		Date	11/07/2022	10/19/2023	5/29/2015	10/23/2015	11/07/2016	10/15/2020	5/29/2015	10/23/2015	11/07/2016	10/19/2021	11/07/2022	10/19/2023	4/10/2017
		Unique Well ID# (or MPCA ID)	626766	626766	416125	416125	416125	416125	625475	625475	625475	625475	625475	625475	720300
Parameter	Units	MDH Human Health-Based Water Guidance Table													
Effective Date		11/13/2023													
Exceedance Key		No Exceed													
Alkalinity, total, as CaCO3	mg/l		184	189	171	165	172	153	154	139	147	159	148	153	--
Chemical Oxygen Demand	mg/l		< 10.0 U	< 10.0 U	--	< 10.0	< 10.0	< 10.0 U	--	< 10.0	< 10.0	< 10.0 U	< 10.0 U	14.2	--
Chloride	mg/l		< 1 U	< 1 U	2.0	2.38	5.09	5.27	14.7	14.4	15.5	16.5	16.7	16.9	--
Dissolved oxygen, field	mg/l		3.5	4.9	--	--	0.2	0.2	--	--	0.2	0.5	0.2	0.5	1.5
Nitrogen, ammonia, as N	mg/l		0.217	0.225	--	0.098	0.091 F1	< 0.100 U	--	0.15	0.17	0.217	0.148	0.175	--
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.100 U	< 0.100 U	--	< 0.050	< 0.050	< 0.100 U	--	< 0.050	< 0.050	< 0.100 U	< 0.100 U	< 0.100 U	--
pH, field	pH units		7.68	7.47	7.88	8.26	7.81	7.45	7.87	8.13	7.81	7.85	7.8	7.85	8.24
Redox (oxidation potential), field	mV		49	-25	--	--	-148.0	-8	--	--	-83.0	-190	-37	-35	-20.0
Solids, total dissolved	mg/l		188 B	197 B	--	169	227	226 J3	--	248	283	2910	280 B	309 B	--
Solids, total suspended	mg/l		< 4.00 U	< 4.00 U	--	< 4.0	< 4.0	< 4.00 U	--	< 4.0	< 4.0	< 4.00 U	19.8	< 4.00 U	--
Specific conductance @ 25 ºC, field	umhos/cm		338	399	379	309	384	387	431	387	435	459	444	454	397
Sulfate, as SO4	mg/l		--	--	24.6	--	--	37.6	49.8	--	--	61.4	--	--	--
Temperature, field	deg C		8.6	10.8	9.7	10.0	10.0	10	9.7	9.9	9.8	10.7	12.9	10.2	9.3
Turbidity, field	NTU		5.0	--	--	--	--	1.9	--	--	--	2.5	1.5	--	--
Total Metals															
Calcium	mg/l		45.9	48.7	48.7	45.4	49.2	54.1	59.5	61.9	59.9 4	64.6	66.0	64.2	--
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		14.7	13.8	14.3	14.2	15.5	17.2	14.7	15.0	14.9	15.7	16.4	14.4	--
Manganese	ug/l	100 HRL23	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l		1.25	1.16	1.6	1.5	1.7	1.64	1.3	1.4	1.4	1.06	1.40	1.28	--
Sodium	mg/l		5.97	5.58	9.3	6.8	7.2	7.40	3.3	3.8	3.8	4.16	3.87	3.45	--

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	22275 Elk Lake Rd NW	22275 Elk Lake Rd NW	22275 Elk Lake Rd NW	12685 221st Ave NW	12685 221st Ave NW	12685 221st Ave NW	12901 221st Ave NW	12901 221st Ave NW	12901 221st Ave NW	13175 221st Ave NW	13175 221st Ave NW	13175 221st Ave NW
		Date	10/18/2017	10/19/2021	10/19/2023	5/29/2015	10/23/2015	11/07/2016	7/07/2016	10/21/2016	10/15/2020	7/07/2016	10/21/2016	10/15/2020
		Unique Well ID# (or MPCA ID)	720300	720300	720300	00439871	00439871	00439871	535970	535970	535970	1000022317	1000022317	1000022317
Parameter	Units	MDH Human Health-Based Water Guidance Table												
Effective Date		11/13/2023												
Exceedance Key		No Exceed												
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.00 U J4	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.50	< 0.500 U C3	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.500 U	< 1.0	< 1.0	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.75	< 0.750 U	< 0.750 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.750 U	< 1.0	< 1.0	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,1-Dichloropropene	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 1.00 U J3	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.00 U C3	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.00 U J3	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 0.050	< 1.00 U C3	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.25	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.250 U	< 1.0	< 1.0	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.00 U	< 0.100 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,3-Dichloropropane	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.50	< 0.500 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.500 U	< 1.0	< 1.0	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
2,2-Dichloropropane	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Acetone	ug/l	3000 HRL23 (1)	< 10	< 10.0 U	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10.0 U J4	< 10	< 10	< 10.0 U J4
Allyl chloride	ug/l	30 HRL94	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	< 0.50	< 0.500 U J4	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.500 U	< 1.0	< 1.0	< 0.500 U
Bromobenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Bromochloromethane	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.0	< 1.00 U J4	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Bromoform	ug/l	40 HRL93	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Bromomethane	ug/l	10 HRL93	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Butylbenzene	ug/l		< 1.0	< 1.00 U C3 J3	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Butylbenzene, sec	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Butylbenzene, tert	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.25	< 0.250 U J4	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.250 U	< 1.0	< 1.0	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 1.00 U	< 1.00 U	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Chloroethane	ug/l	ND RAA16	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Chloroform	ug/l	20 HRL18	< 1.0	< 1.00 U J4	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Chloromethane	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Chlorotoluene, o	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Chlorotoluene, p	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.00 U J4	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.0	< 1.00 U	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Ethyl benzene	ug/l	40 HRL23	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0 ^	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Hexachlorobutadiene	ug/l	1 HRL93	< 0.25	< 0.250 U C3 J3	< 0.250 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 0.250 U	< 1.0	< 1.0	< 0.250 U
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10	< 10.0 U	< 10.0 U C3	< 10	< 10 ^	< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0 ^	< 5.00 U	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.00 U	< 5.0	< 5.0	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0 ^	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Naphthalene	ug/l	70 HRL13	< 1.0	< 1.00 U C3 J3	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Propylbenzene	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Styrene	ug/l		< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18	< 5.0 ^	< 5.00 U	< 5.00 U J3 J4	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.00 U	< 5.0	< 5.0	< 5.00 U
Toluene	ug/l	70 HRL23	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.10	< 0.100 U J4	< 0.100 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.100 U	< 1.0	< 1.0	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.00 U
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 0.0500 U	< 0.0500 U C3	< 0.10	< 0.10	< 0.050	< 0.0040	< 0.050	< 0.0500 U	< 0.0040	< 0.050	< 0.0500 U
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.0	< 2.00 U	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.00 U	< 2.0	< 2.0	< 2.00 U
General Parameters														

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	22275 Elk Lake Rd NW	22275 Elk Lake Rd NW	22275 Elk Lake Rd NW	12685 221st Ave NW	12685 221st Ave NW	12685 221st Ave NW	12901 221st Ave NW	12901 221st Ave NW	12901 221st Ave NW	13175 221st Ave NW	13175 221st Ave NW	13175 221st Ave NW
		Date	10/18/2017	10/19/2021	10/19/2023	5/29/2015	10/23/2015	11/07/2016	7/07/2016	10/21/2016	10/15/2020	7/07/2016	10/21/2016	10/15/2020
		Unique Well ID# (or MPCA ID)	720300	720300	720300	00439871	00439871	00439871	535970	535970	535970	1000022317	1000022317	1000022317
Parameter	Units	MDH Human Health-Based Water Guidance Table												
Effective Date		11/13/2023												
Exceedance Key		No Exceed												
Alkalinity, total, as CaCO3	mg/l		193	196	198	153	152 4	152	172	170	158	164	161	151
Chemical Oxygen Demand	mg/l		< 10.0	< 10.0 U	< 10.0 U	--	< 10.0	< 10.0	--	117	< 10.0 U	--	< 10.0	< 10.0 U
Chloride	mg/l		3.66	3.99	4.8	15.9	17.3	17.3	3.2	1.74	5.18	19.2	21.8	20.1
Dissolved oxygen, field	mg/l		0.5	0.5	0.3	--	--	0.2	0.8	0.2	0.3	0.6	0.3	0.3
Nitrogen, ammonia, as N	mg/l		0.34	0.380	0.349	--	0.035	< 0.020	--	0.086	< 0.100 U	--	0.054	< 0.100 U
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.050	< 0.100 U	< 0.100 U	--	< 0.050	< 0.050	--	< 0.050	< 0.100 U	--	< 0.050	< 0.100 U
pH, field	pH units		7.99	8.09	7.98	7.94	8.19	7.50	7.95	8.03	7.42	7.93	7.93	7.42
Redox (oxidation potential), field	mV		20	-180	-49	--	--	-89.0	-103.0	-144.0	14	-79.0	-142.0	13
Solids, total dissolved	mg/l		262	236	243 B	--	232	281	--	191	227	--	285	306
Solids, total suspended	mg/l		< 4.0	< 4.00 U	< 4.00 U	--	< 4.0	5.2	--	< 4.0	< 4.00 U	--	< 4.0	< 4.00 U
Specific conductance @ 25 ºC, field	umhos/cm		396	399	398	460	403	435	380	357	379	420	451	473
Sulfate, as SO4	mg/l		--	20.6	--	51.0	--	--	21.9	--	26.2	59.1	--	56.6
Temperature, field	deg C		9.6	9.8	10.3	11.0	12.0	11.8	10.4	10.9	10.1	10.9	10.5	10.7
Turbidity, field	NTU		2.6	1.5	--	--	--	--	--	--	1.3	--	--	1.5
Total Metals														
Calcium	mg/l		50.6	53.3	57.6	59.4	60.1	57.2	45.8	43.1	53.7 V	65.0	67.9	74.4
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		16.7	17.1	16.5	16.4	15.9	15.7	14.9	15.0	17.4	14.6	16.2	16.8
Manganese	ug/l	100 HRL23	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l		1.6	1.27	1.61	1.2	1.3	1.3	1.5	1.4	1.43	1.4	1.5	1.39
Sodium	mg/l		4.8	4.90	4.91	3.3	3.5	3.7	5.8	6.2	6.35	3.3	3.4	3.66

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Location: 13175 221ST Ave NW Date: 10/19/2021 Unique Well ID# (or MPCA ID): 1000022317	22017 Elk Lake Rd NW 7/07/2016 1000026209	22017 Elk Lake Rd NW 10/21/2016 1000026209	22248 Elk Lake Rd 4/10/2017 608116	22248 Elk Lake Rd 10/18/2017 608116	22248 ELK LAKE RD 10/19/2021 608116	22447 Tipton St. New 10/23/2015 813437	22447 Tipton St. New 4/25/2016 813437	22447 Tipton St. New 10/21/2016 813437	22447 Tipton St. New 10/18/2017 813437	22447 Tipton St. New 10/16/2018 813437	22447 Tipton St. New 10/24/2019 813437
Effective Date		11/13/2023												
Exceedance Key		No Exceed												
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U C3	< 1.0	< 1.0	< 0.50	< 0.50	< 0.500 U Q	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U	< 1.0	< 1.0	< 0.75	< 0.75	< 0.750 U Q	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,1-Dichloropropene	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.00 U J3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U C4 Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U C3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U J3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U C4 Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U C3	< 1.0	< 1.0	< 0.050	< 0.050	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 0.050	< 0.050	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.250 U	< 1.0	< 1.0	< 0.25	< 0.25	< 0.250 U Q	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U	< 1.0	< 1.0	< 0.50	< 0.50	< 0.500 U Q	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.25
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U	< 10	< 10	< 10	< 10	< 10.0 U Q	< 10	< 10	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Benzene	ug/l	2 HRL09 (1)	< 0.500 U J4	< 1.0	< 1.0	< 0.50	< 0.50	< 0.500 U Q	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50
Bromobenzene	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
Bromomethane	ug/l	10 HRL93	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0
Butylbenzene	ug/l		< 1.00 U C3 J3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U J4	< 1.0	< 1.0	< 0.25	< 0.25	< 0.250 U Q	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25
Chlorobenzene	ug/l	100 HRL93	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
Chloroethane	ug/l	ND RAA16	< 1.00 U	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0
Chloroform	ug/l	20 HRL18	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0
Chloromethane	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0
Chlorotoluene, o	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HRL23	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 2.0
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U C3 J3	< 1.0	< 1.0	< 0.25	< 0.25	< 0.250 U C3J4Q	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 1.4
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U	< 10	< 10	< 10	< 10	< 10.0 U Q	< 10 ^	< 10	< 10	< 10	< 10 ^	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.00 U Q	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.0	< 10
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0 ^
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J4 Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
Naphthalene	ug/l	70 HRL13	< 1.00 U C3 J3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U C3 Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
Propylbenzene	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.00 U	< 5.0	< 5.0	< 5.0 *	< 5.0 ^	< 5.00 U Q	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.0	< 10
Toluene	ug/l	70 HRL23	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.100 U J4	< 1.0	< 1.0	< 0.10	< 0.10	< 0.100 U Q	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U Q	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.0500 U	< 0.0040	< 0.050	< 0.050	< 0.050	< 0.0500 U Q	< 0.10	< 0.0040	< 0.050	< 0.050	< 0.050	< 0.050
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.00 U Q	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0
General Parameters														

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

			Location	13175 221ST Ave NW	22017 Elk Lake Rd NW	22017 Elk Lake Rd NW	22248 Elk Lake Rd	22248 Elk Lake Rd	22248 ELK LAKE RD	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New
			Date	10/19/2021	7/07/2016	10/21/2016	4/10/2017	10/18/2017	10/19/2021	10/23/2015	4/25/2016	10/21/2016	10/18/2017	10/16/2018	10/24/2019
			Unique Well ID# (or MPCA ID)	1000022317	1000026209	1000026209	608116	608116	608116	813437	813437	813437	813437	813437	813437
Parameter	Units	MDH Human Health-Based Water Guidance Table													
Effective Date		11/13/2023													
Exceedance Key		No Exceed													
Alkalinity, total, as CaCO3	mg/l		178	174	176	--	178	173	172	--	168	175	181	217	
Chemical Oxygen Demand	mg/l		< 10.0 U	--	< 10.0	--	< 10.0	< 10.0 U	< 10.0	--	< 10.0	< 10.0	< 10.0	< 10.0	
Chloride	mg/l		21.2	2.8	3.21	--	6.01	6.12	0.527	--	< 0.5	< 0.5	< 0.5	< 1.0	
Dissolved oxygen, field	mg/l		0.9	0.6	0.4	1.2	0.7	0.6	--	0.4	0.6	0.3	0.6	0.7	
Nitrogen, ammonia, as N	mg/l		< 0.100 U	--	0.030	--	0.55	0.543	0.17	--	0.22 F1	0.23	0.23 F1	0.23	
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.100 U J5	--	< 0.050	--	< 0.050	< 0.100 U	< 0.050	--	< 0.050	< 0.050	< 0.050	< 0.050	
pH, field	pH units		7.74	7.91	7.97	8.19	7.94	7.87	8.02	7.89	7.98	7.93	7.82	7.55	
Redox (oxidation potential), field	mV		-97	-102.0	-145.0	-15.0	-20	-99	--	-173	-210.0	-100	-129	-20	
Solids, total dissolved	mg/l		319	--	232	--	260	354	130	--	174	194	194	161	
Solids, total suspended	mg/l		< 4.00 U	--	8.0	--	< 4.0	< 4.00 U	< 4.0	--	< 4.0	< 4.0	< 4.0	< 4.0	
Specific conductance @ 25 ºC, field	umhos/cm		489	386	381	405	405	411	333	337	328	327	328	325	
Sulfate, as SO4	mg/l		59.6	24.7	--	--	--	42.7	--	--	--	--	--	--	
Temperature, field	deg C		10.5	9.9	9.9	9.1	10.2	9.9	10.0	9.2	9.5	9.6	9.8	10.0	
Turbidity, field	NTU		1.6	--	--	--	7.0	1	--	--	--	2.5	2.0	2.2	
Total Metals															
Calcium	mg/l		77.1	53.4	54.2	--	52.1	57.7	43.0	--	40.2	40.5	45.6	43.2	
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	
Magnesium	mg/l		16.6	11.5	12.6	--	15.5	16.6	13.4	--	13.6	13.2	13.9	13.8	
Manganese	ug/l	100 HRL23	--	--	--	--	--	--	--	--	--	--	--	--	
Potassium	mg/l		1.95	1.1	1.1	--	1.7	1.33	1.5	--	1.6	1.4	1.5	1.4	
Sodium	mg/l		3.84	3.3	3.4	--	4.5	4.81	5.9	--	5.9	5.7	5.7	5.5	

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New	12275 239th Ave	12275 239th Ave	12275 239th Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave
Location			22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New	12275 239th Ave	12275 239th Ave	12275 239th Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave
Date			10/15/2020	10/19/2021	11/07/2022	10/19/2023	10/24/2019	10/15/2020	11/07/2022	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/23/2015	4/25/2016
Unique Well ID# (or MPCA ID)			813437	813437	813437	813437	525310	525310	525310	655131	655131	655131	655131	655131	655131	655131
Effective Date		11/13/2023														
Exceedance Key		No Exceed														
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.50	< 0.500 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 1.0	< 0.750 U	< 0.750 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.00 U	< 1.00 U J3	< 1.00 U C4	< 1.00 U	< 5.0	< 1.00 U	< 1.00 U C4	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 5.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 0.050	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.25	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.25	< 0.500 U	< 0.500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 5.0	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 4.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10	< 10.0 U	< 10.0 U	< 20	< 20	< 20	< 20	< 10	< 10 ^	< 10
Allyl chloride	ug/l	30 HRL94	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0 *	< 2.0	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 0.500 U	< 0.500 U J4	< 0.500 U	< 0.500 U	< 0.50	< 0.500 U	< 0.500 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Bromobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 5.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 5.0	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 4.0	< 1.00 U	< 1.00 U J3	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.00 U	< 1.00 U C3 J3	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.25	< 0.250 U	< 0.250 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	ug/l	100 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 5.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 4.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 3.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 3.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 3.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U	< 0.250 U C3 J3	< 0.250 U	< 0.250 U	< 1.4	< 0.250 U	< 0.250 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10	< 10.0 U	< 10.0 U	< 20	< 20	< 20	< 20	< 10	< 10 ^	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 10	< 5.00 U	< 5.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0 ^	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 5.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 1.00 U	< 1.00 U C3 J3	< 1.00 U	< 1.00 U	< 5.0	< 1.00 U	< 1.00 U	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J3 J4	< 10	< 5.00 U	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.100 U	< 0.100 U J4	< 0.100 U	< 0.100 U	< 0.10	< 0.100 U	< 0.100 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 4.0	< 1.00 U	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 2.0	< 1.00 U	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 0.050	< 0.0500 U	< 0.0500 U	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.0040
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 3.0	< 2.00 U	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters																

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New	12275 239th Ave	12275 239th Ave	12275 239th Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave
		Date	10/15/2020	10/19/2021	11/07/2022	10/19/2023	10/24/2019	10/15/2020	11/07/2022	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/23/2015	4/25/2016
		Unique Well ID# (or MPCA ID)	813437	813437	813437	813437	525310	525310	525310	655131	655131	655131	655131	655131	655131	655131
Parameter	Units	MDH Human Health-Based Water Guidance Table														
Effective Date		11/13/2023														
Exceedance Key		No Exceed														
Alkalinity, total, as CaCO3	mg/l		165	180	177	177	275	216	228	271	265	297	7120	270	283 4	--
Chemical Oxygen Demand	mg/l		< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0	< 10.0 U	< 10.0 U	10.8	5.0	< 5.0	< 5.0	--	< 10.0	--
Chloride	mg/l		< 1 U	< 1 U	< 1 U	< 1 U	22.0	23.4	24.5	10.7	10.1	10.7	10.1	12.1	11.3	--
Dissolved oxygen, field	mg/l		0.2	0.4	0.3	0.2	0.4	0.2	0.2	--	--	--	--	--	--	0.9
Nitrogen, ammonia, as N	mg/l		0.205	0.257	0.202	0.220	0.12	< 0.100 U	< 0.100 U	< 0.050	< 0.050	< 0.050	0.098	--	< 0.020	--
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.050	< 0.100 U	< 0.100 U	1.8	1.9	1.4	1.3	--	1.2	--
pH, field	pH units		7.5	7.97	7.64	7.69	7.65	7.59	7.75	7.48	7.52	7.60	7.47	7.44	7.78	7.59
Redox (oxidation potential), field	mV		-55	-99	-85	-61	101	93	-11	--	--	--	--	--	--	-85
Solids, total dissolved	mg/l		180	170	180 B	181 J3	314	353	340 B	272	337	329	336	--	315	--
Solids, total suspended	mg/l		< 4.00 U	< 4.00 U	< 4.00 U	8.53	< 4.0	< 4.00 U	< 4.00 U	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	--
Specific conductance @ 25 ºC, field	umhos/cm		325	341	326	332	512	533	530	516	573	555	530	537	517	544
Sulfate, as SO4	mg/l		< 5.00 U	< 5.00 U	--	--	--	29.7	--	--	--	--	--	22.3	--	--
Temperature, field	deg C		2.2	10	10.6	9.8	9.7	9.9	8.7	9.3	9.5	9.6	9.4	9.6	9.0	9.0
Turbidity, field	NTU		1.9	1.5	1.3	--	1.5	1.5	1.7	--	--	--	--	--	--	--
Total Metals																
Calcium	mg/l		46.8	42.1	43.5	43.2	65.6	73.9	68.8	--	--	--	--	79.1	78.5	--
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		15.1	13.5	13.3	12.3	26.8	30.0	26.9	--	--	--	--	27.9	27.3	--
Manganese	ug/l	100 HRL23	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l		1.54	1.10	1.54	1.36	1.6	1.67	1.70	--	--	--	--	1.5	1.6	--
Sodium	mg/l		6.23	5.70	5.88	5.39	4.1	4.55	4.41	--	--	--	--	3.0	3.3	--

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Location: 12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave New	12163 223rd Ave New	12163 223rd Ave New	12163 223rd Ave New	11661 225th Ave	11661 225th Ave
			Date: 10/20/2016	10/18/2017	10/16/2018	10/24/2019	7/06/2020	10/15/2020	7/14/2021	10/19/2021	6/16/2022	11/07/2022	10/19/2023	12/04/2023	10/20/2011	10/18/2012
			Unique Well ID# (or MPCA ID): 655131	655131	655131	655131	655131	655131	655131	655131	876409	876409	876409	876409	ZW00217	ZW00217
Effective Date		11/13/2023														
Exceedance Key		No Exceed														
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U Q	< 1.00 U	< 0.500 U	< 0.500 U	--	< 2.0	< 2.0
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 0.75	< 0.75	< 1.0	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U Q	--	< 0.750 U	< 0.750 U	--	< 1.0	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4 Q	< 1.00 U C4 J4	< 1.00 U C4	< 1.00 U C3	--	< 3.0	< 3.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4 Q	< 1.00 U C4	< 1.00 U	< 1.00 U C3	--	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.0	< 0.050	< 0.050	< 0.050	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 3.0	< 3.0
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U Q	< 1.00 U	< 0.250 U	< 0.250 U	--	< 1.0	< 1.0
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 0.100 U	--	< 2.0	< 2.0
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U C3	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 5.0	< 5.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 1.0	< 0.50	< 0.50	< 0.25	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U Q	< 1.00 U	< 0.500 U	< 0.500 U	--	< 1.0	< 1.0
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 3.0	< 3.0
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
2,2-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Acetone	ug/l	3000 HRL23 (1)	< 10	< 10	< 10	< 10	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U Q	< 10.0 U C5	< 10.0 U	< 10.0 U	--	< 20	< 20
Allyl chloride	ug/l	30 HRL94	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Benzene	ug/l	2 HRL09 (1)	< 1.0	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U Q	< 1.00 U	< 0.500 U	< 0.500 U	--	< 2.0	< 2.0
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 3.0	< 3.0
Bromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U C3	< 1.00 U J3	< 1.00 U	--	< 2.0	< 2.0
Butylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 2.0	< 2.0
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 1.0	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U Q	< 1.00 U	< 0.250 U	< 0.250 U	--	< 1.0	< 1.0
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Chloroethane	ug/l	ND RAA16	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U C3	< 1.00 U	< 1.00 U	--	< 4.0	< 4.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 2.0	< 2.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Ethyl benzene	ug/l	40 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Hexachlorobutadiene	ug/l	1 HRL93	< 1.0	< 0.25	< 0.25	< 1.4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3J4Q	< 1.00 U	< 0.250 U	< 0.250 U	--	< 2.0	< 2.0
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10	< 10	< 10 ^	< 10	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U Q	< 10.0 U	< 10.0 U	< 10.0 U C3	--	< 20	< 20
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0	< 5.0	< 5.0	< 10	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U Q	< 5.00 U	< 5.00 U	< 5.00 U	--	< 3.0	< 3.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 3.0	< 3.0
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4 Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Naphthalene	ug/l	70 HRL13	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 Q	< 1.00 U C3	< 1.00 U	< 1.00 U C3	--	< 3.0	< 3.0
Propylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U C3	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Styrene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 5.0	< 5.0	< 10	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U Q	< 5.00 U	< 5.00 U	< 5.00 U J3	--	< 5.0	< 5.0
Toluene	ug/l	70 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 1.0	< 0.10	< 0.10	< 0.10	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U Q	< 1.00 U	< 0.100 U	< 0.100 U	--	< 1.0	< 1.0
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	--	< 1.00 U	< 1.00 U	--	< 2.0	< 2.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 0.050	< 0.050	< 0.050	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U Q	< 1.00 U	< 0.0500 U	< 0.0500 U C3	--	< 1.0	< 1.0
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.0	< 2.0	< 2.0	< 3.0	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U Q	< 2.00 U	< 2.00 U	< 2.00 U	--	< 2.0	< 2.0
General Parameters																

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave New	12163 223rd Ave New	12163 223rd Ave New	12163 223rd Ave New	11661 225th Ave	11661 225th Ave
		Date	10/20/2016	10/18/2017	10/16/2018	10/24/2019	7/06/2020	10/15/2020	7/14/2021	10/19/2021	6/16/2022	11/07/2022	10/19/2023	12/04/2023	10/20/2011	10/18/2012
		Unique Well ID# (or MPCA ID)	655131	655131	655131	655131	655131	655131	655131	655131	876409	876409	876409	876409	ZW00217	ZW00217
Parameter	Units	MDH Human Health-Based Water Guidance Table														
Effective Date		11/13/2023														
Exceedance Key		No Exceed														
Alkalinity, total, as CaCO3	mg/l		287	307	319	350	--	298	--	307	--	184	189	--	195	144
Chemical Oxygen Demand	mg/l		< 10.0	< 10.0	< 10.0	< 10.0	--	< 10.0 U	--	< 10.0 U	--	< 10.0 U	< 10.0 U	--	14.6	5.0
Chloride	mg/l		14.1	16.3	15.5	18.3	--	18	--	16.8	--	< 1 U	< 1 U	--	< 1.0	< 1
Dissolved oxygen, field	mg/l		1.2	0.7	1.0	1.1	1.5	0.3	3	0.8	--	0.9	0.4	--	--	--
Nitrogen, ammonia, as N	mg/l		< 0.020	< 0.020	< 0.020	< 0.020	--	< 0.100 U	--	< 0.100 U	--	< 0.100 U	< 0.100 U	--	0.27	0.23
Nitrogen, nitrate + nitrite, as N	mg/l		1.5	1.4	1.2	1.3	--	1.51	--	1.27	--	< 0.100 U	< 0.100 U	--	< 0.050	< 0.050
pH, field	pH units		7.58	7.56	7.55	7.42	7.2	7.3	6.81	7.5	--	7.80	7.64	7.75	7.99	7.98
Redox (oxidation potential), field	mV		138.0	68	99	87	145	113	130	-35	--	-55	-55	--	--	--
Solids, total dissolved	mg/l		358	372	375	390	--	390	--	374	--	189 Q	206 Q	--	171	197
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.00 U	--	< 4.00 U	--	< 4.00 U	< 4.00 U	--	< 4.0	< 4.0
Specific conductance @ 25 ºC, field	umhos/cm		599	628	621	639	655	651	642	684	--	340	341	360	318	346
Sulfate, as SO4	mg/l		--	--	--	--	--	21.8	--	21.3	--	--	--	--	--	--
Temperature, field	deg C		9.2	9.3	9.8	9.4	10	9.4	9.8	9.7	--	10.0	10.3	10.5	9.6	9.8
Turbidity, field	NTU		--	--	0.8	1.5	2.6	1.0	0.9	0.8	--	1.5	--	--	--	--
Total Metals																
Calcium	mg/l		79.4	83.9	93.1	90.6	--	99.2	--	93.6	--	< 1.00 U	< 1.00 U	--	--	--
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	< 5.00 U	--	--
Magnesium	mg/l		29.5	30.8	31.9	31.9	--	34.7	--	31.5	--	< 1.00 U	< 1.00 U	--	--	--
Manganese	ug/l	100 HRL23	--	--	--	--	--	--	--	--	--	--	--	< 10.0 U	--	--
Potassium	mg/l		1.6	1.6	1.8	1.6	--	1.65	--	1.29	--	< 1.00 U	< 1.00 U	--	--	--
Sodium	mg/l		3.6	3.7	3.7	3.7	--	4.21	--	3.89	--	86.3	83.3	--	--	--

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

		Location	11661 225th Ave	11661 225th Ave	11661 225th Ave	11661 225th Ave	11661 225th Ave
		Date	10/15/2013	10/21/2014	10/23/2015	10/16/2018	10/19/2021
		Unique Well ID# (or MPCA ID)	ZW00217	ZW00217	ZW00217	ZW00217	ZW00217
Parameter	Units	MDH Human Health-Based Water Guidance Table					
Effective Date		11/13/2023					
Exceedance Key		No Exceed					
Volatile Organic Compounds							
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U J4
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 2.0	< 2.0	< 1.0	< 0.50	< 0.500 U C3
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 1.0	< 1.0	< 0.75	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,1-Dichloropropene	ug/l		< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
1,2,3-Trichlorobenzene	ug/l		< 3.0	< 3.0	< 1.0	< 1.0	< 1.00 U J3
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U C3
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J3
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 3.0	< 3.0	< 1.0	< 0.050	< 1.00 U C3
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 0.25	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
1,3-Dichlorobenzene	ug/l		< 5.0	< 5.0	< 1.0	< 1.0	< 1.00 U
1,3-Dichloropropane	ug/l		< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 0.50	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 3.0	< 3.0	< 1.0	< 1.0	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
2,2-Dichloropropane	ug/l		< 2.0	< 2.0	< 1.0	< 1.0 ^	< 1.00 U
Acetone	ug/l	3000 HRL23 (1)	< 20	< 20	< 10	< 10	< 10.0 U
Allyl chloride	ug/l	30 HRL94	< 2.0 *	< 2.0	< 1.0	< 1.0	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	< 2.0	< 2.0	< 1.0	< 0.50	< 0.500 U J4
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Bromochloromethane	ug/l		< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J4
Bromoform	ug/l	40 HRL93	< 3.0	< 3.0	< 1.0	< 1.0	< 1.00 U
Bromomethane	ug/l	10 HRL93	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Butylbenzene	ug/l		< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U C3 J3
Butylbenzene, sec	ug/l		< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Butylbenzene, tert	ug/l		< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 0.25	< 0.250 U J4
Chlorobenzene	ug/l	100 HRL93	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Chloroethane	ug/l	ND RAA16	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J4
Chloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U
Chlorotoluene, p	ug/l		< 4.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l		< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Dibromomethane (methylene bromide)	ug/l		< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U J4
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.00 U
Ethyl benzene	ug/l	40 HRL23	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Hexachlorobutadiene	ug/l	1 HRL93	< 2.0	< 2.0	< 1.0	< 0.25	< 0.250 U C3 J3
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 20	< 20	< 10 ^	< 10 ^	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 3.0	< 3.0	< 5.0	< 5.0	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 3.0	< 3.0	< 1.0	< 1.0 ^	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Naphthalene	ug/l	70 HRL13	< 3.0	< 3.0	< 1.0	< 1.0	< 1.00 U C3 J3
Propylbenzene	ug/l		< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Styrene	ug/l		< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 5.0	< 5.0	< 5.0	< 5.00 U
Toluene	ug/l	70 HRL23	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 1.0	< 1.0	< 1.0	< 0.10	< 0.100 U J4
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 1.0	< 1.0	< 0.10	< 0.050	< 0.0500 U
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.00 U
General Parameters							

Table A2
Residential Water Supply Well Data (2011-2023)
Initial Performance Evaluation Report
Elk River Landfill

			Location	11661 225th Ave	11661 225th Ave	11661 225th Ave	11661 225th Ave	11661 225th Ave
			Date	10/15/2013	10/21/2014	10/23/2015	10/16/2018	10/19/2021
			Unique Well ID# (or MPCA ID)	ZW00217	ZW00217	ZW00217	ZW00217	ZW00217
Parameter	Units	MDH Human Health-Based Water Guidance Table						
Effective Date		11/13/2023						
Exceedance Key		No Exceed						
Alkalinity, total, as CaCO3	mg/l		185	207	176	173	185
Chemical Oxygen Demand	mg/l		< 5.0	< 5.0	< 10.0 F1	< 10.0	< 11.7 U
Chloride	mg/l		< 1	< 1	0.748	1.19	1.03
Dissolved oxygen, field	mg/l		--	--	--	0.6	0.6
Nitrogen, ammonia, as N	mg/l		0.17	0.27	0.19	0.21	0.241
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.050	< 0.050	< 0.050	< 0.050	< 0.100 U
pH, field	pH units		8.00	7.94	8.40	7.98	8.09
Redox (oxidation potential), field	mV		--	--	--	-73	-195
Solids, total dissolved	mg/l		179	173	170	177	303
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	< 4.00 U
Specific conductance @ 25 ºC, field	umhos/cm		340	325	316	333	348
Sulfate, as SO4	mg/l		--	--	--	--	5.84
Temperature, field	deg C		9.6	10.5	9.4	9.7	10.3
Turbidity, field	NTU		--	--	--	0.8	1.1
Total Metals							
Calcium	mg/l		--	--	39.0	40.6	41.6
Lead	ug/l		--	--	--	--	--
Magnesium	mg/l		--	--	15.1	15.3	16.3
Manganese	ug/l	100 HRL23	--	--	--	--	--
Potassium	mg/l		--	--	1.5	1.5	2.17
Sodium	mg/l		--	--	8.3	8.2	8.67

Data Footnotes and Qualifiers

Barr Standard Footnotes and Qualifiers

--	Not analyzed/Not available.
*	Estimated value, QA/QC criteria not met.
U	The analyte was analyzed for, but was not detected.

Laboratory Qualifiers

*	LCS or LCSD is outside acceptance limits.
^	ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC is outside acceptance limits.
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
B	Compound was found in the blank and sample.
F1	MS and/or MSD Recovery is outside acceptance limits.
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
C4	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Data is likely to show a low bias concerning the result.
C5	The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
O1	The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.
Q	Sample was prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.
V	The sample concentration is too high to evaluate accurate spike recoveries.

MDH Human Health-Based Water Guidance Table

(1)	Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.
DCP	Value shown is 1,3-dichloropropene in the MDH criterion, however, the laboratory reports cis and trans isomers individually.
HBV20	Health Based Value 2020.
HBV22	Health Based Value 2022.
HRL09	Health Risk Limit 2009
HRL13	Health Risk Limit 2013.
HRL15	Health Risk Limit 2015
HRL18	Health Risk Limit 2018.
HRL23	Health Risk Limit 2023.
HRL93	Health Risk Limit 1993.
HRL94	Health Risk Limit 1994.
HRLMCL	Health Risk Limit; Maximum Contaminant Level.
ND	Not derived due to insufficient information.
RAA13	Risk Assessment Advice 2013
RAA16	Risk Assessment Advice 2016
RAA17	Risk Assessment Advice 2017.
XYL	Value shown is for the sum of the mixed o,m and p Xylene isomers.

Appendix B

Residential Replacement Well Information

resourceful. naturally.
engineering and environmental consultants

BARR

Technical Memorandum

To: File
From: Jim Eidem P.G. and Kevin McGilp
Subject: 2021 – 2022 Residential Well Replacements
Date: March 1, 2024
Project: Elk River Landfill, Groundwater Corrective Action Work Plan Implementation

This technical memorandum describes the residential water supply well replacements completed as part of the Elk River Landfill (ERL) Groundwater Corrective Action Work Plan (Work Plan; Barr, 2021) implementation. The work included replacing six residential wells located southwest of the ERL (Figure 1) with deeper wells (completed in confined bedrock or confined sand at the base of a bedrock valley) to increase the protectiveness of the groundwater corrective action activities[1]. The Work Plan was reviewed and approved by the Minnesota Pollution Control Agency (MPCA) and the well replacement work was conducted by a well contractor licensed by the State of Minnesota.

1 Well Installation

Following MPCA approval of the Work Plan, ERL representatives met with the well owners to discuss rationale for replacement, property access agreements, and general scope and timing for completing the well replacement work. Upon owner agreement for well replacement and after the property access agreements were in place, representatives of ERL, Barr Engineering Co. (Barr), and Able Well, Inc. (Able), a Minnesota licensed water supply well contractor, coordinated site visits to identify and stake locations for replacement well installations for owner approval.

Prior to the start of well installation, Able coordinated public utilities clearance and spoke with the owners regarding any private underground utility lines that they were aware of. The final locations of the replacement wells were determined by drill rig access, setback distances meeting Minnesota Department of Health (MDH) requirements from existing utilities, and owner approval. The residential well replacements were completed by Able using mud rotary drilling techniques between June, 2022 and January, 2023. The wells were constructed in conformance with Minnesota Rules Chapter 4725 (Well Code) and were constructed with either a cased/open hole configuration or a cased/screened configuration depending on if bedrock was encountered and/or the competency of the bedrock to maintain an open borehole. Each replacement well was fully cased and grouted through the lower outwash and unconsolidated geologic material into the bedrock (Eau Claire Formation or Mount Simon Sandstone) or to the depth of the screened interval, as applicable. Well construction documentation is

[1] Four wells were replaced per the Work Plan. The two southernmost wells, 22272 Quinn St and 22130 Quinn St, were replaced voluntarily by the ERL.

included in Attachment A and summarized in Table 1. The well construction logs were used to update geologic cross sections for ERL and are shown on Figure 2 and Figure 3.

Upon completion of well construction, the wells were developed by over pumping by air lifting. Well development continued until the wells produced clear water generally free of sediments.

2 Replacement Well Sampling and Analysis

Groundwater quality samples were collected at the end of the well development process prior to connection to the residence. Samples for volatile organic compound (VOC) analysis were collected by Barr and submitted to the laboratory for analysis per the Work Plan. No VOCs were detected in the samples collected from the six replacement wells (Attachment B).

Groundwater samples from newly constructed water supply wells (as required by the Well Code) for analysis of bacteriological (coliform bacteria), nitrate-nitrogen, and arsenic were collected and submitted to the laboratory by Able. No coliform bacteria were detected in samples from any of the new wells. Nitrate-nitrogen and arsenic results for samples from the new wells were either not detected or were below the Environmental Protection Agency (EPA) maximum contaminant levels (MCLs).

3 New Well Service Connection

The replacement water supply wells were connected to each residence by Able. New submersible pumps sized for the depth of the well and water use based on communications with the owner were installed with new drop pipe and pump electrical cables.

The connection of the replacement water supply wells to the residences consisted of trenching between the new well and the old well and splicing the new water supply line into the existing water supply line into the residence at the old well. Where splicing at the old well was not feasible, such as at 12183 223rd St. NW., the new supply line was spliced into the old supply line where it entered the residence.

Water treatment systems are present at each residence. For several of the new well installations, ERL coordinated with a water treatment vendor (Aquarius Home Services), for the installation of water treatment systems (or inspection/upgrade of existing systems). The new water treatment systems were designed, installed, and adjusted for the water hardness content by the water treatment vendor.

Based on recommendations in the MDH owner's guide to wells information brochure (MDH, 2023), samples were collected from the kitchen faucet for analysis of lead and manganese in the Fall of 2023 except for the well installed at 22130 Quinn St. NW., which had not yet been connected to the residence. The results of the lead and manganese analysis were reported as not detected or below the applicable MCLs.

4 Old Well Sealing Activities

Decommissioning of the former water supply wells (except 22130 Quinn St. NW.) was completed by Able after the replacement wells had been placed into service. In addition, an unused well located on the 12163

223rd St. NW. parcel was also decommissioned. Decommissioning of the old wells was completed in conformance with the Well Code and generally included removal of the existing submersible pump and drop pipe and permanently sealing the well by pressure grouting though a tremie pipe from the bottom of the well up to within a few feet of the ground surface. The wells were then cut off below the ground surface. Well sealing documentation is included in Attachment C.

5 References

Barr Engineering Co. (Barr), 2021. Groundwater Corrective Action Work Plan, Elk River Landfill (SW 74), Elk River, Minnesota, prepared for Elk River Landfill, Inc., March, 2021.

Minnesota Department of Health (MDH), 2023. Owners Guide to Wells, information brochure, https://www.health.state.mn.us/wellguide

Attachments

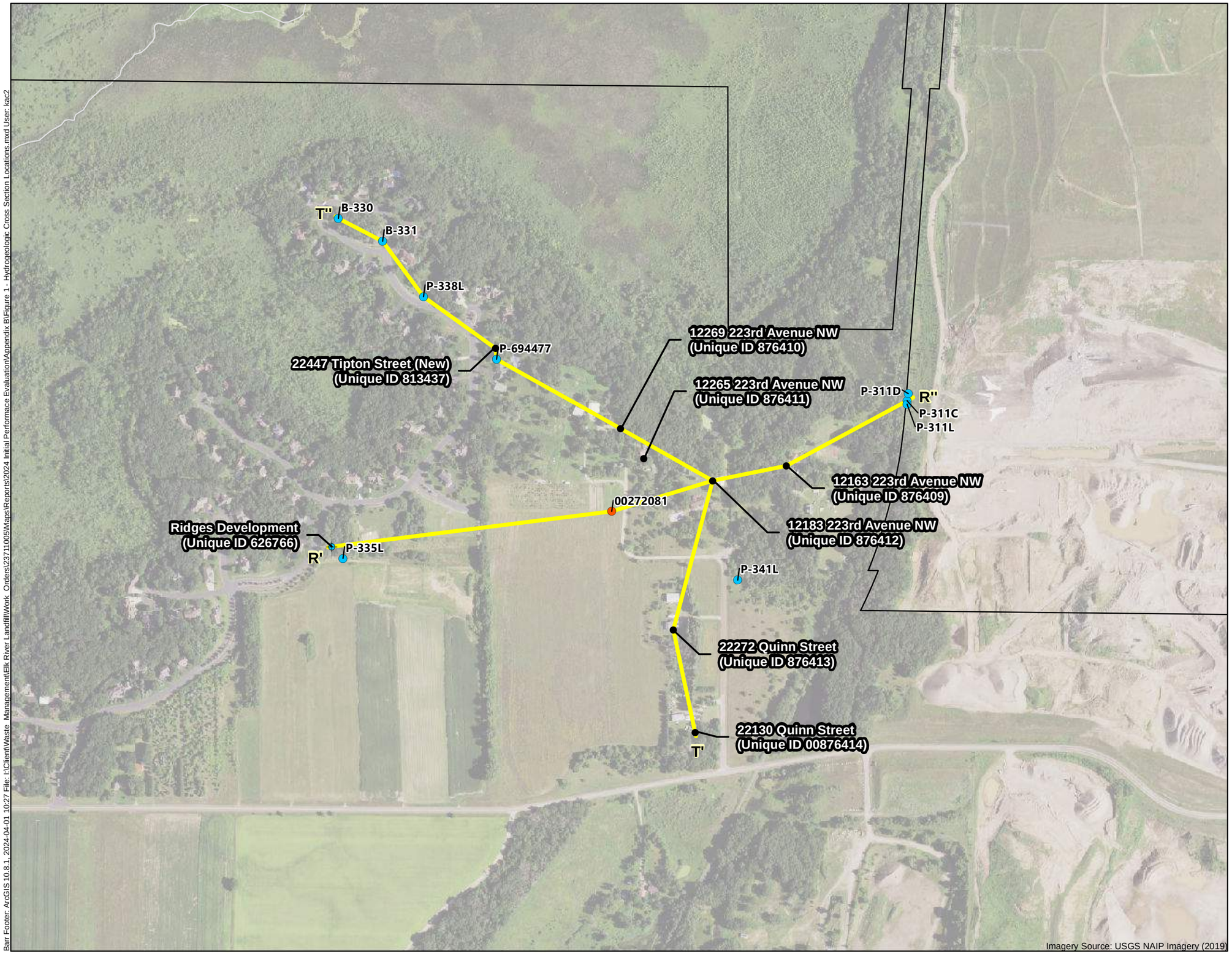
Table 1 – Well Construction Detail Summary
Figure 1 – Residential Well Replacement Locations
Figure 2 – Geologic Cross Section R'-R"
Figure 3 – Geologic Cross Section – T'-T''
Attachment A - Well Construction Records
Attachment B - Laboratory Reports
Attachment C - Well Sealing Records

Attachments

Table 1
Well Construction Detail Summary
Elk River Landfill
Elk River, Minnesota

Address	Replacement Well				Initial Organics Sample Results	Notes
	Unique ID No.	Date Installed	Casing Depth (feet bgs)	Total Depth (feet bgs)		
12163 223rd Ave.	876409	6/16/2022	233	299	ND	Proposed in Corrective Action Work Plan (Barr, 2021)
12269 223rd Ave.	876410	9/22/2022	255	299	ND	
12265 223rd Ave.	876411	9/26/2022	290	296	ND	
12183 223rd Ave.	876412	9/29/2022	254	310	ND	
22272 Quinn St.	876413	12/10/2022	333	379	ND	Voluntarily installed by ERL
22130 Quinn St.	876414	12/14/2022	293	319	ND	

Notes:
bgs - below ground surface
ND - no organics detected



Property Boundary

Residential Well Location

Community Water Supply Well

MGS Soil Boring

Monitoring Well

Cross Section Location

Feet

0 500 1,000

Figure 1

HYDROGEOLOGIC CROSS SECTION LOCATIONS
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-04-01 10:27 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711005\Maps\Reports\2024 Initial Performace Evaluation\Appendix B\Figure 1 - Hydrogeologic Cross Section Locations.mxd User: kac2

R'
WEST

R''
EAST

626766

272081
(MGS soil boring)

876412

876409

P-311L (projected)
P-311C
P-311D (projected)
P-304C

UPPER OUTWASH

TILL

LOWER OUTWASH

TILL

LOWER OUTWASH

TILL

Weathered Sandstone

siltstone/ss (top of Eau Claire)

shale (Eau Claire)

SS/shale (Mt. Simon trans.)

SS (Mt. Simon)

shale and sandrock
green and tan

BEDROCK
(EAU CLAIRE FM.)

shale and sandrock
green and tan

sandrock (white and yellow)

sandrock (white and yellow)

BEDROCK
(MT. SIMON SANDSTONE)

Mt. Simon SS

clay and sand

sandstone and shale

Elevation (ft MSL)

Distance (ft)

EXPLANATION

OUTWASH — Includes the following soil types:
SP: Sand with <5% fines; thin/discontinuous gravel lenses rare to common.
SM: (Where in contact with SP); Silty sand; silt content approximately 30 to 50%.

TILL — Includes the following soil types:
ML: Sandy silt - diamict with approximately 10 to 50% Sand and Gravel; firm to very hard.
CL: Clay textured diamict with varying amounts of sand and gravel; firm to hard.
SM: (Where bounded by ML or CL); Silty sand; silt content approximately 30 - 50%
ML/CL: Silt or clay, <5% sand, massive to thinly bedded

EAU CLAIRE — Eau Claire Formation:
Fine-grained sandstone/siltstone with shale partings present locally.

MT. SIMON — Mt. Simon Sandstone:
Medium to coarse-grained sandstone with very fine-grained sand and siltstone beds present locally.

0 250
Approximate Horizontal Scale in Feet
5X Vertical Exaggeration

LEGEND

Ground Surface (Approximate)
Geologic Contact (Dashed where approximate)
Monitoring Well Screen
Cased borehole
Open borehole
Screened interval

BARR

Figure 2

HYDROGEOLOGIC CROSS SECTION R"-R'"
Elk River Landfill
Elk River, Minnesota

P:\Mpls\23 MN\71\23711005 ERL GW Network Development\WorkFiles\Corrective Action\Implementation\Residential Well Replacements\Res Wells\Cross-sections\Hydrogeologic Cross Section R-R'.ai User: KJN

Barr Footer: ArcGIS 10.4, 2018-03-27 16:18 File: I:\Projects\23\71\1005\Users\kac2\20180102_WP_Cross_Sections\Cross Section H_20180327.mxd User: kac2

SOUTH

NORTH

T"

T'''

Elevation (ft MSL)

Elevation, Feet (MSL)

Distance (ft)

638355 (old)

638355 (new)

876413

P-341 (projected)

876412

876411 (projected)

876410

P-694477

813437

P-338L

B-331

B-330

Do you still want to include the old well?

Thoughts on this? May need to project 694477 and change the alignment slightly

This does not seem right. Do you think it is the projection? Should I use the jagged edges for the Eau Claire?

Look at existing x-section lines

UPPER OUTWASH

LOWER OUTWASH

TILL

lac

shale and sandrock
green and tan

shale
blue, green, and tan

shale and sandrock
blue and tan

sandrock (white)

sandrock (white and yellow)

sandrock
(orange and pink)

BEDROCK
(MT. SIMON SANDSTONE)

siltstone/ss
(Eau Claire)

ss/ shale
(Eau Claire)

BEDROCK
(EAU CLAIRE FM.)

ow

tl

EXPLANATION

OUTWASH	Includes the following soil types: SP: Sand with <5% fines; thin/discontinuous gravel lenses rare to common. SM: (Where in contact with SP); Silty sand; silt content approximately 30 to 50%.
TILL	Includes the following soil types: ML: Sandy silt - diamict with approximately 10 to 50% Sand and Gravel; firm to very hard. CL: Clay textured diamict with varying amounts of sand and gravel; firm to hard. SM: (Where bounded by ML or CL); Silty sand; silt content approximately 30 - 50% ML/CL: Silt or clay, <5% sand, massive to thinly bedded
EAU CLAIRE	Eau Claire Formation: Fine-grained sandstone/siltstone with shale partings present locally.
MT. SIMON	Mt. Simon Sandstone: Medium to coarse-grained sandstone with very fine-grained sand and siltstone beds present locally.

LEGEND

- Ground Surface (Approximate)
- Geologic Contact (Dashed where approximate)
- Monitoring Well Screen
- Groundwater Sample Locations (previous)
- Cased borehole
- Open borehole
- Screened interval

0 250

Approximate Horizontal Scale in Feet
5X Vertical Exaggeration

BARR

Figure 3

HYDROGEOLOGIC CROSS SECTION T"-T'''
Elk River Landfill
Elk River, Minnesota

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P:\Mpls\23 MN\71\23711005 ERL, GW Netwrok Development\WorkFiles\Corrective Action\Implementation\Residential Well Replacements\Res Wells\Cross-sections\Hydrogeologic Cross Section T-T'.ai User: KJN3

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING CONSTRUCTION RECORD

Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO. 876409

WELL OR BORING LOCATION

County Name: Sherburne

Township Name: Elk River | Township No.: 33 | Range No.: 26 | Section No.: 4 | Fraction — Quarter: NW NE SE

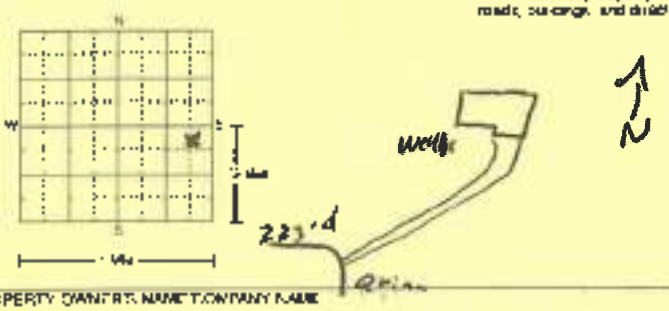
WELL/BORING DEPTH (completed): 299 ft | DATE WORK COMPLETED: 7-15-22

GPS LOCATION — decimal degrees (to five decimal places): Latitude: _____ Longitude: _____

House Number, Street Name, City and ZIP Code of Well Location: 12163 223rd Ave NW, Elk River 55330

Show exact location of well/boring in section grid with "X"

Sketch map of well/boring location. Showing property lines, roads, buildings, and direction.



PROPERTY OWNER'S NAME/COMPANY NAME: K. Eriksen

Property owner's mailing address (if different from well/boring location address indicated above):

WELL OWNER'S NAME/COMPANY NAME:

Well/boring owner's mailing address (if different from property owner's address indicated above):

DRILLING METHOD

☐ Cable Tool ☐ Driven ☐ Dual Rotary
☐ Auger ☒ Rotary ☐ Reverse
☐ Other

DRILLING FLUID: Super Gel

WELL HYDROFRACTURED? ☐ Yes ☒ No — From _____ ft. To _____ ft.

USE
☒ Domestic ☐ Monitoring ☐ Heating/Cooling
☐ Non-community PWS ☐ Irrigation ☐ Industrial/Commercial
☐ Community PWS ☐ Dewatering ☐ Remedial
☐ Geyser ☐ _____

CASING MATERIAL: ☒ Plastic ☐ Steel ☐ Concrete ☐ Other _____
Drive Shoe? ☐ Yes ☐ No ☒ Not Used

CASING

Diameter	To	Weight	Specifications
4 in.	233 ft.	11 lbs./ft.	ASTM-53
_____ in.	_____ ft.	_____ lbs./ft.	
_____ in.	_____ ft.	_____ lbs./ft.	

HOLE DIAM

Diameter	To
8 in.	235 ft.
_____ in.	_____ ft.
4 in.	299 ft.

SCREEN
Make: _____ Type: _____ Slot/Gauge: _____ Set between _____ ft. and _____ ft.
Quantity: _____ Length: _____ Diameter: _____

OPEN HOLE: From 233 ft. To 299 ft.

STATIC WATER LEVEL: 42 ft. ☒ Below ☐ Above land surface
Date measured: 6-16-22 Dry hole? ☐ Yes ☒ No

PUMPING LEVEL (below land surface): _____ ft. after 3 hrs. pumping 60 g.p.m.

WELLHEAD COMPLETION
☒ Pitless adapter manufacturer: Aqua Seal Model: T4-1
☐ Casing protection ☒ 12 in. above grade
☐ At grade ☐ Well House ☐ Hand Pump

GROUT INFORMATION (specify bentonite, cement grout, neat cement, concrete, curtain grout, or other)

Material: Neat Cement	From: 1 ft.	To: 233 ft.	47	☐ Yes ☒ Bags
Material:	From: _____ ft.	To: _____ ft.	_____	☐ Yes ☐ Bags
Material:	From: _____ ft.	To: _____ ft.	_____	☐ Yes ☐ Bags

Other casing seal: From _____ ft. To _____ ft. Bags _____ Chemical/Biological report to owner at 30-day intervals?

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Sandy Clay, Gravel	Brown	Soft	0	22
Sand	Tan	Soft	22	28
Clay	Tan	Med	28	39
Sand	Tan	Soft	39	44
Clay	Gray	Med	44	72
Sand	White	Soft	72	77
Clay w/gravel	Brown	Med	77	91
Sand	Brown	Soft	91	94
Clay w/gravel	Brown	Med	94	117
Sand	Tan	Soft	117	141
Boulder	Yellow	Hard	141	142
Clay w/gravel	Brown	Med	142	168
Clay w/gravel	Gray	Med	169	180
Shale + Sandrock	Tan/Green	M-H	180	226
Sandrock	White-Yellow	Hard	226	299

Use a revised sheet if needed.

REMARKS, ELEVATION, SOURCE OF DATA, etc.:

NEAREST KNOWN SOURCE OF CONTAMINATION

Well: 65 feet 5 direction from Septic type

Will be sterilized upon completion? ☒ Yes ☐ No

PUMP

☐ Not installed Date installed: 7-15-22

Manufacturer's name: Goulds

Model number: 10GS07 HP: 3/4 Volts: 230

Length of drop pipe: 80 ft. Capacity: 12 g.p.m.

Type: ☒ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐

ABANDONED WELLS

Does property have any not in use and not sealed well? ☐ Yes ☒ No

VARIANCE

Was a variance granted from the MDH for this well? ☐ Yes ☒ No If Yes, Var. No.: _____

WELL CONTRACTOR CERTIFICATION

This well was drilled under my supervision and in accordance with Minnesota Rules, chapter 4725. The information contained in this report is true to the best of my knowledge.

Able Well, Inc. 1377
Licensee Business Name — License Reg. No.

Scott Thompson 972 7-15-22
Certified Representative Signature — Certified Rep. No. — Date

Scott Thompson
Name of Driller

IMPORTANT: FILE WITH PROPERTY PAPERS. WELL OWNER COPY

876409

ID #52603

MDH 6135-18 (Rev. 3-21)

WELL OR BORING LOCATION

County Name: Sherburne

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING CONSTRUCTION RECORD
Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO.: 876412

Township Name	Township No.	Range No.	Section No.	Fraction (sm. = lg.)
Elk River	33	26	4	SE NW SE

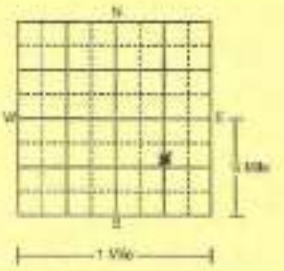
WELL/BORING DEPTH (completed): 310 ft.

DATE WORK COMPLETED: 12-5-22

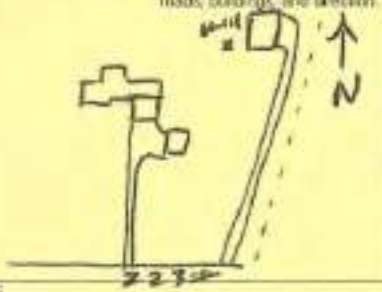
GPS LOCATION — decimal degrees (to four decimal places). Latitude _____ Longitude _____

House Number, Street Name, City, and ZIP Code of Well Location: 12483 223rd Ave. NW, Elk River 55330

Show exact location of well/boring in section grid with "X."



Sketch map of well/boring location. Showing property lines, roads, buildings, and direction.



PROPERTY OWNER'S NAME/COMPANY NAME: Chet Corrow

Property owner's mailing address if different than well location address indicated above.

WELL OWNER'S NAME/COMPANY NAME

Well/boring owner's mailing address if different than property owner's address indicated above.

DRILLING METHOD: ☐ Cable Tool ☐ Driven ☐ Dual Rotary ☐ Auger ☒ Rotary ☐ Reverse ☐ Other

DRILLING FLUID: Super Gel

WELL HYDROFRACTURED? ☐ Yes ☒ No From _____ ft. To _____ ft.

USE: ☒ Domestic ☐ Monitoring ☐ Heating/Cooling ☐ Noncommunity PWS ☐ Irrigation ☐ Industry/Commercial ☐ Community PWS ☐ Dewatering ☐ Remedial ☐ Elevator ☐ _____

CASING MATERIAL: ☒ Steel ☒ Threaded ☐ Welded ☐ Plastic ☐ _____

Drive Shoe? ☒ Yes ☐ No

CASING Diameter	Weight	Specifications	HOLE DIAM.
4 in. To 254 ft.	11 lbs./ft.	ASTM-A53	8 in. To 254 ft.
in. To ft.	lbs./ft.		in. To ft.
in. To ft.	lbs./ft.		4 in. To 310 ft.

SCREEN: Make _____ Type _____ Slot/Gauze _____ Set between _____ ft. and _____ ft.

OPEN HOLE: From 254 ft. To 310 ft. Diam. _____ Length _____ FITTINGS _____

STATIC WATER LEVEL: 45 ft. ☒ Below ☐ Above land surface. Date measured 9-30-22. Dry hole ☐ Yes ☒ No

PUMPING LEVEL (below land surface): _____ ft. after 4 hrs. pumping 75 g.p.m.

WELLHEAD COMPLETION: ☒ Pitless adapter manufacturer: Aqua Seal Model: J4-1. ☐ Casing protection ☒ 12 in. above grade. ☐ At-grade ☐ Well House ☐ Hand Pump

GROUT INFORMATION (specify bentonite, cement-sand, neat-cement, concrete, cuttings, or other)

Material: Neat Cement	From 0	To 254 ft.	50	☐ Yds.	☒ Bags
Material:	From	To ft.		☐ Yds.	☐ Bags
Material:	From	To ft.		☐ Yds.	☐ Bags

Driven casing seal: From _____ To _____ Bags. One bag = 94 lbs. cement or 50 lbs. bentonite

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Sand	Brown	Soft	0	5
Sand + Gravel	Brown	Soft	5	26
Sandy Clay + Gravel	Tan	Med	26	41
Sand + Gravel	Tan	Soft	41	52
Clay	Gray	Med	52	67
Sand	Tan	Soft	67	72
Clay	Gray	Med	72	74
Sand	Tan	Soft	74	81
Clay w/gravel	Brown	Med	81	116
Sand + Gravel	Brown	Soft	116	130
Clay w/gravel	Orange Brown	Med	130	161
Clay w/gravel	Gray	Med	161	192
Sand	Brown	Soft	192	198
Shale + Sandstone	Gray Tan	M-H	198	241
Sandrock	White, Yellow	M-H	241	310

Use a second sheet, if needed.

REMARKS, ELEVATION, SOURCE OF DATA, etc.

NEAREST KNOWN SOURCE OF CONTAMINATION: Well is 80 feet E direction from Drainfield. Well disinfected upon completion? ☐ Yes ☐ No

PUMP: ☐ Not Installed. Date Installed: 12-5-22. Manufacturer's name: Goulds. Model Number: 18GS10. HP: 1. Volts: 230. Length of drop pipe: 100 ft. Capacity: 18 g.p.m. Type: ☒ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ _____

ABANDONED WELLS: Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

VARIANCE: Was a variance granted from the MDH for this well? ☐ Yes ☒ No. If Yes, Var. _____

WELL CONTRACTOR CERTIFICATION: This well was drilled under my supervision and in accordance with Minnesota Rules, chapter 4725. The information contained in this report is true to the best of my knowledge.

Able Well, Inc. — Licensee Business Name — Lic. or Reg. No. 1377

Certified Representative Signature — Certified Rep. No. 972 — Date 12-15-22

Name of Driller: Scott Thompson

IMPORTANT-FILE WITH PROPERTY PAPERS-WELL OWNER COPY 876412

© MDH

MDH-01205-18 (Rev. 2-19)

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING CONSTRUCTION RECORD

Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO. 876411

WELL OR BORING LOCATION

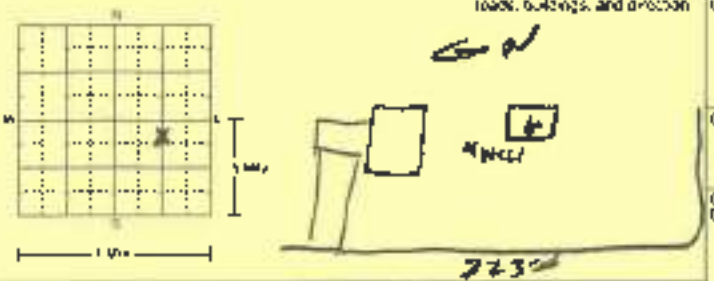
County Name: Sherburne

Township Name	Township No.	Range No.	Section No.	Fraction (use 4 letters)
Elk River	33	26	4	NE NW SE

GPS LOCATION (decimal degrees no less than 5 decimal places)
Latitude _____ Longitude _____

House Number, Street Name, City and ZIP Code of Well Location
12265 223rd Ave NW, Elk River 55330

Show exact location of well/boring on section grid with "X"



Sketch map of well/boring location showing property lines, roads, buildings, and direction

WELL/BORING DEPTH (completed)	DATE WORK COMPLETED
300	10-21-22

DRILLING METHOD: ☐ Cable Tool ☐ Driven ☐ Dual Rotary ☐ Auger ☒ Boring ☐ Hollow Stem ☐ Other

DRILLING FLUID: Super Gel

WELL HYDROFRACTURED? ☐ Yes ☒ No From _____ ft. To _____ ft.

USE: ☒ Domestic ☐ Monitoring ☐ Heating-Cooling ☐ Non-community PWS ☐ Irrigation ☐ Industrial/Commercial ☐ Community PWS ☐ Dewatering ☐ Remediation ☐ Elevator ☐ _____

CASING MATERIAL: ☒ Steel ☐ Plastic ☐ _____ Drive Shoe? ☐ Yes ☐ No ☐ Threaded ☐ Welded

CASING DIAMETER / WEIGHT / SPECIFICATIONS

in. To 290 ft.	11 lbs./ft.	ASTM-53	
in. To ft.	lbs./ft.		
in. To ft.	lbs./ft.		

HOLE DIAM.: 8 1/4 in. To 290 ft.; 4 in. To 310 ft.

SCREEN: ☒ Yes ☐ No
Make: Johnson
Type: SS Diam: 2"
Slot/Gauge: 10 Slot Length: 12'
Set between 290 ft. and 302 ft. FITTINGS: K-Packer

OPEN HOLE: From _____ ft. To _____ ft.

STATIC WATER LEVEL: 50 ft. ☒ Below ☐ Above land surface
Date measured 10-21-22 Dry hole ☐ Yes ☒ No

PUMPING LEVEL (below land surface)
After 4 hrs. pumping 20 GPM

WELL HEAD COMPLETION
☒ Pitless adapter manufacturer: Aqua Seal Model: 74-1
Casing protection: ☒ 12 in. above grade
☐ At grade ☐ Well House ☐ Hand Pump

GROUT INFORMATION (specify bentonite, cement type, neat cement, sand-cement, concrete, cuttings, or other)
Material: Neat Cement From: 0 To: 290 ft. 55 Gal. ☐ Yes ☒ No
Material: _____ From: _____ To: _____ ft. _____ ☐ Yes ☐ No
Material: _____ From: _____ To: _____ ft. _____ ☐ Yes ☐ No
Drive shoe used ☐ From _____ To _____ ☐ Bags
One bag = 94 lbs. cement or 30 lbs. bentonite

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Sand & Gravel	Brown	Soft	0	5
Clay w/Gravel	Brown	Soft	5	10
Sand & Gravel	Brown	Soft	10	35
Clay	Tan	med	35	61
Sand	Tan	Soft	61	63
Clay	Gray	med	63	69
Gravel	Tan	Soft	69	72
Clay	Gray	med	72	79
Gravel	White	Soft	79	81
Clay w/Gravel	Brown	med	81	95
Sandy Clay	Brown	Soft	95	111
Clay w/Gravel	Brown	med	111	128
Sand	Tan	Soft	128	150
Clay w/Gravel	Brown	med	150	184
Sand	White	Soft	184	199
Clay Use a second sheet if necessary	Gray	med	199	204
REMARKS, ELEVATION, SOURCE OF DATA, etc.				
Sand	Mixed	Soft	204	229
Sandy Clay	Brown	Med	229	260
Sandrock	White	Med	260	310

NEAREST KNOWN SOURCE OF CONTAMINATION
Well is 55 feet W direction from Sewer type
Well disinfected upon completion? ☒ Yes ☐ No line

PUMP
☐ Not installed Date installed 10-21-22
Manufacturer's name: Goulds
Model Number: 10CS07 HP 3/4 Volts 230
Length of drop pipe 80 ft. Capacity 10 GPM
Type: ☒ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ _____

ABANDONED WELLS
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

VARIANCE
Was a variance granted from the MDH for this well? ☐ Yes ☒ No If Yes, Var. No. _____

WELL CONTRACTOR'S CERTIFICATION
This well was drilled under my supervision and in accordance with Minnesota Rules, chapter 4725. The information reported in this report is true to the best of my knowledge.

Able Well, Inc. 1377
Licensed Business Name Lic. or Reg. No.

[signature] 972 10-27-22
Licensed Representative Signature Certification No. Date

Scott Thompson
Name of Driller

IMPORTANT: FILE WITH PROPERTY PAPERS. WELL OWNER COPY

876411

ID #52603

MDH 6074 (Rev. 2/19)

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING CONSTRUCTION RECORD
Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO: 876410

WELL OR BORING LOCATION

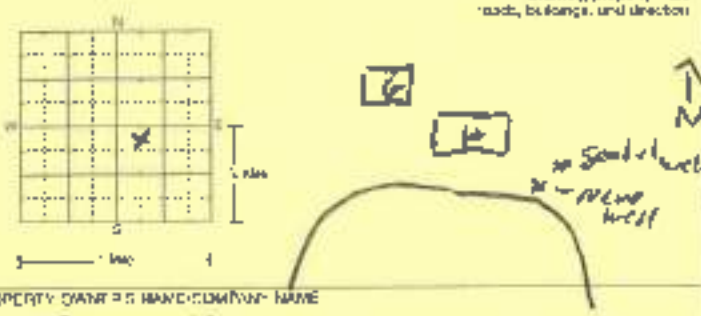
County Name: Sherburne

Township Name	Township No.	Range No.	Section No.	Fraction (use 4 if 1/4 or 2 if 1/2)
Elk River	33	26	4	NW NW SE

GPS LOCATION — decimal degrees (to five decimal places)
Latitude: _____ Longitude: _____

Property Number, Street Name, City, and ZIP Code of Well Location: 1269 223rd Ave NW, Elk River, 55330

Show exact location of well/boring in section grid with "X" — Sketch map of well/boring location showing property lines, roads, buildings, and direction



PROPERTY OWNER'S NAME/COMPANY NAME: Doug Hipsag

Property owner's mailing address, if different from well location (address above)

WELL OWNER'S NAME/COMPANY NAME

Well/boring owner's mailing address, if different from property owner's address (or street address above)

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Sand	Brown	Soft	0	6
Clay w/gravel	Brown	Med	6	9
Sand	Tan	Soft	9	37
Clay	Tan	Med	37	66
Clay	Gray	Med	66	75
Sand & Gravel	Tan	Soft	75	97
Clay w/Gravel	Brown	Med	97	144
Sand & Gravel	Tan	Soft	144	150
Clay w/Gravel	Brown	Med	150	184
Sand & Gravel	Brown	Soft	184	207
Clay w/gravel	Brown	Med	207	223
Shale	Blue Tan Green	Med-H	223	248
Sand rock	White	Hard	248	299

Use a second sheet if needed

REMARKS, ELEVATION, SOURCE OF DATA, etc.

IMPORTANT: FILE WITH PROPERTY PAPERS—WELL OWNER COPY

876410

WELL/BORING DEPTH (completed): 299 ft.

DATE WORK COMPLETED: 10-21-22

DRILLING METHOD: [ ] Cable Tool [ ] Driven [ ] Dual Rotary [ ] Auger [X] Rotary [ ] Reverse [ ] Other

DRILLING FLUID: Super Gel

ANTI-HYDRATION INSERT? [ ] Yes [X] No — From _____ ft. To _____ ft.

USE: [X] Domestic [ ] Monitoring [ ] Heating/Cooling [ ] Non-community PWS [ ] Irrigation [ ] Industry/Commercial [ ] Community PWS [ ] Dewatering [ ] Test/Exploration [ ] Elevator [ ] _____

CASING MATERIAL: [X] Steel [ ] Plastic [ ] _____ — Drive Shoe? [ ] Yes [X] No — [X] Threaded [ ] Welded

CASING DIAMETER / WEIGHT / SPECIFICATIONS:
- 4 in. to 255 ft., 11 lbs./ft., ASTM-53
- _____ in. to _____ ft., _____ lbs./ft.
- _____ in. to _____ ft., _____ lbs./ft.

HOLE DIAM:
- _____ in. to _____ ft.
- 4 in. to 299 ft.

SCREEN: [ ] Make _____ [ ] Type _____ [ ] Slot/Gauge _____ [ ] Set between _____ ft. and _____ ft. — Diam. _____ Length _____ Fittings _____

OPEN HOLE: From 255 ft. to 299 ft.

STATIC WATER LEVEL: 52 ft. [X] Land surface [ ] Above land surface — Date measured: 9-21-22 — Flowing? [ ] Yes [X] No

PUMPING LEVEL (below land surface): ft. after 3 hrs. pumping 60 gpm

WELLHEAD COMPLETION: [X] Pitless adapter (manufacturer): Ayer Sealed — Model: 7425-1 — [ ] Casing protector — [X] At least 12" above grade — [ ] At grade — [ ] Well vault — [ ] Hand Pump

GROUT INFORMATION (specify bentonite, cement-sand, neat cement, concrete, or chips or other):
- Material: Neat Cement — From 0 ft. to 255 ft. — 48 — [ ] Yds [X] Bags
- Material: _____ From _____ ft. to _____ ft. — _____ [ ] Yds [ ] Bags
- Material: _____ From _____ ft. to _____ ft. — _____ [ ] Yds [ ] Bags

Grout displaced: From _____ ft. to _____ ft. — _____ Bags — One bag = 94 lbs. cement or 92 lbs. bentonite

NEAREST KNOWN SOURCE OF CONTAMINATION: Well 52 ft. feet — N direction from Septic — type

Well abandoned upon completion? [X] No [ ] Yes

PUMP: [ ] Not installed — Date installed: 10-21-22

Manufacturer's name: Grundfos

Model number: 22SQE 15 — HP: 1½ — Volts: 230

Length of drop pipe: 100 ft. — Capacity: 22 gpm

Type: [X] Submersible [ ] L.S. Turbine [ ] Reciprocating [ ] Jet [ ] _____

ABANDONED WELLS: Does property have any not in use and not sealed wells? [ ] Yes [X] No

VARIANCE: Was a variance granted from the MDH for this well? [ ] Yes [X] No — If Yes, Var. No. _____

WELL CONTRACTOR CERTIFICATION: This well was drilled under my supervision and in accordance with Minnesota Rules, chapter 4725. The information contained in this report is true to the best of my knowledge.

Able Well, Inc. — License Business Name — 1379 — License Reg. No.

Scott Thompson — Certified Rep. Signature — 972 — Certified Rep. No. — 10-25-22 — Date

Scott Thompson — Name of Driller

MN 01229-19 (Rev. 8-19)

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING CONSTRUCTION RECORD

Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO. 876414

WELL OR BORING LOCATION

County Name: Sherburne

Township Name	Township No.	Range No.	Section No.	Fraction (an. → lg.)
Elk River	33	26	4	SE SW SE

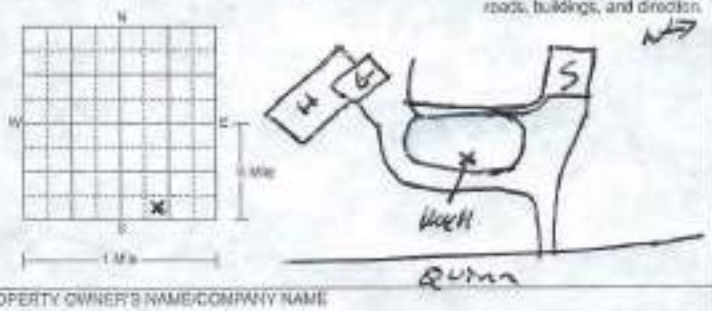
WELL/BORING DEPTH (completed): 319 ft.

DATE WORK COMPLETED: 12-14-22

GPS LOCATION — decimal degrees (to four decimal places): Latitude _____ Longitude _____

House Number, Street Name, City, and ZIP Code of Well Location: 22130 Quinn St NW, Elk River 55330

Show exact location of well/boring in section grid with "X". Sketch map of well/boring location. Showing property lines, roads, buildings, and direction.



PROPERTY OWNER'S NAME/COMPANY NAME: R. Mathson

Property owner's mailing address if different than well location address indicated above.

WELL OWNER'S NAME/COMPANY NAME

Well/boring owner's mailing address if different than property owner's address indicated above.

DRILLING METHOD: ☐ Cable Tool ☐ Driven ☐ Dual Rotary ☐ Auger ☒ Rotary ☐ Rotosonic ☐ Other

DRILLING FLUID: Super Gel

WELL HYDROFRACTURED? ☐ Yes ☒ No From _____ ft. To _____ ft.

USE: ☒ Domestic ☐ Monitoring ☐ Heating/Cooling ☐ Noncommunity PWS ☐ Irrigation ☐ Industry/Commercial ☐ Community PWS ☐ Dewatering ☐ Remedial ☐ Elevator ☐ _____

CASING MATERIAL: ☒ Steel ☐ Plastic — Drive Shoe? ☒ Yes ☐ No — ☒ Threaded ☐ Welded ☐ _____

CASING Diameter	Weight	Specifications	HOLE DIAM.
4 in. To 293 ft.	11 lbs./ft.	ASTM-A53	8 in. To 293 ft.
in. To ft.	lbs./ft.		in. To ft.
in. To ft.	lbs./ft.		4 in. To 319 ft.

SCREEN: Yes — Make: Johnson — Type: SS — Diam.: 2" — Slot/Gauze: 12 slot — Length: 29' — Set between 293 ft. and 319 ft. — FITTINGS: Packer + Sump

OPEN HOLE: From _____ ft. To _____ ft.

STATIC WATER LEVEL: 45 ft. ☒ Below ☐ Above land surface — Date measured: 12-14-22 — Dry hole ☐ Yes ☒ No

PUMPING LEVEL (below land surface): _____ ft. after 2 hrs. pumping 40 g.p.m.

WELLHEAD COMPLETION: ☒ Pitless adapter manufacturer: Aqua Seal — Model: T4-1 — ☐ Casing protection ☒ 12 in. above grade — ☐ At-grade ☐ Well House ☐ Hand Pump

GROUT INFORMATION (specify bentonite, cement grout, neat cement, concrete, cuttings, or other)

Material	From	To			
Neat Cement	0	293 ft.	54	☐ Yes	☒ Bags
		ft.		☐ Yes	☐ Bags
		ft.		☐ Yes	☐ Bags

Driven casing seal: From _____ To _____ Bags — One bag = 94 lbs. cement or 50 lbs. bentonite

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Sand - Some Gravel	Tan	Soft	0	24
Sandy Clay	Brown	Soft	24	57
Clay w/gravel	Brown	Med	57	65
Clay w/gravel	Gray	Med	65	82
Clay w/gravel	Brown	Med	82	96
Sand	Tan	Soft	96	102
Clay w/gravel	Brown	Med	102	119
Sand	Tan	Soft	119	139
Boulder	Black/White	Hard	139	141
Sand	Tan	Soft	141	146
Clay	Gray	Med	146	214
Clay w/gravel	Brown	Med	214	282
Sand	Gray	Soft	282	319

Use a second sheet if needed.

NEAREST KNOWN SOURCE OF CONTAMINATION: Well is 95 feet N direction from Septic Tank type — Well disinfected upon completion? ☒ Yes ☐ No

PUMP: ☐ Not installed Date installed _____ — Manufacturer's name: Goulds — Model Number: 10CS07 — HP: 3/4 — Volts: 230 — Length of drop pipe: 100 ft. — Capacity: 12 g.p.m. — Type: ☒ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ _____

ABANDONED WELLS: Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

VARIANCE: Was a variance granted from the MDH for this well? ☐ Yes ☒ No TN# _____

REMARKS, ELEVATION, SOURCE OF DATA, etc.

WELL CONTRACTOR CERTIFICATION

This well was drilled under my supervision and in accordance with Minnesota Rules, chapter 4725. The information contained in this report is true to the best of my knowledge.

Able Well, Inc — 1377
Licensee Business Name — Lic. or Reg. No.

Scott G. Thompson — 972 — 12-15-22
Certified Representative Signature — Certified Rep. No. — Date

Scott Thompson
Name of Driller

MINN. DEPT. OF HEALTH COPY 876414

ID #52003

HE-01205-18 (Rev. 8/18)

WELL OR BORING LOCATION

County Name: Sherburne

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING CONSTRUCTION RECORD
Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO.: 876413

Township Name	Township No.	Range No.	Section No.	Fraction (sm. → lg.)
Elk River	33	26	4	NE SW SE

WELL/BORING DEPTH (completed): 379 ft.

DATE WORK COMPLETED: 12-10-22

GPS LOCATION — decimal degrees (to four decimal places)
Latitude _____ Longitude _____

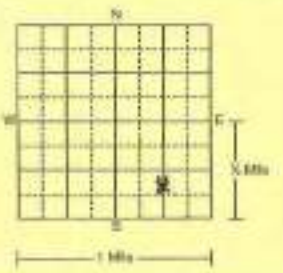
House Number, Street Name, City, and ZIP Code of Well Location: 22272 Quinn St. NW, Elk River 55330

DRILLING METHOD
☐ Cable Tool ☐ Driven ☐ Dual Rotary
☐ Auger ☑ Rotary ☐ Reboomic
☐ Other _____

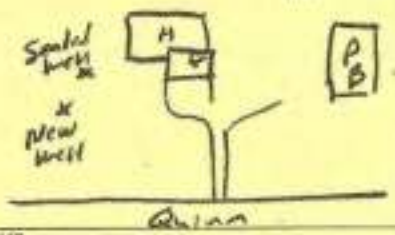
DRILLING FLUID: Super Gel

WELL HYDROFRACTURED? ☐ Yes ☒ No — From _____ ft. To _____ ft.

Show exact location of well/boring in section grid with "X"



Sketch map of well/boring location. Showing property lines, roads, buildings, and direction.



USE
☒ Domestic ☐ Monitoring ☐ Heating/Cooling
☐ Noncommunity PWS ☐ Irrigation ☐ Industry/Commercial
☐ Community PWS ☐ Dewatering ☐ Remedial
☐ Elevator ☐ _____

CASING MATERIAL: ☐ Steel ☐ Plastic — Drive Shoe? ☒ Yes ☐ No — ☒ Threaded ☐ Welded

CASING Diameter		Weight		Specifications	HOLE DIAM.	
4 in. To	333 ft.	11 lbs./ft.		ASTM-A53	8 in. To	333 ft.
in. To	ft.	lbs./ft.			in. To	ft.
in. To	ft.	lbs./ft.			4 in. To	379 ft.

PROPERTY OWNER'S NAME/COMPANY NAME: Paul Higgs

Property owner's mailing address if different than well location address indicated above.

SCREEN — Make _____ Type _____ Slot/Gauze _____ Set between _____ ft. and _____ ft.
Diam. _____ Length _____ FITTINGS _____

OPEN HOLE: From 333 ft. To 379 ft.

STATIC WATER LEVEL: 50 ft. ☒ Below ☐ Above land surface
Date measured 12-10-22 Dry hole ☐ Yes ☒ No

WELL OWNER'S NAME/COMPANY NAME

PUMPING LEVEL (below land surface): _____ ft. after 2 hrs. pumping 50 g.p.m.

Well/boring owner's mailing address if different than property owner's address indicated above.

WELLHEAD COMPLETION
☒ Pitless adapter manufacturer: Ages Seal Model: T4-1
☐ Casing protection _____ ☒ 12 in. above grade
☐ At-grade ☐ Well House ☐ Hand Pump

GROUT INFORMATION (specify bentonite, cement-sand, neat cement, concrete, cuttings, or other)

Material	From	To		
Neat Cement	0 ft.	333 ft.	60 Bags	☐ Yes ☒ No
	ft.	ft.	Bags	☐ Yes ☐ No
	ft.	ft.	Bags	☐ Yes ☐ No

Driven casing seal: From _____ To _____ Bags
One bag = 94 lbs. cement or 50 lbs. bentonite

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Sand	Brown	Soft	0	8
Clay	Brown	Soft	8	11
Sand	Brown	Soft	11	21
Sandy Clay	Brown	Soft	21	50
Clay w/gravel	Gray	Med	50	99
Clay w/gravel	Brown	Med	99	123
Sand & gravel	Tan	Soft	123	151
Clay	Gray	Med	151	224
Clay w/gravel	Brown	Med	224	279
Sand & gravel	Gray	Soft	279	325
Sandrock	Orange & Pink	Hard	325	379

Use a second sheet if needed.

REMARKS, ELEVATION, SOURCE OF DATA, etc.

NEAREST KNOWN SOURCE OF CONTAMINATION
Well is 75 feet E direction from Drain field type
Well disinfected upon completion? ☒ Yes ☐ No

PUMP
☐ Not Installed Date Installed 1-26-23
Manufacturer's name Goulds
Model Number 18GS10 HP 1 Volts 230
Length of drop pipe 100 ft. Capacity 18 g.p.m.
Type: ☒ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ _____

ABANDONED WELLS
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

VARIANCE
Was a variance granted from the MDH for this well? ☐ Yes ☒ No If Yes, attach.

WELL CONTRACTOR CERTIFICATION
This well was drilled under my supervision and in accordance with Minnesota Rules, chapter 4725. This information contained in this report is true to the best of my knowledge.

Able Well, Inc. — Licensee Business Name — Lic. or Reg. No. 1377
Certified Representative Signature — Certified Rep. No. 972 — Date 12-15-22
Scott Thompson — Name of Driller

IMPORTANT-FILE WITH PROPERTY PAPERS/WELL OWNER COPY 876413

MDH 6/2022

MDH 6/2022 (Rev. 3/19)

ANALYTICAL REPORT

June 24, 2022

Elk River Landfill

Sample Delivery Group:	L1506115
Samples Received:	06/17/2022
Project Number:	200
Description:	Residential Well Replacement
Site:	MN02
Report To:	Andrea Nord 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

Stacy Kennedy
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

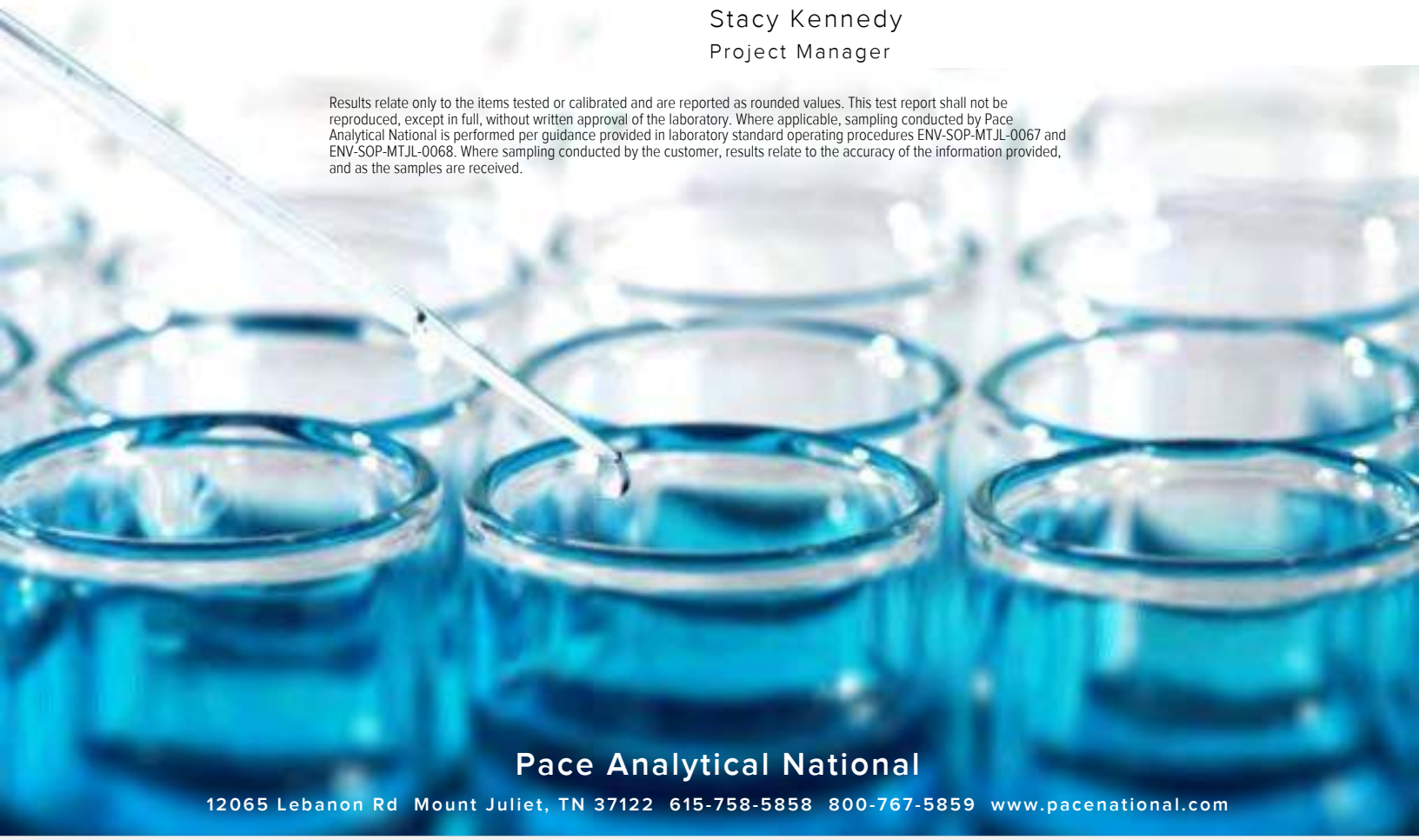


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Qc: Quality Control Summary 9

Volatile Organic Compounds (GC/MS) by Method 8260D 9

Gl: Glossary of Terms 14

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Sc: Sample Chain of Custody 16

#876409 L1506115-01 GW

Collected by: KM
Collected date/time: 06/16/22 12:00
Received date/time: 06/17/22 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1883931	1	06/23/22 12:25	06/23/22 12:25	ADM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1885068	1	06/24/22 12:51	06/24/22 12:51	JHH	Mt. Juliet, TN

TRIP BLANK L1506115-02 GW

Collected by: KM
Collected date/time: 06/16/22 00:00
Received date/time: 06/17/22 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1883931	1	06/23/22 12:06	06/23/22 12:06	ADM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1885068	1	06/24/22 12:31	06/24/22 12:31	JHH	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Stacy Kennedy
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Sample Delivery Group (SDG) Narrative

Analyzed from headspace vial.

Batch	Method	Lab Sample ID
WG1885068	8260D	L1506115-02

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Data is likely to show a low bias concerning the result.

Batch	Lab Sample ID	Analytes
WG1883931	L1506115-01	1,2,3-Trichlorobenzene and 1,2,4-Trichlorobenzene

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG1883931	L1506115-01	1,3,5-Trimethylbenzene, 4-Chlorotoluene, Bromomethane, Naphthalene and n-Propylbenzene
WG1883931	L1506115-02	1,3,5-Trimethylbenzene, 4-Chlorotoluene, Bromomethane, Naphthalene and n-Propylbenzene

The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.

Batch	Lab Sample ID	Analytes
WG1883931	L1506115-01	Acetone

The associated batch QC was below the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG1883931	(LCS) R3807136-1, L1506115-01	1,2,3-Trichlorobenzene

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	06/23/2022 12:25	WG1883931
1,1,1-Trichloroethane	ND		1.00	1	06/23/2022 12:25	WG1883931
1,1,2,2-Tetrachloroethane	ND		1.00	1	06/23/2022 12:25	WG1883931
1,1-Dichloroethane	ND		1.00	1	06/23/2022 12:25	WG1883931
1,1-Dichloroethene	ND		1.00	1	06/23/2022 12:25	WG1883931
1,1-Dichloropropene	ND		1.00	1	06/23/2022 12:25	WG1883931
1,2,3-Trichlorobenzene	ND	C4 J4	1.00	1	06/23/2022 12:25	WG1883931
1,2,3-Trichloropropane	ND		1.00	1	06/23/2022 12:25	WG1883931
1,2,4-Trichlorobenzene	ND	C4	1.00	1	06/23/2022 12:25	WG1883931
1,2,4-Trimethylbenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
1,2-Dibromo-3-Chloropropane	ND		1.00	1	06/23/2022 12:25	WG1883931
1,2-Dibromoethane	ND		1.00	1	06/23/2022 12:25	WG1883931
1,2-Dichlorobenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
1,2-Dichloroethane	ND		1.00	1	06/23/2022 12:25	WG1883931
1,2-Dichloropropane	ND		1.00	1	06/23/2022 12:25	WG1883931
1,3,5-Trimethylbenzene	ND	C3	1.00	1	06/23/2022 12:25	WG1883931
1,3-Dichlorobenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
1,3-Dichloropropane	ND		1.00	1	06/23/2022 12:25	WG1883931
1,4-Dichlorobenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
2,2-Dichloropropane	ND		1.00	1	06/23/2022 12:25	WG1883931
2-Butanone (MEK)	ND		10.0	1	06/23/2022 12:25	WG1883931
2-Chlorotoluene	ND		1.00	1	06/23/2022 12:25	WG1883931
4-Chlorotoluene	ND	C3	1.00	1	06/23/2022 12:25	WG1883931
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	06/23/2022 12:25	WG1883931
Acetone	ND	C5	10.0	1	06/23/2022 12:25	WG1883931
Allyl chloride	ND		1.00	1	06/23/2022 12:25	WG1883931
Benzene	ND		1.00	1	06/23/2022 12:25	WG1883931
Bromobenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
Bromochloromethane	ND		1.00	1	06/23/2022 12:25	WG1883931
Bromodichloromethane	ND		1.00	1	06/23/2022 12:25	WG1883931
Bromoform	ND		1.00	1	06/23/2022 12:25	WG1883931
Bromomethane	ND	C3	1.00	1	06/23/2022 12:25	WG1883931
Carbon tetrachloride	ND		1.00	1	06/23/2022 12:25	WG1883931
Chlorobenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
Chlorodibromomethane	ND		1.00	1	06/23/2022 12:25	WG1883931
Chloroethane	ND		1.00	1	06/23/2022 12:25	WG1883931
Chloroform	ND		1.00	1	06/23/2022 12:25	WG1883931
Chloromethane	ND		1.00	1	06/23/2022 12:25	WG1883931
Dibromomethane	ND		1.00	1	06/23/2022 12:25	WG1883931
Dichlorodifluoromethane	ND		1.00	1	06/23/2022 12:25	WG1883931
Dichlorofluoromethane	ND		1.00	1	06/23/2022 12:25	WG1883931
Ethyl ether	ND		1.00	1	06/23/2022 12:25	WG1883931
Ethylbenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
Hexachloro-1,3-butadiene	ND		1.00	1	06/23/2022 12:25	WG1883931
Isopropylbenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
Methyl tert-butyl ether	ND		1.00	1	06/23/2022 12:25	WG1883931
Methylene Chloride	ND		1.00	1	06/23/2022 12:25	WG1883931
Naphthalene	ND	C3	1.00	1	06/23/2022 12:25	WG1883931
Styrene	ND		1.00	1	06/23/2022 12:25	WG1883931
Tetrachloroethene	ND		1.00	1	06/23/2022 12:25	WG1883931
Tetrahydrofuran	ND		5.00	1	06/23/2022 12:25	WG1883931
Toluene	ND		1.00	1	06/23/2022 12:25	WG1883931
Trichloroethene	ND		1.00	1	06/23/2022 12:25	WG1883931
Trichlorofluoromethane	ND		1.00	1	06/23/2022 12:25	WG1883931
Vinyl chloride	ND		1.00	1	06/24/2022 12:51	WG1885068
Xylenes, Total	ND		2.00	1	06/23/2022 12:25	WG1883931

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
cis-1,2-Dichloroethene	ND		1.00	1	06/23/2022 12:25	WG1883931
cis-1,3-Dichloropropene	ND		1.00	1	06/23/2022 12:25	WG1883931
n-Butylbenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
n-Propylbenzene	ND	C3	1.00	1	06/23/2022 12:25	WG1883931
p-Isopropyltoluene	ND		1.00	1	06/23/2022 12:25	WG1883931
sec-Butylbenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
tert-Butylbenzene	ND		1.00	1	06/23/2022 12:25	WG1883931
trans-1,2-Dichloroethene	ND		1.00	1	06/23/2022 12:25	WG1883931
trans-1,3-Dichloropropene	ND		1.00	1	06/23/2022 12:25	WG1883931
(S) 4-Bromofluorobenzene	*96.3*			*67.0-138*	*06/23/2022 12:25*	WG1883931
(S) 4-Bromofluorobenzene	*88.3*			*67.0-138*	*06/24/2022 12:51*	WG1885068
(S) Toluene-d8	*94.6*			*75.0-131*	*06/23/2022 12:25*	WG1883931
(S) Toluene-d8	*111*			*75.0-131*	*06/24/2022 12:51*	WG1885068
(S) 1,2-Dichloroethane-d4	*113*			*70.0-130*	*06/23/2022 12:25*	WG1883931
(S) 1,2-Dichloroethane-d4	*94.3*			*70.0-130*	*06/24/2022 12:51*	WG1885068

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	06/23/2022 12:06	WG1883931
1,1,1-Trichloroethane	ND		1.00	1	06/23/2022 12:06	WG1883931
1,1,2,2-Tetrachloroethane	ND		1.00	1	06/23/2022 12:06	WG1883931
1,1-Dichloroethane	ND		1.00	1	06/23/2022 12:06	WG1883931
1,1-Dichloroethene	ND		1.00	1	06/23/2022 12:06	WG1883931
1,1-Dichloropropene	ND		1.00	1	06/23/2022 12:06	WG1883931
1,2,3-Trichlorobenzene	ND		1.00	1	06/24/2022 12:31	WG1885068
1,2,3-Trichloropropane	ND		1.00	1	06/23/2022 12:06	WG1883931
1,2,4-Trichlorobenzene	ND		1.00	1	06/24/2022 12:31	WG1885068
1,2,4-Trimethylbenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
1,2-Dibromo-3-Chloropropane	ND		1.00	1	06/23/2022 12:06	WG1883931
1,2-Dibromoethane	ND		1.00	1	06/23/2022 12:06	WG1883931
1,2-Dichlorobenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
1,2-Dichloroethane	ND		1.00	1	06/23/2022 12:06	WG1883931
1,2-Dichloropropane	ND		1.00	1	06/23/2022 12:06	WG1883931
1,3,5-Trimethylbenzene	ND	C3	1.00	1	06/23/2022 12:06	WG1883931
1,3-Dichlorobenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
1,3-Dichloropropane	ND		1.00	1	06/23/2022 12:06	WG1883931
1,4-Dichlorobenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
2,2-Dichloropropane	ND		1.00	1	06/23/2022 12:06	WG1883931
2-Butanone (MEK)	ND		10.0	1	06/23/2022 12:06	WG1883931
2-Chlorotoluene	ND		1.00	1	06/23/2022 12:06	WG1883931
4-Chlorotoluene	ND	C3	1.00	1	06/23/2022 12:06	WG1883931
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	06/23/2022 12:06	WG1883931
Acetone	ND		10.0	1	06/23/2022 12:06	WG1883931
Allyl chloride	ND		1.00	1	06/23/2022 12:06	WG1883931
Benzene	ND		1.00	1	06/23/2022 12:06	WG1883931
Bromobenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
Bromochloromethane	ND		1.00	1	06/23/2022 12:06	WG1883931
Bromodichloromethane	ND		1.00	1	06/23/2022 12:06	WG1883931
Bromoform	ND		1.00	1	06/23/2022 12:06	WG1883931
Bromomethane	ND	C3	1.00	1	06/23/2022 12:06	WG1883931
Carbon tetrachloride	ND		1.00	1	06/23/2022 12:06	WG1883931
Chlorobenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
Chlorodibromomethane	ND		1.00	1	06/23/2022 12:06	WG1883931
Chloroethane	ND		1.00	1	06/23/2022 12:06	WG1883931
Chloroform	ND		1.00	1	06/23/2022 12:06	WG1883931
Chloromethane	ND		1.00	1	06/23/2022 12:06	WG1883931
Dibromomethane	ND		1.00	1	06/23/2022 12:06	WG1883931
Dichlorodifluoromethane	ND		1.00	1	06/23/2022 12:06	WG1883931
Dichlorofluoromethane	ND		1.00	1	06/23/2022 12:06	WG1883931
Ethyl ether	ND		1.00	1	06/23/2022 12:06	WG1883931
Ethylbenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
Hexachloro-1,3-butadiene	ND		1.00	1	06/23/2022 12:06	WG1883931
Isopropylbenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
Methyl tert-butyl ether	ND		1.00	1	06/23/2022 12:06	WG1883931
Methylene Chloride	ND		1.00	1	06/23/2022 12:06	WG1883931
Naphthalene	ND	C3	1.00	1	06/23/2022 12:06	WG1883931
Styrene	ND		1.00	1	06/23/2022 12:06	WG1883931
Tetrachloroethene	ND		1.00	1	06/23/2022 12:06	WG1883931
Tetrahydrofuran	ND		5.00	1	06/23/2022 12:06	WG1883931
Toluene	ND		1.00	1	06/23/2022 12:06	WG1883931
Trichloroethene	ND		1.00	1	06/23/2022 12:06	WG1883931
Trichlorofluoromethane	ND		1.00	1	06/23/2022 12:06	WG1883931
Vinyl chloride	ND		1.00	1	06/24/2022 12:31	WG1885068
Xylenes, Total	ND		2.00	1	06/23/2022 12:06	WG1883931

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
cis-1,2-Dichloroethene	ND		1.00	1	06/23/2022 12:06	WG1883931
cis-1,3-Dichloropropene	ND		1.00	1	06/23/2022 12:06	WG1883931
n-Butylbenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
n-Propylbenzene	ND	C3	1.00	1	06/23/2022 12:06	WG1883931
p-Isopropyltoluene	ND		1.00	1	06/23/2022 12:06	WG1883931
sec-Butylbenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
tert-Butylbenzene	ND		1.00	1	06/23/2022 12:06	WG1883931
trans-1,2-Dichloroethene	ND		1.00	1	06/23/2022 12:06	WG1883931
trans-1,3-Dichloropropene	ND		1.00	1	06/23/2022 12:06	WG1883931
(S) 4-Bromofluorobenzene	*96.1*			*67.0-138*	*06/23/2022 12:06*	WG1883931
(S) 4-Bromofluorobenzene	*88.8*			*67.0-138*	*06/24/2022 12:31*	WG1885068
(S) Toluene-d8	*97.0*			*75.0-131*	*06/23/2022 12:06*	WG1883931
(S) Toluene-d8	*108*			*75.0-131*	*06/24/2022 12:31*	WG1885068
(S) 1,2-Dichloroethane-d4	*111*			*70.0-130*	*06/23/2022 12:06*	WG1883931
(S) 1,2-Dichloroethane-d4	*94.4*			*70.0-130*	*06/24/2022 12:31*	WG1885068

Method Blank (MB)

(MB) R3807136-3 06/23/22 09:51

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
2-Chlorotoluene	ND		0.0346	0.100
4-Chlorotoluene	ND		0.0180	0.200
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl Chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	1.00
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chlorodibromomethane	ND		0.0245	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromomethane	ND		0.0300	0.200
Dichlorodifluoromethane	ND		0.0644	0.100

Method Blank (MB)

(MB) R3807136-3 06/23/22 09:51

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	1.00
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 4-Bromofluorobenzene	*99.7*			*67.0-138*
(S) Toluene-d8	*96.9*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*114*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3807136-1 06/23/22 08:33 • (LCSD) R3807136-2 06/23/22 08:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	4.79	4.96	95.8	99.2	74.0-129			3.49	20
1,1,1-Trichloroethane	5.00	5.07	5.48	101	110	69.0-126			7.77	20
1,1,2,2-Tetrachloroethane	5.00	4.81	4.92	96.2	98.4	68.0-128			2.26	20
1,1-Dichloroethane	5.00	5.28	5.61	106	112	70.0-127			6.06	20
1,1-Dichloroethene	5.00	5.07	5.23	101	105	65.0-131			3.11	20
1,1-Dichloropropene	5.00	5.11	5.34	102	107	73.0-125			4.40	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3807136-1 06/23/22 08:33 • (LCSD) R3807136-2 06/23/22 08:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,2,3-Trichlorobenzene	5.00	2.85	3.25	57.0	65.0	59.0-139	J4		13.1	20
1,2,3-Trichloropropane	5.00	5.05	5.01	101	100	67.0-129			0.795	20
1,2,4-Trichlorobenzene	5.00	4.27	4.28	85.4	85.6	62.0-137			0.234	20
1,2,4-Trimethylbenzene	5.00	4.05	4.29	81.0	85.8	70.0-126			5.76	20
1,2-Dibromo-3-Chloropropane	5.00	4.90	4.87	98.0	97.4	59.0-130			0.614	20
1,2-Dibromoethane	5.00	4.77	4.84	95.4	96.8	74.0-128			1.46	20
1,2-Dichlorobenzene	5.00	4.51	4.72	90.2	94.4	76.0-124			4.55	20
1,2-Dichloroethane	5.00	5.36	5.46	107	109	65.0-131			1.85	20
1,2-Dichloropropane	5.00	5.48	5.47	110	109	74.0-125			0.183	20
1,3,5-Trimethylbenzene	5.00	3.95	4.23	79.0	84.6	73.0-127			6.85	20
1,3-Dichlorobenzene	5.00	4.40	4.42	88.0	88.4	76.0-125			0.454	20
1,3-Dichloropropane	5.00	4.82	4.69	96.4	93.8	80.0-125			2.73	20
1,4-Dichlorobenzene	5.00	4.48	4.64	89.6	92.8	77.0-121			3.51	20
2,2-Dichloropropane	5.00	5.41	5.68	108	114	59.0-135			4.87	20
2-Butanone (MEK)	25.0	32.5	36.1	130	144	30.0-160			10.5	24
2-Chlorotoluene	5.00	4.14	4.28	82.8	85.6	75.0-124			3.33	20
4-Chlorotoluene	5.00	3.96	4.19	79.2	83.8	75.0-124			5.64	20
4-Methyl-2-pentanone (MIBK)	25.0	27.2	27.9	109	112	56.0-143			2.54	20
Acetone	25.0	33.6	37.4	134	150	10.0-160			10.7	31
Allyl chloride	25.0	23.2	24.9	92.8	99.6	70.0-131			7.07	20
Benzene	5.00	4.71	4.99	94.2	99.8	70.0-123			5.77	20
Bromobenzene	5.00	4.37	4.42	87.4	88.4	73.0-121			1.14	20
Bromochloromethane	5.00	5.30	5.77	106	115	77.0-128			8.49	20
Bromodichloromethane	5.00	5.02	5.16	100	103	73.0-121			2.75	20
Bromoform	5.00	4.84	4.99	96.8	99.8	64.0-132			3.05	20
Bromomethane	5.00	3.79	3.36	75.8	67.2	56.0-147			12.0	20
Carbon tetrachloride	5.00	5.23	5.41	105	108	66.0-128			3.38	20
Chlorobenzene	5.00	4.48	4.48	89.6	89.6	76.0-128			0.000	20
Chlorodibromomethane	5.00	4.59	4.67	91.8	93.4	74.0-127			1.73	20
Chloroethane	5.00	4.50	4.03	90.0	80.6	61.0-134			11.0	20
Chloroform	5.00	5.08	5.34	102	107	72.0-123			4.99	20
Chloromethane	5.00	4.60	5.03	92.0	101	51.0-138			8.93	20
Dibromomethane	5.00	5.74	5.61	115	112	75.0-122			2.29	20
Dichlorodifluoromethane	5.00	4.61	4.69	92.2	93.8	43.0-156			1.72	20
Dichlorofluoromethane	5.00	5.35	4.99	107	99.8	65.0-137			6.96	20
Ethyl ether	5.00	5.85	5.66	117	113	64.0-137			3.30	20
Ethylbenzene	5.00	4.37	4.49	87.4	89.8	74.0-126			2.71	20
Hexachloro-1,3-butadiene	5.00	4.13	4.51	82.6	90.2	57.0-150			8.80	20
Isopropylbenzene	5.00	4.31	4.48	86.2	89.6	72.0-127			3.87	20
Methyl tert-butyl ether	5.00	5.60	5.86	112	117	66.0-132			4.54	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3807136-1 06/23/22 08:33 • (LCSD) R3807136-2 06/23/22 08:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Methylene Chloride	5.00	5.35	5.47	107	109	68.0-123			2.22	20
Naphthalene	5.00	3.72	3.96	74.4	79.2	59.0-130			6.25	20
Styrene	5.00	4.10	4.20	82.0	84.0	72.0-127			2.41	20
Tetrachloroethene	5.00	4.46	4.62	89.2	92.4	70.0-136			3.52	20
Tetrahydrofuran	5.00	7.08	6.93	142	139	37.0-146			2.14	24
Toluene	5.00	4.25	4.35	85.0	87.0	75.0-121			2.33	20
Trichloroethene	5.00	4.46	4.82	89.2	96.4	76.0-126			7.76	20
Trichlorofluoromethane	5.00	4.51	3.98	90.2	79.6	61.0-142			12.5	20
Xylenes, Total	15.0	13.1	13.6	87.3	90.7	72.0-127			3.75	20
cis-1,2-Dichloroethene	5.00	5.23	5.36	105	107	73.0-125			2.46	20
cis-1,3-Dichloropropene	5.00	5.15	5.28	103	106	76.0-127			2.49	20
n-Butylbenzene	5.00	4.38	4.61	87.6	92.2	68.0-135			5.12	20
n-Propylbenzene	5.00	3.95	4.15	79.0	83.0	74.0-126			4.94	20
p-Isopropyltoluene	5.00	4.26	4.52	85.2	90.4	72.0-133			5.92	20
sec-Butylbenzene	5.00	4.10	4.23	82.0	84.6	74.0-130			3.12	20
tert-Butylbenzene	5.00	3.98	4.07	79.6	81.4	75.0-127			2.24	20
trans-1,2-Dichloroethene	5.00	4.80	5.16	96.0	103	71.0-125			7.23	20
trans-1,3-Dichloropropene	5.00	4.89	4.92	97.8	98.4	73.0-127			0.612	20
(S) 4-Bromofluorobenzene				*99.7*	*97.6*	*67.0-138*				
(S) Toluene-d8				*95.3*	*94.4*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*114*	*119*	*70.0-130*				

Method Blank (MB)

(MB) R3807168-3 06/24/22 05:20

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
Vinyl chloride	ND		0.0462	0.0500
(S) 4-Bromofluorobenzene	*91.4*			*67.0-138*
(S) Toluene-d8	*109*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*89.6*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3807168-1 06/24/22 04:21 • (LCSD) R3807168-2 06/24/22 04:41

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,2,3-Trichlorobenzene	5.00	5.01	4.37	100	87.4	59.0-139			13.6	20
1,2,4-Trichlorobenzene	5.00	5.04	4.40	101	88.0	62.0-137			13.6	20
Vinyl chloride	5.00	4.45	3.92	89.0	78.4	63.0-134			12.7	20
(S) 4-Bromofluorobenzene				*93.3*	*92.4*	*67.0-138*				
(S) Toluene-d8				*103*	*105*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*99.1*	*97.4*	*70.0-130*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
C4	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Data is likely to show a low bias concerning the result.
C5	The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.
J4	The associated batch QC was outside the established quality control range for accuracy.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Andrea Nord

Email To:
anord@barr.com;datamgt@barr.com;jsidem@b

Project Description:
Residential Well Replacement

City/State Collected:

Please Circle: PT MT CT ET

Phone: 952-832-2893

Client Project #
200

Lab Project #
WMELKRIVMN-REPLACE1

Collected by (print):
Kevin Mohr

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
X Three Day

Quote #

Date Results Needed

No. of Cntrs

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	250mlAmb-HCl	40mlAmb-HCl-Blk (VOA)	8260 Elk River Landfill RLs
#876409	Grab	GW		6.16.22	12:00	6	X		X
		GW				3	X		
		GW				3	X		
		GW				3	X		
		GW				3	X		
		GW				3	X		
		GW				3	X		
		GW				3	X		
		GW				3	X		
TRIP BLANK	QC	GW		—	—	1		X	

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

SDG # L1506115

Table # G149

Acctnum: WMELKRIVMN

Template: T207576

Prelogin: P918638

PM: 364 - T. Alan Harvill

PB: JA 4/16/22

Shipped Via: FedEX Ground

Remarks | Sample # (lab only)

#876409 — 01

TRIP BLANK — 02

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other

Remarks: 12163 223rd Ave NW,

pH ___ Temp ___

Flow ___ Other ___

Samples returned via:
__ UPS X FedEx __ Courier

Tracking # 5719 6179 7196

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles Arrive Intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCl / MeoH TBR
Kevin Mohr	6.16.22	17:30		
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp: 3.8 / 3.9 °C Bottles Received: 5719 6179 6
				If preservation required by Login: Date/Time
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 6/17/22 Time: 9:00
				Hold: Condition: NCF / OK

ANALYTICAL REPORT

September 30, 2022

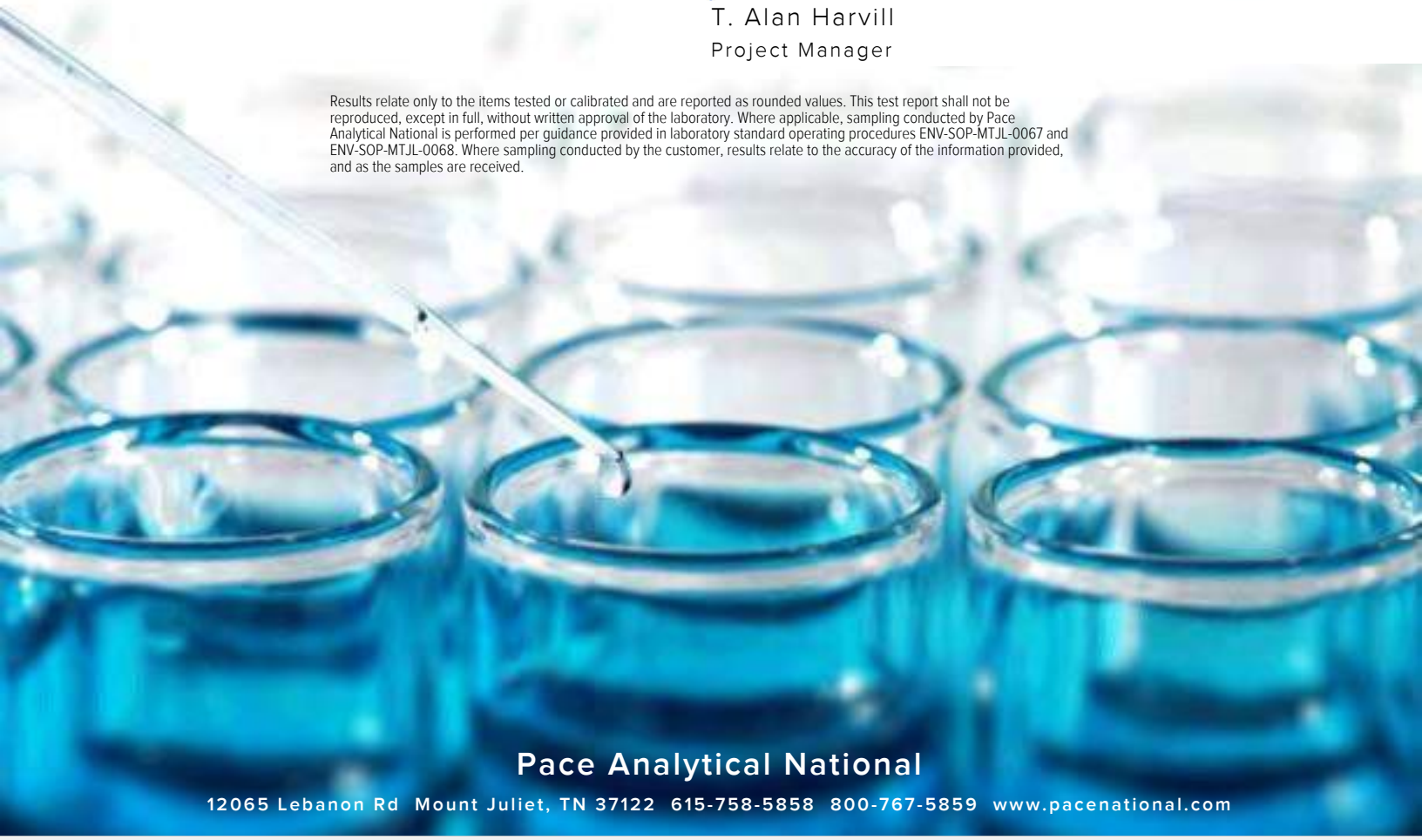
Elk River Landfill

Sample Delivery Group:	L1538364
Samples Received:	09/22/2022
Project Number:	900
Description:	Elk River Landfill Residential Well
Site:	MN02
Report To:	Andrea Nord 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

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SAMPLE SUMMARY

#876410 L1538364-01 GW

Collected by: Kevin McGilp
Collected date/time: 09/21/22 11:50
Received date/time: 09/22/22 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1933154	1	09/27/22 18:30	09/27/22 18:30	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1934357	1	09/29/22 13:46	09/29/22 13:46	ADM	Mt. Juliet, TN

TRIP BLANK L1538364-02 GW

Collected by: Kevin McGilp
Collected date/time: 09/21/22 00:00
Received date/time: 09/22/22 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1933154	1	09/27/22 14:15	09/27/22 14:15	ACG	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1934357	1	09/29/22 14:07	09/29/22 14:07	ADM	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG1933154	L1538364-01	Acetone, Bromomethane, Dichlorofluoromethane, tert-Butylbenzene and Tetrahydrofuran
WG1933154	L1538364-02	Acetone, Bromomethane, Dichlorofluoromethane, tert-Butylbenzene and Tetrahydrofuran

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	09/27/2022 18:30	WG1933154
1,1,1-Trichloroethane	ND		1.00	1	09/27/2022 18:30	WG1933154
1,1,2,2-Tetrachloroethane	ND		1.00	1	09/27/2022 18:30	WG1933154
1,1-Dichloroethane	ND		1.00	1	09/27/2022 18:30	WG1933154
1,1-Dichloroethene	ND		1.00	1	09/27/2022 18:30	WG1933154
1,1-Dichloropropene	ND		1.00	1	09/27/2022 18:30	WG1933154
1,2,3-Trichlorobenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
1,2,3-Trichloropropane	ND		1.00	1	09/27/2022 18:30	WG1933154
1,2,4-Trichlorobenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
1,2,4-Trimethylbenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
1,2-Dibromo-3-Chloropropane	ND		1.00	1	09/27/2022 18:30	WG1933154
1,2-Dibromoethane	ND		1.00	1	09/27/2022 18:30	WG1933154
1,2-Dichlorobenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
1,2-Dichloroethane	ND		1.00	1	09/27/2022 18:30	WG1933154
1,2-Dichloropropane	ND		1.00	1	09/27/2022 18:30	WG1933154
1,3,5-Trimethylbenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
1,3-Dichlorobenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
1,3-Dichloropropane	ND		1.00	1	09/27/2022 18:30	WG1933154
1,4-Dichlorobenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
2,2-Dichloropropane	ND		1.00	1	09/27/2022 18:30	WG1933154
2-Butanone (MEK)	ND		10.0	1	09/27/2022 18:30	WG1933154
2-Chlorotoluene	ND		1.00	1	09/27/2022 18:30	WG1933154
4-Chlorotoluene	ND		1.00	1	09/27/2022 18:30	WG1933154
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	09/27/2022 18:30	WG1933154
Acetone	ND	C3	10.0	1	09/27/2022 18:30	WG1933154
Allyl chloride	ND		1.00	1	09/27/2022 18:30	WG1933154
Benzene	ND		1.00	1	09/27/2022 18:30	WG1933154
Bromobenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
Bromochloromethane	ND		1.00	1	09/27/2022 18:30	WG1933154
Bromodichloromethane	ND		1.00	1	09/27/2022 18:30	WG1933154
Bromoform	ND		1.00	1	09/27/2022 18:30	WG1933154
Bromomethane	ND	C3	1.00	1	09/27/2022 18:30	WG1933154
Carbon tetrachloride	ND		1.00	1	09/27/2022 18:30	WG1933154
Chlorobenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
Chlorodibromomethane	ND		1.00	1	09/27/2022 18:30	WG1933154
Chloroethane	ND		1.00	1	09/27/2022 18:30	WG1933154
Chloroform	ND		1.00	1	09/27/2022 18:30	WG1933154
Chloromethane	ND		1.00	1	09/27/2022 18:30	WG1933154
Dibromomethane	ND		1.00	1	09/27/2022 18:30	WG1933154
Dichlorodifluoromethane	ND		1.00	1	09/27/2022 18:30	WG1933154
Dichlorofluoromethane	ND	C3	1.00	1	09/27/2022 18:30	WG1933154
Ethyl ether	ND		1.00	1	09/27/2022 18:30	WG1933154
Ethylbenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
Hexachloro-1,3-butadiene	ND		1.00	1	09/27/2022 18:30	WG1933154
Isopropylbenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
Methyl tert-butyl ether	ND		1.00	1	09/27/2022 18:30	WG1933154
Methylene Chloride	ND		1.00	1	09/27/2022 18:30	WG1933154
Naphthalene	ND		1.00	1	09/27/2022 18:30	WG1933154
Styrene	ND		1.00	1	09/27/2022 18:30	WG1933154
Tetrachloroethene	ND		1.00	1	09/27/2022 18:30	WG1933154
Tetrahydrofuran	ND	C3	5.00	1	09/27/2022 18:30	WG1933154
Toluene	ND		1.00	1	09/27/2022 18:30	WG1933154
Trichloroethene	ND		1.00	1	09/27/2022 18:30	WG1933154
Trichlorofluoromethane	ND		1.00	1	09/27/2022 18:30	WG1933154
Vinyl chloride	ND		1.00	1	09/29/2022 13:46	WG1934357
Xylenes, Total	ND		2.00	1	09/27/2022 18:30	WG1933154

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
cis-1,2-Dichloroethene	ND		1.00	1	09/27/2022 18:30	WG1933154
cis-1,3-Dichloropropene	ND		1.00	1	09/27/2022 18:30	WG1933154
n-Butylbenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
n-Propylbenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
p-Isopropyltoluene	ND		1.00	1	09/27/2022 18:30	WG1933154
sec-Butylbenzene	ND		1.00	1	09/27/2022 18:30	WG1933154
tert-Butylbenzene	ND	C3	1.00	1	09/27/2022 18:30	WG1933154
trans-1,2-Dichloroethene	ND		1.00	1	09/27/2022 18:30	WG1933154
trans-1,3-Dichloropropene	ND		1.00	1	09/27/2022 18:30	WG1933154
(S) 4-Bromofluorobenzene	*101*			*67.0-138*	*09/27/2022 18:30*	WG1933154
(S) 4-Bromofluorobenzene	*101*			*67.0-138*	*09/29/2022 13:46*	WG1934357
(S) Toluene-d8	*99.5*			*75.0-131*	*09/27/2022 18:30*	WG1933154
(S) Toluene-d8	*101*			*75.0-131*	*09/29/2022 13:46*	WG1934357
(S) 1,2-Dichloroethane-d4	*101*			*70.0-130*	*09/27/2022 18:30*	WG1933154
(S) 1,2-Dichloroethane-d4	*101*			*70.0-130*	*09/29/2022 13:46*	WG1934357

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	09/27/2022 14:15	WG1933154
1,1,1-Trichloroethane	ND		1.00	1	09/27/2022 14:15	WG1933154
1,1,2,2-Tetrachloroethane	ND		1.00	1	09/27/2022 14:15	WG1933154
1,1-Dichloroethane	ND		1.00	1	09/27/2022 14:15	WG1933154
1,1-Dichloroethene	ND		1.00	1	09/27/2022 14:15	WG1933154
1,1-Dichloropropene	ND		1.00	1	09/27/2022 14:15	WG1933154
1,2,3-Trichlorobenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
1,2,3-Trichloropropane	ND		1.00	1	09/27/2022 14:15	WG1933154
1,2,4-Trichlorobenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
1,2,4-Trimethylbenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
1,2-Dibromo-3-Chloropropane	ND		1.00	1	09/27/2022 14:15	WG1933154
1,2-Dibromoethane	ND		1.00	1	09/27/2022 14:15	WG1933154
1,2-Dichlorobenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
1,2-Dichloroethane	ND		1.00	1	09/27/2022 14:15	WG1933154
1,2-Dichloropropane	ND		1.00	1	09/27/2022 14:15	WG1933154
1,3,5-Trimethylbenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
1,3-Dichlorobenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
1,3-Dichloropropane	ND		1.00	1	09/27/2022 14:15	WG1933154
1,4-Dichlorobenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
2,2-Dichloropropane	ND		1.00	1	09/27/2022 14:15	WG1933154
2-Butanone (MEK)	ND		10.0	1	09/27/2022 14:15	WG1933154
2-Chlorotoluene	ND		1.00	1	09/27/2022 14:15	WG1933154
4-Chlorotoluene	ND		1.00	1	09/27/2022 14:15	WG1933154
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	09/27/2022 14:15	WG1933154
Acetone	ND	C3	10.0	1	09/27/2022 14:15	WG1933154
Allyl chloride	ND		1.00	1	09/27/2022 14:15	WG1933154
Benzene	ND		1.00	1	09/27/2022 14:15	WG1933154
Bromobenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
Bromochloromethane	ND		1.00	1	09/27/2022 14:15	WG1933154
Bromodichloromethane	ND		1.00	1	09/27/2022 14:15	WG1933154
Bromoform	ND		1.00	1	09/27/2022 14:15	WG1933154
Bromomethane	ND	C3	1.00	1	09/27/2022 14:15	WG1933154
Carbon tetrachloride	ND		1.00	1	09/27/2022 14:15	WG1933154
Chlorobenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
Chlorodibromomethane	ND		1.00	1	09/27/2022 14:15	WG1933154
Chloroethane	ND		1.00	1	09/27/2022 14:15	WG1933154
Chloroform	ND		1.00	1	09/27/2022 14:15	WG1933154
Chloromethane	ND		1.00	1	09/27/2022 14:15	WG1933154
Dibromomethane	ND		1.00	1	09/27/2022 14:15	WG1933154
Dichlorodifluoromethane	ND		1.00	1	09/27/2022 14:15	WG1933154
Dichlorofluoromethane	ND	C3	1.00	1	09/27/2022 14:15	WG1933154
Ethyl ether	ND		1.00	1	09/27/2022 14:15	WG1933154
Ethylbenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
Hexachloro-1,3-butadiene	ND		1.00	1	09/27/2022 14:15	WG1933154
Isopropylbenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
Methyl tert-butyl ether	ND		1.00	1	09/27/2022 14:15	WG1933154
Methylene Chloride	ND		1.00	1	09/27/2022 14:15	WG1933154
Naphthalene	ND		1.00	1	09/27/2022 14:15	WG1933154
Styrene	ND		1.00	1	09/27/2022 14:15	WG1933154
Tetrachloroethene	ND		1.00	1	09/27/2022 14:15	WG1933154
Tetrahydrofuran	ND	C3	5.00	1	09/27/2022 14:15	WG1933154
Toluene	ND		1.00	1	09/27/2022 14:15	WG1933154
Trichloroethene	ND		1.00	1	09/27/2022 14:15	WG1933154
Trichlorofluoromethane	ND		1.00	1	09/27/2022 14:15	WG1933154
Vinyl chloride	ND		1.00	1	09/29/2022 14:07	WG1934357
Xylenes, Total	ND		2.00	1	09/27/2022 14:15	WG1933154

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
cis-1,2-Dichloroethene	ND		1.00	1	09/27/2022 14:15	WG1933154
cis-1,3-Dichloropropene	ND		1.00	1	09/27/2022 14:15	WG1933154
n-Butylbenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
n-Propylbenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
p-Isopropyltoluene	ND		1.00	1	09/27/2022 14:15	WG1933154
sec-Butylbenzene	ND		1.00	1	09/27/2022 14:15	WG1933154
tert-Butylbenzene	ND	C3	1.00	1	09/27/2022 14:15	WG1933154
trans-1,2-Dichloroethene	ND		1.00	1	09/27/2022 14:15	WG1933154
trans-1,3-Dichloropropene	ND		1.00	1	09/27/2022 14:15	WG1933154
(S) 4-Bromofluorobenzene	*102*			*67.0-138*	*09/27/2022 14:15*	WG1933154
(S) 4-Bromofluorobenzene	*98.9*			*67.0-138*	*09/29/2022 14:07*	WG1934357
(S) Toluene-d8	*101*			*75.0-131*	*09/27/2022 14:15*	WG1933154
(S) Toluene-d8	*103*			*75.0-131*	*09/29/2022 14:07*	WG1934357
(S) 1,2-Dichloroethane-d4	*99.4*			*70.0-130*	*09/27/2022 14:15*	WG1933154
(S) 1,2-Dichloroethane-d4	*107*			*70.0-130*	*09/29/2022 14:07*	WG1934357

Method Blank (MB)

(MB) R3841959-3 09/27/22 13:54

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
2-Chlorotoluene	ND		0.0346	0.100
4-Chlorotoluene	ND		0.0180	0.200
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl Chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	1.00
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chlorodibromomethane	ND		0.0245	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromomethane	ND		0.0300	0.200
Dichlorodifluoromethane	ND		0.0644	0.100

Method Blank (MB)

(MB) R3841959-3 09/27/22 13:54

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	1.00
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 4-Bromofluorobenzene	*101*			*67.0-138*
(S) Toluene-d8	*102*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*99.9*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3841959-1 09/27/22 11:44 • (LCSD) R3841959-2 09/27/22 12:06

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	4.31	4.46	86.2	89.2	74.0-129			3.42	20
1,1,1-Trichloroethane	5.00	4.77	4.87	95.4	97.4	69.0-126			2.07	20
1,1,2,2-Tetrachloroethane	5.00	5.18	4.94	104	98.8	68.0-128			4.74	20
1,1-Dichloroethane	5.00	4.38	3.92	87.6	78.4	70.0-127			11.1	20
1,1-Dichloroethene	5.00	5.36	5.05	107	101	65.0-131			5.96	20
1,1-Dichloropropene	5.00	4.93	4.85	98.6	97.0	73.0-125			1.64	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3841959-1 09/27/22 11:44 • (LCSD) R3841959-2 09/27/22 12:06

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,2,3-Trichlorobenzene	5.00	4.52	4.64	90.4	92.8	59.0-139			2.62	20
1,2,3-Trichloropropane	5.00	5.29	4.92	106	98.4	67.0-129			7.25	20
1,2,4-Trichlorobenzene	5.00	4.64	4.62	92.8	92.4	62.0-137			0.432	20
1,2,4-Trimethylbenzene	5.00	4.71	4.70	94.2	94.0	70.0-126			0.213	20
1,2-Dibromo-3-Chloropropane	5.00	4.52	4.65	90.4	93.0	59.0-130			2.84	20
1,2-Dibromoethane	5.00	4.78	4.88	95.6	97.6	74.0-128			2.07	20
1,2-Dichlorobenzene	5.00	4.90	4.92	98.0	98.4	76.0-124			0.407	20
1,2-Dichloroethane	5.00	4.87	4.62	97.4	92.4	65.0-131			5.27	20
1,2-Dichloropropane	5.00	4.42	4.16	88.4	83.2	74.0-125			6.06	20
1,3,5-Trimethylbenzene	5.00	4.72	4.59	94.4	91.8	73.0-127			2.79	20
1,3-Dichlorobenzene	5.00	5.30	5.09	106	102	76.0-125			4.04	20
1,3-Dichloropropane	5.00	5.16	5.03	103	101	80.0-125			2.55	20
1,4-Dichlorobenzene	5.00	5.30	5.13	106	103	77.0-121			3.26	20
2,2-Dichloropropane	5.00	5.27	5.26	105	105	59.0-135			0.190	20
2-Butanone (MEK)	25.0	23.3	27.2	93.2	109	30.0-160			15.4	24
2-Chlorotoluene	5.00	4.84	4.34	96.8	86.8	75.0-124			10.9	20
4-Chlorotoluene	5.00	4.50	4.12	90.0	82.4	75.0-124			8.82	20
4-Methyl-2-pentanone (MIBK)	25.0	25.3	26.1	101	104	56.0-143			3.11	20
Acetone	25.0	18.4	22.7	73.6	90.8	10.0-160			20.9	31
Allyl chloride	25.0	23.0	22.9	92.0	91.6	70.0-131			0.436	20
Benzene	5.00	5.32	5.34	106	107	70.0-123			0.375	20
Bromobenzene	5.00	5.07	5.19	101	104	73.0-121			2.34	20
Bromochloromethane	5.00	4.89	4.61	97.8	92.2	77.0-128			5.89	20
Bromodichloromethane	5.00	4.52	4.52	90.4	90.4	73.0-121			0.000	20
Bromoform	5.00	5.25	5.03	105	101	64.0-132			4.28	20
Bromomethane	5.00	2.88	2.94	57.6	58.8	56.0-147			2.06	20
Carbon tetrachloride	5.00	5.03	4.82	101	96.4	66.0-128			4.26	20
Chlorobenzene	5.00	4.97	4.97	99.4	99.4	76.0-128			0.000	20
Chlorodibromomethane	5.00	4.56	4.87	91.2	97.4	74.0-127			6.57	20
Chloroethane	5.00	4.28	4.07	85.6	81.4	61.0-134			5.03	20
Chloroform	5.00	4.50	4.36	90.0	87.2	72.0-123			3.16	20
Chloromethane	5.00	5.28	5.36	106	107	51.0-138			1.50	20
Dibromomethane	5.00	4.48	4.55	89.6	91.0	75.0-122			1.55	20
Dichlorodifluoromethane	5.00	4.49	4.62	89.8	92.4	43.0-156			2.85	20
Dichlorofluoromethane	5.00	3.40	3.64	68.0	72.8	65.0-137			6.82	20
Ethyl ether	5.00	5.63	5.13	113	103	64.0-137			9.29	20
Ethylbenzene	5.00	4.80	4.73	96.0	94.6	74.0-126			1.47	20
Hexachloro-1,3-butadiene	5.00	5.75	5.77	115	115	57.0-150			0.347	20
Isopropylbenzene	5.00	4.70	4.62	94.0	92.4	72.0-127			1.72	20
Methyl tert-butyl ether	5.00	4.69	5.05	93.8	101	66.0-132			7.39	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3841959-1 09/27/22 11:44 • (LCSD) R3841959-2 09/27/22 12:06

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Methylene Chloride	5.00	4.33	4.32	86.6	86.4	68.0-123			0.231	20
Naphthalene	5.00	4.39	4.44	87.8	88.8	59.0-130			1.13	20
Styrene	5.00	5.45	5.05	109	101	72.0-127			7.62	20
Tetrachloroethene	5.00	4.42	4.60	88.4	92.0	70.0-136			3.99	20
Tetrahydrofuran	5.00	3.68	4.26	73.6	85.2	37.0-146			14.6	24
Toluene	5.00	5.16	5.16	103	103	75.0-121			0.000	20
Trichloroethene	5.00	4.79	4.97	95.8	99.4	76.0-126			3.69	20
Trichlorofluoromethane	5.00	4.73	4.75	94.6	95.0	61.0-142			0.422	20
Xylenes, Total	15.0	14.5	14.7	96.7	98.0	72.0-127			1.37	20
cis-1,2-Dichloroethene	5.00	4.67	4.46	93.4	89.2	73.0-125			4.60	20
cis-1,3-Dichloropropene	5.00	4.81	4.68	96.2	93.6	76.0-127			2.74	20
n-Butylbenzene	5.00	5.15	5.07	103	101	68.0-135			1.57	20
n-Propylbenzene	5.00	5.01	4.85	100	97.0	74.0-126			3.25	20
p-Isopropyltoluene	5.00	4.86	4.77	97.2	95.4	72.0-133			1.87	20
sec-Butylbenzene	5.00	5.00	5.12	100	102	74.0-130			2.37	20
tert-Butylbenzene	5.00	3.89	3.76	77.8	75.2	75.0-127			3.40	20
trans-1,2-Dichloroethene	5.00	4.56	4.30	91.2	86.0	71.0-125			5.87	20
trans-1,3-Dichloropropene	5.00	4.77	4.91	95.4	98.2	73.0-127			2.89	20
(S) 4-Bromofluorobenzene				*104*	*103*	*67.0-138*				
(S) Toluene-d8				*97.3*	*102*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*96.5*	*95.3*	*70.0-130*				

Method Blank (MB)

(MB) R3842978-3 09/29/22 09:05

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Vinyl chloride	ND		0.0462	0.0500
(S) 4-Bromofluorobenzene	*92.3*			*67.0-138*
(S) Toluene-d8	*100*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3842978-1 09/29/22 08:02 • (LCSD) R3842978-2 09/29/22 08:23

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Vinyl chloride	5.00	4.53	4.78	90.6	95.6	63.0-134			5.37	20
(S) 4-Bromofluorobenzene				*101*	*100*	*67.0-138*				
(S) Toluene-d8				*105*	*102*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*109*	*105*	*70.0-130*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Andrea Nord

Email To:
anord@barr.com;datamgt@barr.com;jeidem@b

Project Description:
Elk River Landfill Residential Well

City/State Collected:

Please Circle:
PT MT CT ET

Phone: 952-832-2893

Client Project #
900

Lab Project #
WMELKRIVMN-RESIDENT

Collected by (print):
Kevin McGilp

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
X Three Day

Quote #

Date Results Needed

No. of Cntrs

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	VB260 40mlAmb-HCl Elk River Landfill RLS	VB260 40mlAmb-HCl-Blk Elk River Landfill RLS
#876410	Grab	GW		9.21.22	11:50	3	X	
TRIP BLANK	QC	GW				1		X

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other

Remarks: 12269 223rd St.

pH ____ Temp ____
Flow ____ Other ____

Samples returned via:
__ UPS X FedEx __ Courier

Tracking # 5982 7541 8741 (NM)

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	9.21.22	15:30	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: (Yes / No) HCl / MeoH TBR
1

Temp: 2.8 °C Bottles Received:
3.0 + 0 = 3.0 3

Date: 9-22-22 Time: 0900

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles Arrive Intact: Y N
Correct Bottles Used: Y N
Sufficient Volume Sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Chain of Custody Page 1 of 1

Pace
MT JULIET, TN

SDG # L1538364
E051

Acctnum: WMELKRIVMN
Template: T212305
Prelogin: P936230
PM: 364 - T. Alan Harvill
PB: 9/22/22

Shipped Via: FedEX Ground

Remarks | Sample # (lab only)

ANALYTICAL REPORT

September 30, 2022

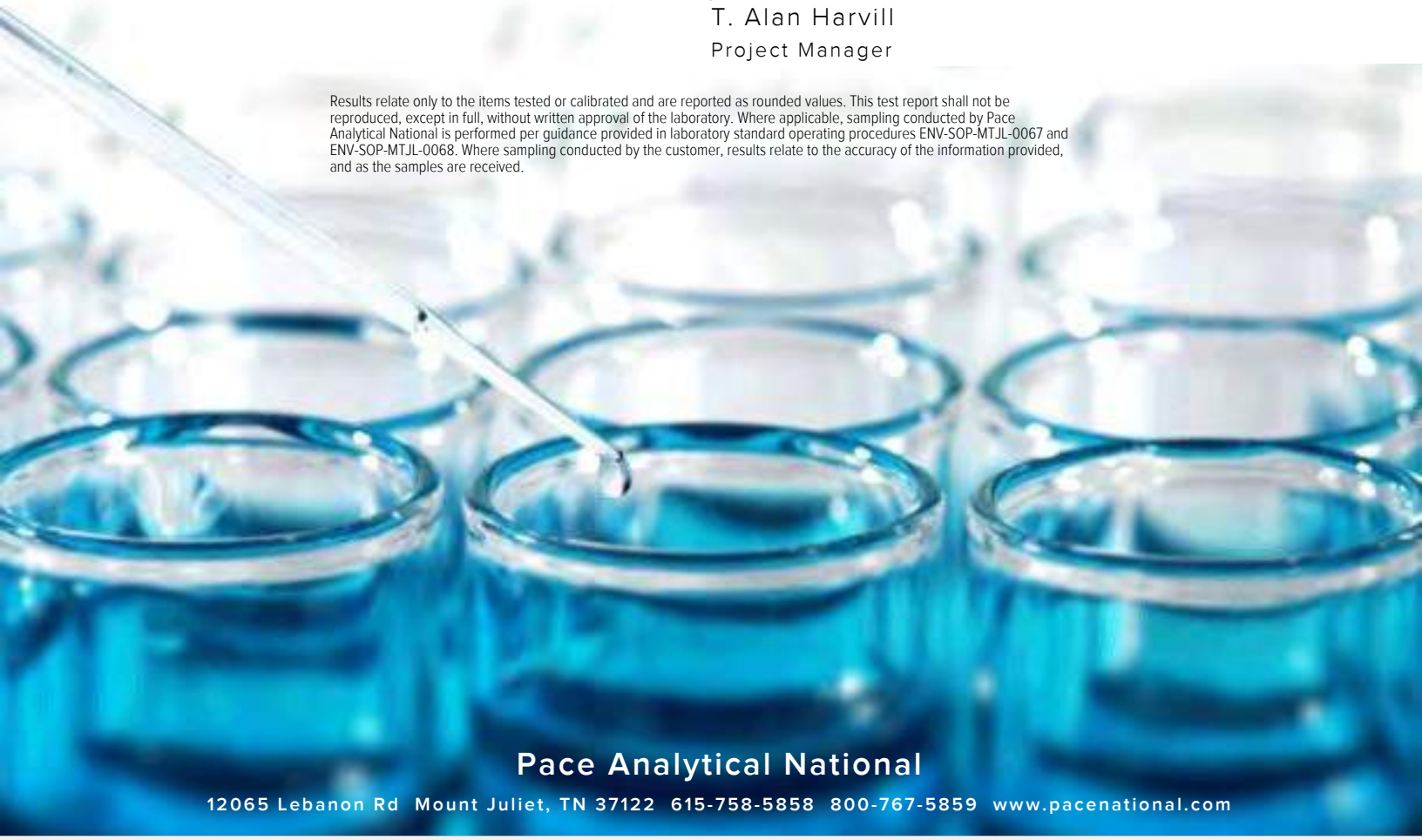
Elk River Landfill

Sample Delivery Group:	L1539899
Samples Received:	09/27/2022
Project Number:	900
Description:	Elk River Landfill Residential Well
Site:	MN02
Report To:	Andrea Nord 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

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SAMPLE SUMMARY

876411 L1539899-01 GW

Collected by: DP
Collected date/time: 09/26/22 12:55
Received date/time: 09/27/22 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1934751	1	09/30/22 03:07	09/30/22 03:07	ADM	Mt. Juliet, TN

TRIP BLANK L1539899-02 GW

Collected by: DP
Collected date/time: 09/26/22 00:00
Received date/time: 09/27/22 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1934751	1	09/30/22 01:52	09/30/22 01:52	ADM	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG1934751	L1539899-01	2,2-Dichloropropane, 2-Butanone (MEK), Bromomethane and Trichlorofluoromethane
WG1934751	L1539899-02	2,2-Dichloropropane, 2-Butanone (MEK), Bromomethane and Trichlorofluoromethane

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1934751	(LCSD) R3843440-3, L1539899-01, 02	Trichlorofluoromethane

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	09/30/2022 03:07	WG1934751
1,1,1-Trichloroethane	ND		1.00	1	09/30/2022 03:07	WG1934751
1,1,2,2-Tetrachloroethane	ND		1.00	1	09/30/2022 03:07	WG1934751
1,1-Dichloroethane	ND		1.00	1	09/30/2022 03:07	WG1934751
1,1-Dichloroethene	ND		1.00	1	09/30/2022 03:07	WG1934751
1,1-Dichloropropene	ND		1.00	1	09/30/2022 03:07	WG1934751
1,2,3-Trichlorobenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
1,2,3-Trichloropropane	ND		1.00	1	09/30/2022 03:07	WG1934751
1,2,4-Trichlorobenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
1,2,4-Trimethylbenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
1,2-Dibromo-3-Chloropropane	ND		1.00	1	09/30/2022 03:07	WG1934751
1,2-Dibromoethane	ND		1.00	1	09/30/2022 03:07	WG1934751
1,2-Dichlorobenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
1,2-Dichloroethane	ND		1.00	1	09/30/2022 03:07	WG1934751
1,2-Dichloropropane	ND		1.00	1	09/30/2022 03:07	WG1934751
1,3,5-Trimethylbenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
1,3-Dichlorobenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
1,3-Dichloropropane	ND		1.00	1	09/30/2022 03:07	WG1934751
1,4-Dichlorobenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
2,2-Dichloropropane	ND	C3	1.00	1	09/30/2022 03:07	WG1934751
2-Butanone (MEK)	ND	C3	10.0	1	09/30/2022 03:07	WG1934751
2-Chlorotoluene	ND		1.00	1	09/30/2022 03:07	WG1934751
4-Chlorotoluene	ND		1.00	1	09/30/2022 03:07	WG1934751
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	09/30/2022 03:07	WG1934751
Acetone	ND		10.0	1	09/30/2022 03:07	WG1934751
Allyl chloride	ND		1.00	1	09/30/2022 03:07	WG1934751
Benzene	ND		1.00	1	09/30/2022 03:07	WG1934751
Bromobenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
Bromochloromethane	ND		1.00	1	09/30/2022 03:07	WG1934751
Bromodichloromethane	ND		1.00	1	09/30/2022 03:07	WG1934751
Bromoform	ND		1.00	1	09/30/2022 03:07	WG1934751
Bromomethane	ND	C3	1.00	1	09/30/2022 03:07	WG1934751
Carbon tetrachloride	ND		1.00	1	09/30/2022 03:07	WG1934751
Chlorobenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
Chlorodibromomethane	ND		1.00	1	09/30/2022 03:07	WG1934751
Chloroethane	ND		1.00	1	09/30/2022 03:07	WG1934751
Chloroform	ND		1.00	1	09/30/2022 03:07	WG1934751
Chloromethane	ND		1.00	1	09/30/2022 03:07	WG1934751
Dibromomethane	ND		1.00	1	09/30/2022 03:07	WG1934751
Dichlorodifluoromethane	ND		1.00	1	09/30/2022 03:07	WG1934751
Dichlorofluoromethane	ND		1.00	1	09/30/2022 03:07	WG1934751
Ethyl ether	ND		1.00	1	09/30/2022 03:07	WG1934751
Ethylbenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
Hexachloro-1,3-butadiene	ND		1.00	1	09/30/2022 03:07	WG1934751
Isopropylbenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
Methyl tert-butyl ether	ND		1.00	1	09/30/2022 03:07	WG1934751
Methylene Chloride	ND		1.00	1	09/30/2022 03:07	WG1934751
Naphthalene	ND		1.00	1	09/30/2022 03:07	WG1934751
Styrene	ND		1.00	1	09/30/2022 03:07	WG1934751
Tetrachloroethene	ND		1.00	1	09/30/2022 03:07	WG1934751
Tetrahydrofuran	ND		5.00	1	09/30/2022 03:07	WG1934751
Toluene	ND		1.00	1	09/30/2022 03:07	WG1934751
Trichloroethene	ND		1.00	1	09/30/2022 03:07	WG1934751
Trichlorofluoromethane	ND	C3 J3	1.00	1	09/30/2022 03:07	WG1934751
Vinyl chloride	ND		1.00	1	09/30/2022 03:07	WG1934751
Xylenes, Total	ND		2.00	1	09/30/2022 03:07	WG1934751

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
cis-1,2-Dichloroethene	ND		1.00	1	09/30/2022 03:07	WG1934751
cis-1,3-Dichloropropene	ND		1.00	1	09/30/2022 03:07	WG1934751
n-Butylbenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
n-Propylbenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
p-Isopropyltoluene	ND		1.00	1	09/30/2022 03:07	WG1934751
sec-Butylbenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
tert-Butylbenzene	ND		1.00	1	09/30/2022 03:07	WG1934751
trans-1,2-Dichloroethene	ND		1.00	1	09/30/2022 03:07	WG1934751
trans-1,3-Dichloropropene	ND		1.00	1	09/30/2022 03:07	WG1934751
(S) 4-Bromofluorobenzene	*96.8*			*67.0-138*	*09/30/2022 03:07*	WG1934751
(S) Toluene-d8	*101*			*75.0-131*	*09/30/2022 03:07*	WG1934751
(S) 1,2-Dichloroethane-d4	*90.7*			*70.0-130*	*09/30/2022 03:07*	WG1934751

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	09/30/2022 01:52	WG1934751
1,1,1-Trichloroethane	ND		1.00	1	09/30/2022 01:52	WG1934751
1,1,2,2-Tetrachloroethane	ND		1.00	1	09/30/2022 01:52	WG1934751
1,1-Dichloroethane	ND		1.00	1	09/30/2022 01:52	WG1934751
1,1-Dichloroethene	ND		1.00	1	09/30/2022 01:52	WG1934751
1,1-Dichloropropene	ND		1.00	1	09/30/2022 01:52	WG1934751
1,2,3-Trichlorobenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
1,2,3-Trichloropropane	ND		1.00	1	09/30/2022 01:52	WG1934751
1,2,4-Trichlorobenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
1,2,4-Trimethylbenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
1,2-Dibromo-3-Chloropropane	ND		1.00	1	09/30/2022 01:52	WG1934751
1,2-Dibromoethane	ND		1.00	1	09/30/2022 01:52	WG1934751
1,2-Dichlorobenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
1,2-Dichloroethane	ND		1.00	1	09/30/2022 01:52	WG1934751
1,2-Dichloropropane	ND		1.00	1	09/30/2022 01:52	WG1934751
1,3,5-Trimethylbenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
1,3-Dichlorobenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
1,3-Dichloropropane	ND		1.00	1	09/30/2022 01:52	WG1934751
1,4-Dichlorobenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
2,2-Dichloropropane	ND	C3	1.00	1	09/30/2022 01:52	WG1934751
2-Butanone (MEK)	ND	C3	10.0	1	09/30/2022 01:52	WG1934751
2-Chlorotoluene	ND		1.00	1	09/30/2022 01:52	WG1934751
4-Chlorotoluene	ND		1.00	1	09/30/2022 01:52	WG1934751
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	09/30/2022 01:52	WG1934751
Acetone	ND		10.0	1	09/30/2022 01:52	WG1934751
Allyl chloride	ND		1.00	1	09/30/2022 01:52	WG1934751
Benzene	ND		1.00	1	09/30/2022 01:52	WG1934751
Bromobenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
Bromochloromethane	ND		1.00	1	09/30/2022 01:52	WG1934751
Bromodichloromethane	ND		1.00	1	09/30/2022 01:52	WG1934751
Bromoform	ND		1.00	1	09/30/2022 01:52	WG1934751
Bromomethane	ND	C3	1.00	1	09/30/2022 01:52	WG1934751
Carbon tetrachloride	ND		1.00	1	09/30/2022 01:52	WG1934751
Chlorobenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
Chlorodibromomethane	ND		1.00	1	09/30/2022 01:52	WG1934751
Chloroethane	ND		1.00	1	09/30/2022 01:52	WG1934751
Chloroform	ND		1.00	1	09/30/2022 01:52	WG1934751
Chloromethane	ND		1.00	1	09/30/2022 01:52	WG1934751
Dibromomethane	ND		1.00	1	09/30/2022 01:52	WG1934751
Dichlorodifluoromethane	ND		1.00	1	09/30/2022 01:52	WG1934751
Dichlorofluoromethane	ND		1.00	1	09/30/2022 01:52	WG1934751
Ethyl ether	ND		1.00	1	09/30/2022 01:52	WG1934751
Ethylbenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
Hexachloro-1,3-butadiene	ND		1.00	1	09/30/2022 01:52	WG1934751
Isopropylbenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
Methyl tert-butyl ether	ND		1.00	1	09/30/2022 01:52	WG1934751
Methylene Chloride	ND		1.00	1	09/30/2022 01:52	WG1934751
Naphthalene	ND		1.00	1	09/30/2022 01:52	WG1934751
Styrene	ND		1.00	1	09/30/2022 01:52	WG1934751
Tetrachloroethene	ND		1.00	1	09/30/2022 01:52	WG1934751
Tetrahydrofuran	ND		5.00	1	09/30/2022 01:52	WG1934751
Toluene	ND		1.00	1	09/30/2022 01:52	WG1934751
Trichloroethene	ND		1.00	1	09/30/2022 01:52	WG1934751
Trichlorofluoromethane	ND	C3 J3	1.00	1	09/30/2022 01:52	WG1934751
Vinyl chloride	ND		1.00	1	09/30/2022 01:52	WG1934751
Xylenes, Total	ND		2.00	1	09/30/2022 01:52	WG1934751

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
cis-1,2-Dichloroethene	ND		1.00	1	09/30/2022 01:52	WG1934751
cis-1,3-Dichloropropene	ND		1.00	1	09/30/2022 01:52	WG1934751
n-Butylbenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
n-Propylbenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
p-Isopropyltoluene	ND		1.00	1	09/30/2022 01:52	WG1934751
sec-Butylbenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
tert-Butylbenzene	ND		1.00	1	09/30/2022 01:52	WG1934751
trans-1,2-Dichloroethene	ND		1.00	1	09/30/2022 01:52	WG1934751
trans-1,3-Dichloropropene	ND		1.00	1	09/30/2022 01:52	WG1934751
(S) 4-Bromofluorobenzene	*99.7*			*67.0-138*	*09/30/2022 01:52*	WG1934751
(S) Toluene-d8	*101*			*75.0-131*	*09/30/2022 01:52*	WG1934751
(S) 1,2-Dichloroethane-d4	*89.9*			*70.0-130*	*09/30/2022 01:52*	WG1934751

Method Blank (MB)

(MB) R3843440-2 09/30/22 01:34

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
2-Chlorotoluene	ND		0.0346	0.100
4-Chlorotoluene	ND		0.0180	0.200
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl Chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	1.00
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chlorodibromomethane	ND		0.0245	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromomethane	ND		0.0300	0.200
Dichlorodifluoromethane	ND		0.0644	0.100

Method Blank (MB)

(MB) R3843440-2 09/30/22 01:34

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	1.00
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Vinyl chloride	ND		0.0462	0.0500
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 4-Bromofluorobenzene	*100*			*67.0-138*
(S) Toluene-d8	*103*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*87.4*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3843440-1 09/30/22 00:38 • (LCSD) R3843440-3 09/30/22 09:03

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	4.31	4.22	86.2	84.4	74.0-129			2.11	20
1,1,1-Trichloroethane	5.00	4.50	4.58	90.0	91.6	69.0-126			1.76	20
1,1,2,2-Tetrachloroethane	5.00	5.01	4.60	100	92.0	68.0-128			8.53	20
1,1-Dichloroethane	5.00	4.96	4.80	99.2	96.0	70.0-127			3.28	20
1,1-Dichloroethene	5.00	4.85	5.03	97.0	101	65.0-131			3.64	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3843440-1 09/30/22 00:38 • (LCSD) R3843440-3 09/30/22 09:03

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1-Dichloropropene	5.00	4.96	4.94	99.2	98.8	73.0-125			0.404	20
1,2,3-Trichlorobenzene	5.00	5.22	4.34	104	86.8	59.0-139			18.4	20
1,2,3-Trichloropropane	5.00	5.00	4.43	100	88.6	67.0-129			12.1	20
1,2,4-Trichlorobenzene	5.00	4.74	4.28	94.8	85.6	62.0-137			10.2	20
1,2,4-Trimethylbenzene	5.00	4.56	4.48	91.2	89.6	70.0-126			1.77	20
1,2-Dibromo-3-Chloropropane	5.00	5.18	4.68	104	93.6	59.0-130			10.1	20
1,2-Dibromoethane	5.00	5.07	4.75	101	95.0	74.0-128			6.52	20
1,2-Dichlorobenzene	5.00	4.43	4.79	88.6	95.8	76.0-124			7.81	20
1,2-Dichloroethane	5.00	4.21	4.45	84.2	89.0	65.0-131			5.54	20
1,2-Dichloropropane	5.00	4.64	4.76	92.8	95.2	74.0-125			2.55	20
1,3,5-Trimethylbenzene	5.00	4.75	4.63	95.0	92.6	73.0-127			2.56	20
1,3-Dichlorobenzene	5.00	4.57	4.69	91.4	93.8	76.0-125			2.59	20
1,3-Dichloropropane	5.00	5.28	4.99	106	99.8	80.0-125			5.65	20
1,4-Dichlorobenzene	5.00	4.51	4.61	90.2	92.2	77.0-121			2.19	20
2,2-Dichloropropane	5.00	3.83	3.92	76.6	78.4	59.0-135			2.32	20
2-Butanone (MEK)	25.0	23.7	21.3	94.8	85.2	30.0-160			10.7	24
2-Chlorotoluene	5.00	4.92	5.00	98.4	100	75.0-124			1.61	20
4-Chlorotoluene	5.00	4.92	4.97	98.4	99.4	75.0-124			1.01	20
4-Methyl-2-pentanone (MIBK)	25.0	24.8	24.4	99.2	97.6	56.0-143			1.63	20
Acetone	25.0	27.7	28.8	111	115	10.0-160			3.89	31
Allyl chloride	25.0	26.7	25.5	107	102	70.0-131			4.60	20
Benzene	5.00	5.10	5.06	102	101	70.0-123			0.787	20
Bromobenzene	5.00	4.93	5.10	98.6	102	73.0-121			3.39	20
Bromochloromethane	5.00	5.44	5.00	109	100	77.0-128			8.43	20
Bromodichloromethane	5.00	4.78	4.49	95.6	89.8	73.0-121			6.26	20
Bromoform	5.00	5.53	5.45	111	109	64.0-132			1.46	20
Bromomethane	5.00	3.64	3.48	72.8	69.6	56.0-147			4.49	20
Carbon tetrachloride	5.00	4.33	4.47	86.6	89.4	66.0-128			3.18	20
Chlorobenzene	5.00	4.74	4.65	94.8	93.0	76.0-128			1.92	20
Chlorodibromomethane	5.00	5.05	4.81	101	96.2	74.0-127			4.87	20
Chloroethane	5.00	4.45	4.32	89.0	86.4	61.0-134			2.96	20
Chloroform	5.00	4.35	4.50	87.0	90.0	72.0-123			3.39	20
Chloromethane	5.00	4.24	4.52	84.8	90.4	51.0-138			6.39	20
Dibromomethane	5.00	4.88	5.12	97.6	102	75.0-122			4.80	20
Dichlorodifluoromethane	5.00	4.40	4.90	88.0	98.0	43.0-156			10.8	20
Dichlorofluoromethane	5.00	4.23	4.46	84.6	89.2	65.0-137			5.29	20
Ethyl ether	5.00	4.60	4.96	92.0	99.2	64.0-137			7.53	20
Ethylbenzene	5.00	4.78	4.59	95.6	91.8	74.0-126			4.06	20
Hexachloro-1,3-butadiene	5.00	5.06	4.62	101	92.4	57.0-150			9.09	20
Isopropylbenzene	5.00	4.56	4.40	91.2	88.0	72.0-127			3.57	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3843440-1 09/30/22 00:38 • (LCSD) R3843440-3 09/30/22 09:03

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Methyl tert-butyl ether	5.00	4.50	4.61	90.0	92.2	66.0-132			2.41	20
Methylene Chloride	5.00	5.18	5.19	104	104	68.0-123			0.193	20
Naphthalene	5.00	5.79	5.03	116	101	59.0-130			14.0	20
Styrene	5.00	4.56	4.34	91.2	86.8	72.0-127			4.94	20
Tetrachloroethene	5.00	4.48	4.42	89.6	88.4	70.0-136			1.35	20
Tetrahydrofuran	5.00	4.52	5.20	90.4	104	37.0-146			14.0	24
Toluene	5.00	4.62	4.58	92.4	91.6	75.0-121			0.870	20
Trichloroethene	5.00	4.69	4.99	93.8	99.8	76.0-126			6.20	20
Trichlorofluoromethane	5.00	3.54	4.36	70.8	87.2	61.0-142		J3	20.8	20
Vinyl chloride	5.00	5.07	4.89	101	97.8	63.0-134			3.61	20
Xylenes, Total	15.0	14.1	14.0	94.0	93.3	72.0-127			0.712	20
cis-1,2-Dichloroethene	5.00	5.04	5.11	101	102	73.0-125			1.38	20
cis-1,3-Dichloropropene	5.00	4.76	4.56	95.2	91.2	76.0-127			4.29	20
n-Butylbenzene	5.00	4.44	4.48	88.8	89.6	68.0-135			0.897	20
n-Propylbenzene	5.00	4.80	4.79	96.0	95.8	74.0-126			0.209	20
p-Isopropyltoluene	5.00	4.60	4.70	92.0	94.0	72.0-133			2.15	20
sec-Butylbenzene	5.00	4.57	4.58	91.4	91.6	74.0-130			0.219	20
tert-Butylbenzene	5.00	4.92	4.77	98.4	95.4	75.0-127			3.10	20
trans-1,2-Dichloroethene	5.00	4.76	4.32	95.2	86.4	71.0-125			9.69	20
trans-1,3-Dichloropropene	5.00	4.98	4.76	99.6	95.2	73.0-127			4.52	20
(S) 4-Bromofluorobenzene				*99.6*	*104*	*67.0-138*				
(S) Toluene-d8				*101*	*99.6*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*87.9*	*101*	*70.0-130*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
J3	The associated batch QC was outside the established quality control range for precision.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Andrea Nord

Email To:
anord@barr.com;datamgt@barr.com;jeidem@b

Project Description:
Elk River Landfill Residential Well

City/State Collected:

Please Circle: PT MT CT ET

Phone: 952-832-2893

Client Project #
900

Lab Project #
WMELKRIVMN-RESIDENT

Collected by (print):
DAM 2

Site/Facility ID #
MN02

P.O. #
2371405.22

Quote #

Collected by (signature):

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
X Three Day

Date Results Needed

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	V8260ULLC 40mlAmb-HCl	V8260ULLC 40mlAmb-HCl-Blk												
876411	grab	GW		9.26.22	12:55	3	X													-01
TRIP BLANK		GW				1		X												-02

Analysis / Container / Preservative

Chain of Custody Page 1 of 1

Pace
MT JULIET, TN

SDG # L1539899
A124

Acctnum: WMELKRIVMN
Template: T212305
Prelogin: P936227
PM: 364 - T. Alan Harvill
PB: 9/28/22
Shipped Via: FedEx Ground

Remarks | Sample # (lab only)

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other ____

Remarks: 12265 223rd street

pH ____ Temp ____
Flow ____ Other ____

Samples returned via:
__ UPS X FedEx __ Courier ____

Tracking # 5910 0138 6400

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen: <0.5 mR/hr Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	9/26/22	14:00	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	9/26/22	1400	
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes No HCl MeoH TBR
1

Temp 0.4°C Bottles Received: 3
0.4 to 0.4

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Date: 9/27/22 Time: 900

ANALYTICAL REPORT

October 07, 2022

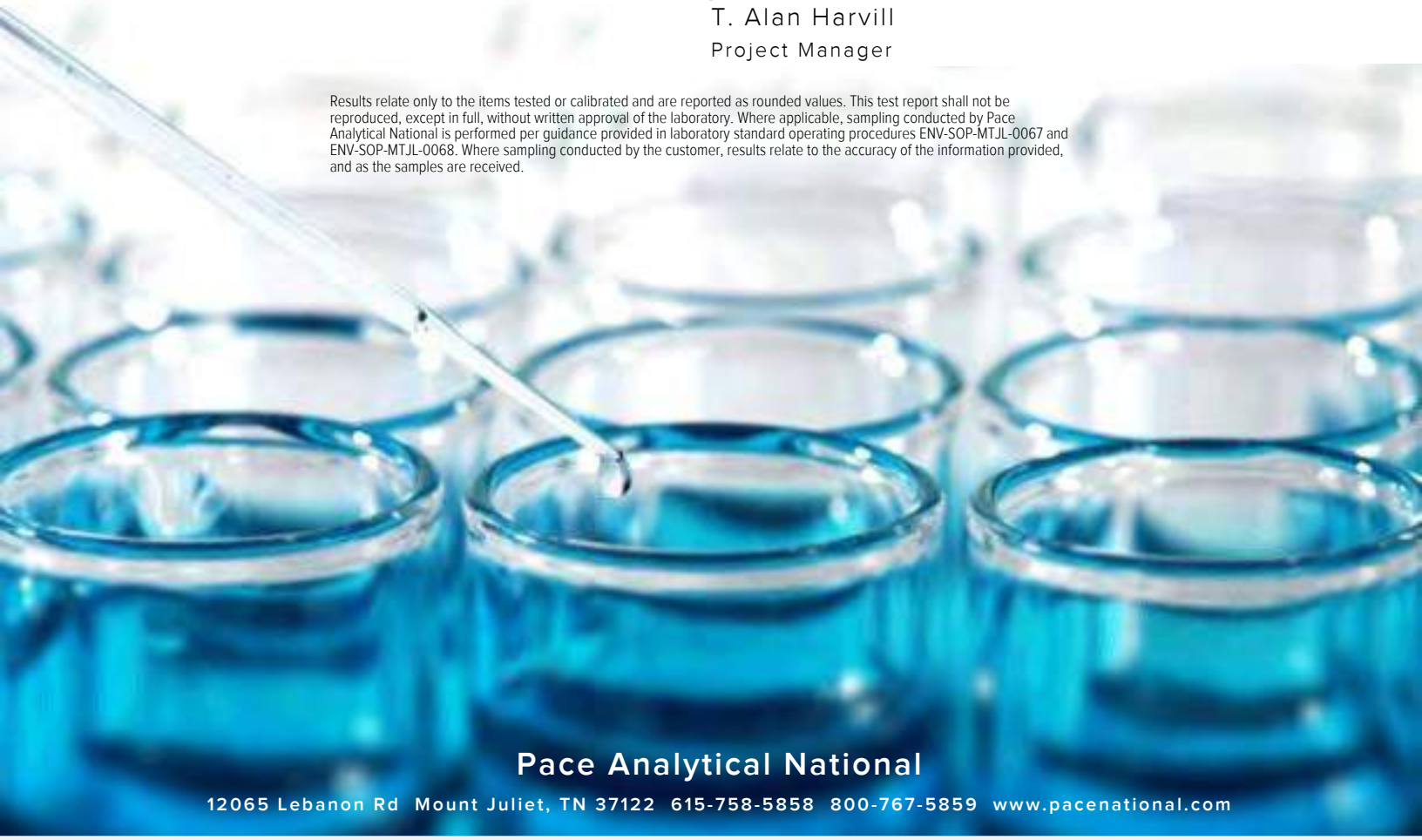
Elk River Landfill

Sample Delivery Group:	L1541347
Samples Received:	09/30/2022
Project Number:	900
Description:	Elk River Landfill Residential Well
Site:	MN02
Report To:	Andrea Nord 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

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TRIP BLANK L1541347-02 7

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SAMPLE SUMMARY

876412 L1541347-01 GW

Collected by | Collected date/time 09/29/22 12:15 | Received date/time 09/30/22 10:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1936825	1	10/06/22 17:43	10/06/22 17:43	JHH	Mt. Juliet, TN

TRIP BLANK L1541347-02 GW

Collected by | Collected date/time 09/29/22 00:00 | Received date/time 09/30/22 10:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1936825	1	10/06/22 11:03	10/06/22 11:03	JHH	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Data is likely to show a low bias concerning the result.

Batch	Lab Sample ID	Analytes
WG1936825	L1541347-01	1,2,3-Trichlorobenzene and 1,2,4-Trichlorobenzene
WG1936825	L1541347-02	1,2,3-Trichlorobenzene and 1,2,4-Trichlorobenzene

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG1936825	L1541347-01	Acetone and Tetrahydrofuran

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	10/06/2022 17:43	WG1936825
1,1,1-Trichloroethane	ND		1.00	1	10/06/2022 17:43	WG1936825
1,1,2,2-Tetrachloroethane	ND		1.00	1	10/06/2022 17:43	WG1936825
1,1-Dichloroethane	ND		1.00	1	10/06/2022 17:43	WG1936825
1,1-Dichloroethene	ND		1.00	1	10/06/2022 17:43	WG1936825
1,1-Dichloropropene	ND		1.00	1	10/06/2022 17:43	WG1936825
1,2,3-Trichlorobenzene	ND	C4	1.00	1	10/06/2022 17:43	WG1936825
1,2,3-Trichloropropane	ND		1.00	1	10/06/2022 17:43	WG1936825
1,2,4-Trichlorobenzene	ND	C4	1.00	1	10/06/2022 17:43	WG1936825
1,2,4-Trimethylbenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
1,2-Dibromo-3-Chloropropane	ND		1.00	1	10/06/2022 17:43	WG1936825
1,2-Dibromoethane	ND		1.00	1	10/06/2022 17:43	WG1936825
1,2-Dichlorobenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
1,2-Dichloroethane	ND		1.00	1	10/06/2022 17:43	WG1936825
1,2-Dichloropropane	ND		1.00	1	10/06/2022 17:43	WG1936825
1,3,5-Trimethylbenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
1,3-Dichlorobenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
1,3-Dichloropropane	ND		1.00	1	10/06/2022 17:43	WG1936825
1,4-Dichlorobenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
2,2-Dichloropropane	ND		1.00	1	10/06/2022 17:43	WG1936825
2-Butanone (MEK)	ND		10.0	1	10/06/2022 17:43	WG1936825
2-Chlorotoluene	ND		1.00	1	10/06/2022 17:43	WG1936825
4-Chlorotoluene	ND		1.00	1	10/06/2022 17:43	WG1936825
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	10/06/2022 17:43	WG1936825
Acetone	ND	C3	10.0	1	10/06/2022 17:43	WG1936825
Allyl chloride	ND		1.00	1	10/06/2022 17:43	WG1936825
Benzene	ND		1.00	1	10/06/2022 17:43	WG1936825
Bromobenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
Bromochloromethane	ND		1.00	1	10/06/2022 17:43	WG1936825
Bromodichloromethane	ND		1.00	1	10/06/2022 17:43	WG1936825
Bromoform	ND		1.00	1	10/06/2022 17:43	WG1936825
Bromomethane	ND		1.00	1	10/06/2022 17:43	WG1936825
Carbon tetrachloride	ND		1.00	1	10/06/2022 17:43	WG1936825
Chlorobenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
Chlorodibromomethane	ND		1.00	1	10/06/2022 17:43	WG1936825
Chloroethane	ND		1.00	1	10/06/2022 17:43	WG1936825
Chloroform	ND		1.00	1	10/06/2022 17:43	WG1936825
Chloromethane	ND		1.00	1	10/06/2022 17:43	WG1936825
Dibromomethane	ND		1.00	1	10/06/2022 17:43	WG1936825
Dichlorodifluoromethane	ND		1.00	1	10/06/2022 17:43	WG1936825
Dichlorofluoromethane	ND		1.00	1	10/06/2022 17:43	WG1936825
Ethyl ether	ND		1.00	1	10/06/2022 17:43	WG1936825
Ethylbenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
Hexachloro-1,3-butadiene	ND		1.00	1	10/06/2022 17:43	WG1936825
Isopropylbenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
Methyl tert-butyl ether	ND		1.00	1	10/06/2022 17:43	WG1936825
Methylene Chloride	ND		1.00	1	10/06/2022 17:43	WG1936825
Naphthalene	ND		1.00	1	10/06/2022 17:43	WG1936825
Styrene	ND		1.00	1	10/06/2022 17:43	WG1936825
Tetrachloroethene	ND		1.00	1	10/06/2022 17:43	WG1936825
Tetrahydrofuran	ND	C3	5.00	1	10/06/2022 17:43	WG1936825
Toluene	ND		1.00	1	10/06/2022 17:43	WG1936825
Trichloroethene	ND		1.00	1	10/06/2022 17:43	WG1936825
Trichlorofluoromethane	ND		1.00	1	10/06/2022 17:43	WG1936825
Vinyl chloride	ND		1.00	1	10/06/2022 17:43	WG1936825
Xylenes, Total	ND		2.00	1	10/06/2022 17:43	WG1936825

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
cis-1,2-Dichloroethene	ND		1.00	1	10/06/2022 17:43	WG1936825
cis-1,3-Dichloropropene	ND		1.00	1	10/06/2022 17:43	WG1936825
n-Butylbenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
n-Propylbenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
p-Isopropyltoluene	ND		1.00	1	10/06/2022 17:43	WG1936825
sec-Butylbenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
tert-Butylbenzene	ND		1.00	1	10/06/2022 17:43	WG1936825
trans-1,2-Dichloroethene	ND		1.00	1	10/06/2022 17:43	WG1936825
trans-1,3-Dichloropropene	ND		1.00	1	10/06/2022 17:43	WG1936825
(S) 4-Bromofluorobenzene	*99.1*			*67.0-138*	*10/06/2022 17:43*	WG1936825
(S) Toluene-d8	*109*			*75.0-131*	*10/06/2022 17:43*	WG1936825
(S) 1,2-Dichloroethane-d4	*103*			*70.0-130*	*10/06/2022 17:43*	WG1936825

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	10/06/2022 11:03	WG1936825
1,1,1-Trichloroethane	ND		1.00	1	10/06/2022 11:03	WG1936825
1,1,2,2-Tetrachloroethane	ND		1.00	1	10/06/2022 11:03	WG1936825
1,1-Dichloroethane	ND		1.00	1	10/06/2022 11:03	WG1936825
1,1-Dichloroethene	ND		1.00	1	10/06/2022 11:03	WG1936825
1,1-Dichloropropene	ND		1.00	1	10/06/2022 11:03	WG1936825
1,2,3-Trichlorobenzene	ND	C4	1.00	1	10/06/2022 11:03	WG1936825
1,2,3-Trichloropropane	ND		1.00	1	10/06/2022 11:03	WG1936825
1,2,4-Trichlorobenzene	ND	C4	1.00	1	10/06/2022 11:03	WG1936825
1,2,4-Trimethylbenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
1,2-Dibromo-3-Chloropropane	ND		1.00	1	10/06/2022 11:03	WG1936825
1,2-Dibromoethane	ND		1.00	1	10/06/2022 11:03	WG1936825
1,2-Dichlorobenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
1,2-Dichloroethane	ND		1.00	1	10/06/2022 11:03	WG1936825
1,2-Dichloropropane	ND		1.00	1	10/06/2022 11:03	WG1936825
1,3,5-Trimethylbenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
1,3-Dichlorobenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
1,3-Dichloropropane	ND		1.00	1	10/06/2022 11:03	WG1936825
1,4-Dichlorobenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
2,2-Dichloropropane	ND		1.00	1	10/06/2022 11:03	WG1936825
2-Butanone (MEK)	ND		10.0	1	10/06/2022 11:03	WG1936825
2-Chlorotoluene	ND		1.00	1	10/06/2022 11:03	WG1936825
4-Chlorotoluene	ND		1.00	1	10/06/2022 11:03	WG1936825
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	10/06/2022 11:03	WG1936825
Acetone	ND		10.0	1	10/06/2022 11:03	WG1936825
Allyl chloride	ND		1.00	1	10/06/2022 11:03	WG1936825
Benzene	ND		1.00	1	10/06/2022 11:03	WG1936825
Bromobenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
Bromochloromethane	ND		1.00	1	10/06/2022 11:03	WG1936825
Bromodichloromethane	ND		1.00	1	10/06/2022 11:03	WG1936825
Bromoform	ND		1.00	1	10/06/2022 11:03	WG1936825
Bromomethane	ND		1.00	1	10/06/2022 11:03	WG1936825
Carbon tetrachloride	ND		1.00	1	10/06/2022 11:03	WG1936825
Chlorobenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
Chlorodibromomethane	ND		1.00	1	10/06/2022 11:03	WG1936825
Chloroethane	ND		1.00	1	10/06/2022 11:03	WG1936825
Chloroform	ND		1.00	1	10/06/2022 11:03	WG1936825
Chloromethane	ND		1.00	1	10/06/2022 11:03	WG1936825
Dibromomethane	ND		1.00	1	10/06/2022 11:03	WG1936825
Dichlorodifluoromethane	ND		1.00	1	10/06/2022 11:03	WG1936825
Dichlorofluoromethane	ND		1.00	1	10/06/2022 11:03	WG1936825
Ethyl ether	ND		1.00	1	10/06/2022 11:03	WG1936825
Ethylbenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
Hexachloro-1,3-butadiene	ND		1.00	1	10/06/2022 11:03	WG1936825
Isopropylbenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
Methyl tert-butyl ether	ND		1.00	1	10/06/2022 11:03	WG1936825
Methylene Chloride	ND		1.00	1	10/06/2022 11:03	WG1936825
Naphthalene	ND		1.00	1	10/06/2022 11:03	WG1936825
Styrene	ND		1.00	1	10/06/2022 11:03	WG1936825
Tetrachloroethene	ND		1.00	1	10/06/2022 11:03	WG1936825
Tetrahydrofuran	ND		5.00	1	10/06/2022 11:03	WG1936825
Toluene	ND		1.00	1	10/06/2022 11:03	WG1936825
Trichloroethene	ND		1.00	1	10/06/2022 11:03	WG1936825
Trichlorofluoromethane	ND		1.00	1	10/06/2022 11:03	WG1936825
Vinyl chloride	ND		1.00	1	10/06/2022 11:03	WG1936825
Xylenes, Total	ND		2.00	1	10/06/2022 11:03	WG1936825

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
cis-1,2-Dichloroethene	ND		1.00	1	10/06/2022 11:03	WG1936825
cis-1,3-Dichloropropene	ND		1.00	1	10/06/2022 11:03	WG1936825
n-Butylbenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
n-Propylbenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
p-Isopropyltoluene	ND		1.00	1	10/06/2022 11:03	WG1936825
sec-Butylbenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
tert-Butylbenzene	ND		1.00	1	10/06/2022 11:03	WG1936825
trans-1,2-Dichloroethene	ND		1.00	1	10/06/2022 11:03	WG1936825
trans-1,3-Dichloropropene	ND		1.00	1	10/06/2022 11:03	WG1936825
(S) 4-Bromofluorobenzene	*104*			*67.0-138*	*10/06/2022 11:03*	WG1936825
(S) Toluene-d8	*109*			*75.0-131*	*10/06/2022 11:03*	WG1936825
(S) 1,2-Dichloroethane-d4	*95.8*			*70.0-130*	*10/06/2022 11:03*	WG1936825

Method Blank (MB)

(MB) R3845747-3 10/06/22 10:06

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
2-Chlorotoluene	ND		0.0346	0.100
4-Chlorotoluene	ND		0.0180	0.200
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl Chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	1.00
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chlorodibromomethane	ND		0.0245	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromomethane	ND		0.0300	0.200
Dichlorodifluoromethane	ND		0.0644	0.100

Method Blank (MB)

(MB) R3845747-3 10/06/22 10:06

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	1.00
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Vinyl chloride	ND		0.0462	0.0500
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 4-Bromofluorobenzene	*105*			*67.0-138*
(S) Toluene-d8	*108*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*97.4*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3845747-1 10/06/22 01:42 • (LCSD) R3845747-2 10/06/22 02:01

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	5.77	6.02	115	120	74.0-129			4.24	20
1,1,1-Trichloroethane	5.00	5.41	5.75	108	115	69.0-126			6.09	20
1,1,2,2-Tetrachloroethane	5.00	4.47	5.13	89.4	103	68.0-128			13.7	20
1,1-Dichloroethane	5.00	4.43	4.62	88.6	92.4	70.0-127			4.20	20
1,1-Dichloroethene	5.00	4.92	5.09	98.4	102	65.0-131			3.40	20

QUALITY CONTROL SUMMARY

L1541347-01,02

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3845747-1 10/06/22 01:42 • (LCSD) R3845747-2 10/06/22 02:01

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1-Dichloropropene	5.00	5.19	5.17	104	103	73.0-125			0.386	20
1,2,3-Trichlorobenzene	5.00	4.94	5.06	98.8	101	59.0-139			2.40	20
1,2,3-Trichloropropane	5.00	5.17	5.77	103	115	67.0-129			11.0	20
1,2,4-Trichlorobenzene	5.00	4.81	4.92	96.2	98.4	62.0-137			2.26	20
1,2,4-Trimethylbenzene	5.00	4.93	5.03	98.6	101	70.0-126			2.01	20
1,2-Dibromo-3-Chloropropane	5.00	5.32	6.04	106	121	59.0-130			12.7	20
1,2-Dibromoethane	5.00	5.78	5.86	116	117	74.0-128			1.37	20
1,2-Dichlorobenzene	5.00	5.18	5.30	104	106	76.0-124			2.29	20
1,2-Dichloroethane	5.00	4.47	4.49	89.4	89.8	65.0-131			0.446	20
1,2-Dichloropropane	5.00	4.84	5.00	96.8	100	74.0-125			3.25	20
1,3,5-Trimethylbenzene	5.00	4.79	5.19	95.8	104	73.0-127			8.02	20
1,3-Dichlorobenzene	5.00	5.07	5.10	101	102	76.0-125			0.590	20
1,3-Dichloropropane	5.00	5.39	5.39	108	108	80.0-125			0.000	20
1,4-Dichlorobenzene	5.00	4.87	5.21	97.4	104	77.0-121			6.75	20
2,2-Dichloropropane	5.00	5.40	5.24	108	105	59.0-135			3.01	20
2-Butanone (MEK)	25.0	24.8	26.2	99.2	105	30.0-160			5.49	24
2-Chlorotoluene	5.00	5.20	5.52	104	110	75.0-124			5.97	20
4-Chlorotoluene	5.00	4.32	4.73	86.4	94.6	75.0-124			9.06	20
4-Methyl-2-pentanone (MIBK)	25.0	26.7	27.7	107	111	56.0-143			3.68	20
Acetone	25.0	20.7	16.5	82.8	66.0	10.0-160			22.6	31
Allyl chloride	25.0	22.2	22.5	88.8	90.0	70.0-131			1.34	20
Benzene	5.00	4.63	4.77	92.6	95.4	70.0-123			2.98	20
Bromobenzene	5.00	5.35	5.91	107	118	73.0-121			9.95	20
Bromochloromethane	5.00	5.27	5.41	105	108	77.0-128			2.62	20
Bromodichloromethane	5.00	5.01	5.14	100	103	73.0-121			2.56	20
Bromoform	5.00	6.15	6.45	123	129	64.0-132			4.76	20
Bromomethane	5.00	5.25	5.35	105	107	56.0-147			1.89	20
Carbon tetrachloride	5.00	5.79	6.20	116	124	66.0-128			6.84	20
Chlorobenzene	5.00	5.22	5.46	104	109	76.0-128			4.49	20
Chlorodibromomethane	5.00	6.03	6.16	121	123	74.0-127			2.13	20
Chloroethane	5.00	5.99	5.87	120	117	61.0-134			2.02	20
Chloroform	5.00	4.47	4.70	89.4	94.0	72.0-123			5.02	20
Chloromethane	5.00	4.35	4.48	87.0	89.6	51.0-138			2.94	20
Dibromomethane	5.00	4.99	5.21	99.8	104	75.0-122			4.31	20
Dichlorodifluoromethane	5.00	4.00	3.93	80.0	78.6	43.0-156			1.77	20
Dichlorofluoromethane	5.00	5.25	5.29	105	106	65.0-137			0.759	20
Ethyl ether	5.00	4.66	4.56	93.2	91.2	64.0-137			2.17	20
Ethylbenzene	5.00	5.43	5.60	109	112	74.0-126			3.08	20
Hexachloro-1,3-butadiene	5.00	5.84	6.03	117	121	57.0-150			3.20	20
Isopropylbenzene	5.00	5.59	5.73	112	115	72.0-127			2.47	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3845747-1 10/06/22 01:42 • (LCSD) R3845747-2 10/06/22 02:01

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Methyl tert-butyl ether	5.00	4.63	4.68	92.6	93.6	66.0-132			1.07	20
Methylene Chloride	5.00	4.47	4.35	89.4	87.0	68.0-123			2.72	20
Naphthalene	5.00	4.90	5.73	98.0	115	59.0-130			15.6	20
Styrene	5.00	5.24	5.23	105	105	72.0-127			0.191	20
Tetrachloroethene	5.00	6.74	6.81	135	136	70.0-136			1.03	20
Tetrahydrofuran	5.00	4.27	4.23	85.4	84.6	37.0-146			0.941	24
Toluene	5.00	5.05	5.20	101	104	75.0-121			2.93	20
Trichloroethene	5.00	5.88	5.90	118	118	76.0-126			0.340	20
Trichlorofluoromethane	5.00	4.85	5.11	97.0	102	61.0-142			5.22	20
Vinyl chloride	5.00	6.01	6.30	120	126	63.0-134			4.71	20
Xylenes, Total	15.0	16.5	16.7	110	111	72.0-127			1.20	20
cis-1,2-Dichloroethene	5.00	4.75	4.88	95.0	97.6	73.0-125			2.70	20
cis-1,3-Dichloropropene	5.00	5.06	5.09	101	102	76.0-127			0.591	20
n-Butylbenzene	5.00	4.59	4.69	91.8	93.8	68.0-135			2.16	20
n-Propylbenzene	5.00	4.49	5.00	89.8	100	74.0-126			10.7	20
p-Isopropyltoluene	5.00	4.71	4.98	94.2	99.6	72.0-133			5.57	20
sec-Butylbenzene	5.00	5.08	5.54	102	111	74.0-130			8.66	20
tert-Butylbenzene	5.00	6.02	5.71	120	114	75.0-127			5.29	20
trans-1,2-Dichloroethene	5.00	4.69	4.75	93.8	95.0	71.0-125			1.27	20
trans-1,3-Dichloropropene	5.00	5.25	5.51	105	110	73.0-127			4.83	20
(S) 4-Bromofluorobenzene				*102*	*100*	*67.0-138*				
(S) Toluene-d8				*108*	*110*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*96.6*	*93.8*	*70.0-130*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
C4	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Data is likely to show a low bias concerning the result.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Andrea Nord

Email To:
anord@barr.com;datamgt@barr.com;jeidam@b

Project Description:
Elk River Landfill Residential Well

City/State Collected:

Please Circle: PT MT CT ET

Phone: 952-832-2893

Client Project #
900

Lab Project #
WMELKRIVMN-RESIDENT

Collected by (print):

Site/Facility ID #
MN02

P.O. #
2371005.22 2nd 200

Collected by (signature):

Immediately Packed on Ice N ___ Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
X Three Day

Date Results Needed

Quote #

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	V8260ULLC 40mlAmb-HCl	V8260ULLC 40mlAmb-HCl-Blk	Remarks	Sample # (lab only)
876412	Grab	GW		9/29/22	12:15	3	X			-01
TRIP BLANK		GW				1		X		-02

Anabois / Container / Preservation

Chain of Custody Page 1 of 1

Pace
ANALYTICAL ADVANCING SCIENCE

MT JULIET, TN

12065 Lebanon Rd Mount Juliet, TN 37122
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1541347
C028

Acctnum: WMELKRIVMN
Template: T212305
Prelogin: P936228
PM: 364 - T. Alan Harvill
PB: 5 22 tod

Shipped Via: FedEX Ground

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: 12183 223rd Street

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS X FedEx __ Courier

Tracking # 5910 0138 6557

Sample Receipt Checklist
COC Seal Present/Intact: NP / Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No / HCl / MeoH / TBR	If preservation required by Login: Date/Time
	9/29/22	13:29			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp NSA GC 4.0+0=4.0 Bottles Received: 3	
	9/29/22	1329			
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 09.30.22 Time: 1000	Hold: / Condition: NCF /

ANALYTICAL REPORT

December 22, 2022

Elk River Landfill

Sample Delivery Group:	L1567589
Samples Received:	12/14/2022
Project Number:	900
Description:	Elk River Landfill Residential Well
Site:	MN02
Report To:	Andrea Nord 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

Stacy Kennedy
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

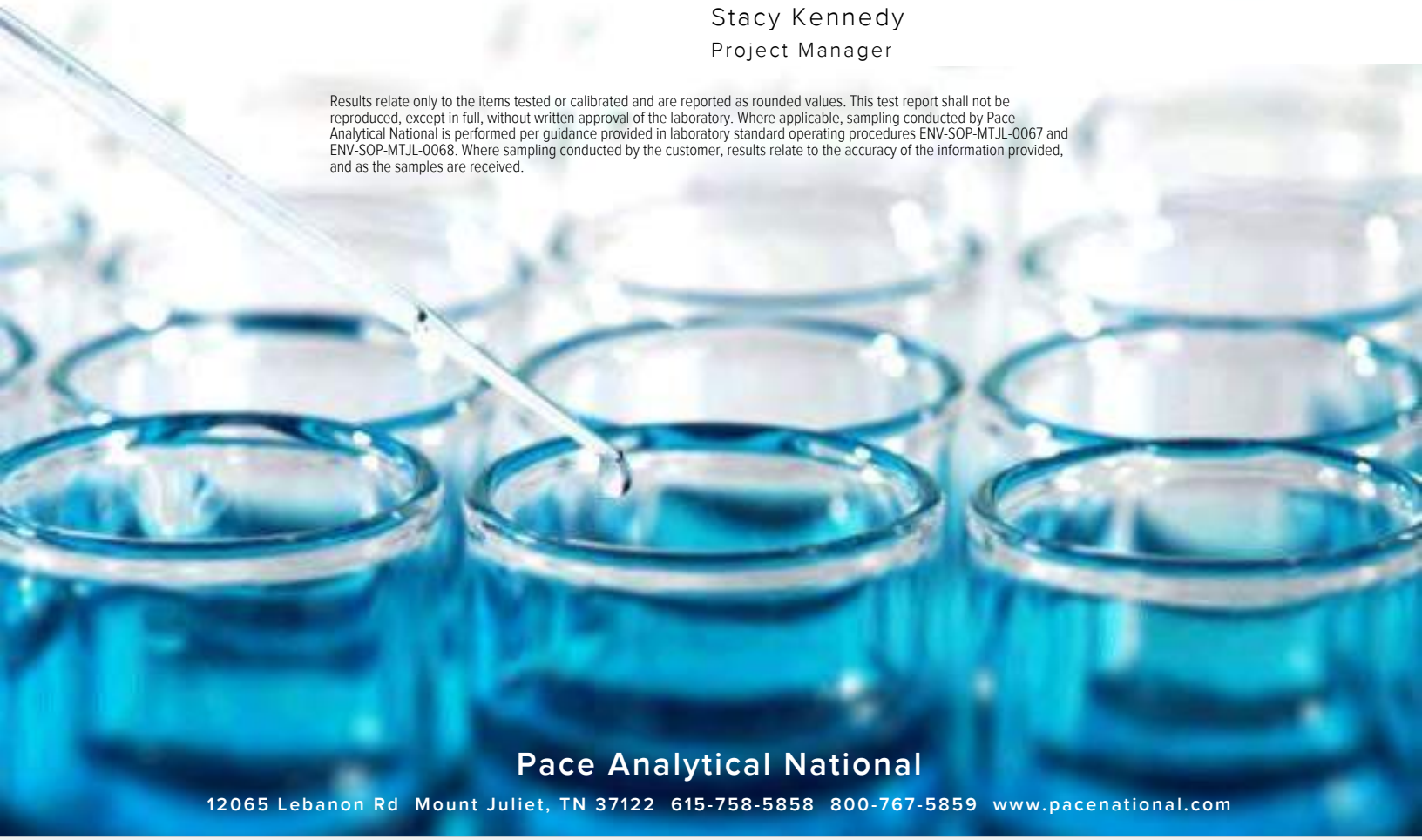


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#876413 L1567589-01 5

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SAMPLE SUMMARY

#876413 L1567589-01 GW

Collected by: Kevin McGilp
Collected date/time: 12/10/22 16:15
Received date/time: 12/14/22 09:10

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1977432	1	12/21/22 14:59	12/21/22 14:59	JHH	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Stacy Kennedy
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG1977432	L1567589-01	1,1,2-Trichlorotrifluoroethane, Dichlorodifluoromethane and Trichlorofluoromethane

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	12/21/2022 14:59	WG1977432
1,1,1-Trichloroethane	ND		1.00	1	12/21/2022 14:59	WG1977432
1,1,2-Trichloroethane	ND		0.750	1	12/21/2022 14:59	WG1977432
1,1,2-Trichlorotrifluoroethane	ND	C3	1.00	1	12/21/2022 14:59	WG1977432
1,1,2,2-Tetrachloroethane	ND		1.00	1	12/21/2022 14:59	WG1977432
1,1-Dichloroethane	ND		1.00	1	12/21/2022 14:59	WG1977432
1,1-Dichloroethene	ND		1.00	1	12/21/2022 14:59	WG1977432
1,1-Dichloropropene	ND		1.00	1	12/21/2022 14:59	WG1977432
1,2,3-Trichlorobenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
1,2,3-Trichloropropane	ND		1.00	1	12/21/2022 14:59	WG1977432
1,2,4-Trichlorobenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
1,2,4-Trimethylbenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
1,2-Dibromo-3-Chloropropane	ND		1.00	1	12/21/2022 14:59	WG1977432
1,2-Dibromoethane	ND		1.00	1	12/21/2022 14:59	WG1977432
1,2-Dichlorobenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
1,2-Dichloroethane	ND		1.00	1	12/21/2022 14:59	WG1977432
1,2-Dichloropropane	ND		1.00	1	12/21/2022 14:59	WG1977432
1,3,5-Trimethylbenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
1,3-Dichlorobenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
1,3-Dichloropropane	ND		1.00	1	12/21/2022 14:59	WG1977432
1,4-Dichlorobenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
2,2-Dichloropropane	ND		1.00	1	12/21/2022 14:59	WG1977432
2-Butanone (MEK)	ND		10.0	1	12/21/2022 14:59	WG1977432
2-Chlorotoluene	ND		1.00	1	12/21/2022 14:59	WG1977432
4-Chlorotoluene	ND		1.00	1	12/21/2022 14:59	WG1977432
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	12/21/2022 14:59	WG1977432
Acetone	ND		10.0	1	12/21/2022 14:59	WG1977432
Allyl chloride	ND		1.00	1	12/21/2022 14:59	WG1977432
Benzene	ND		1.00	1	12/21/2022 14:59	WG1977432
Bromobenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
Bromochloromethane	ND		1.00	1	12/21/2022 14:59	WG1977432
Bromodichloromethane	ND		1.00	1	12/21/2022 14:59	WG1977432
Bromoform	ND		1.00	1	12/21/2022 14:59	WG1977432
Bromomethane	ND		1.00	1	12/21/2022 14:59	WG1977432
Carbon tetrachloride	ND		1.00	1	12/21/2022 14:59	WG1977432
Chlorobenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
Chlorodibromomethane	ND		1.00	1	12/21/2022 14:59	WG1977432
Chloroethane	ND		1.00	1	12/21/2022 14:59	WG1977432
Chloroform	ND		1.00	1	12/21/2022 14:59	WG1977432
Chloromethane	ND		1.00	1	12/21/2022 14:59	WG1977432
Dibromomethane	ND		1.00	1	12/21/2022 14:59	WG1977432
Dichlorodifluoromethane	ND	C3	1.00	1	12/21/2022 14:59	WG1977432
Dichlorofluoromethane	ND		1.00	1	12/21/2022 14:59	WG1977432
Ethyl ether	ND		1.00	1	12/21/2022 14:59	WG1977432
Ethylbenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
Hexachloro-1,3-butadiene	ND		1.00	1	12/21/2022 14:59	WG1977432
Isopropylbenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
Methyl tert-butyl ether	ND		1.00	1	12/21/2022 14:59	WG1977432
Methylene Chloride	ND		1.00	1	12/21/2022 14:59	WG1977432
Naphthalene	ND		1.00	1	12/21/2022 14:59	WG1977432
Styrene	ND		1.00	1	12/21/2022 14:59	WG1977432
Tetrachloroethene	ND		1.00	1	12/21/2022 14:59	WG1977432
Tetrahydrofuran	ND		5.00	1	12/21/2022 14:59	WG1977432
Toluene	ND		1.00	1	12/21/2022 14:59	WG1977432
Trichloroethene	ND		1.00	1	12/21/2022 14:59	WG1977432
Trichlorofluoromethane	ND	C3	1.00	1	12/21/2022 14:59	WG1977432

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Vinyl chloride	ND		1.00	1	12/21/2022 14:59	WG1977432
Xylenes, Total	ND		2.00	1	12/21/2022 14:59	WG1977432
cis-1,2-Dichloroethene	ND		1.00	1	12/21/2022 14:59	WG1977432
cis-1,3-Dichloropropene	ND		1.00	1	12/21/2022 14:59	WG1977432
n-Butylbenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
n-Propylbenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
p-Isopropyltoluene	ND		1.00	1	12/21/2022 14:59	WG1977432
sec-Butylbenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
tert-Butylbenzene	ND		1.00	1	12/21/2022 14:59	WG1977432
trans-1,2-Dichloroethene	ND		1.00	1	12/21/2022 14:59	WG1977432
trans-1,3-Dichloropropene	ND		1.00	1	12/21/2022 14:59	WG1977432
(S) 4-Bromofluorobenzene	*102*			*67.0-138*	*12/21/2022 14:59*	WG1977432
(S) Toluene-d8	*98.5*			*75.0-131*	*12/21/2022 14:59*	WG1977432
(S) 1,2-Dichloroethane-d4	*96.3*			*70.0-130*	*12/21/2022 14:59*	WG1977432

Method Blank (MB)

(MB) R3874556-2 12/21/22 14:11

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2-Trichloroethane	ND		0.0239	0.100
1,1,2-Trichlorotrifluoroethane	ND		0.0302	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
2-Chlorotoluene	ND		0.0346	0.100
4-Chlorotoluene	ND		0.0180	0.200
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl Chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	1.00
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chlorodibromomethane	ND		0.0245	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500

Method Blank (MB)

(MB) R3874556-2 12/21/22 14:11

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dibromomethane	ND		0.0300	0.200
Dichlorodifluoromethane	ND		0.0644	0.100
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	1.00
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	0.0110		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	0.334	J	0.141	0.500
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Vinyl chloride	ND		0.0462	0.0500
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 4-Bromofluorobenzene	*102*			*67.0-138*
(S) Toluene-d8	*99.7*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*95.4*			*70.0-130*

Laboratory Control Sample (LCS)

(LCS) R3874556-1 12/21/22 11:18

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
1,1,1,2-Tetrachloroethane	5.00	5.69	114	74.0-129	
1,1,1-Trichloroethane	5.00	5.59	112	69.0-126	
1,1,2-Trichloroethane	5.00	5.60	112	78.0-123	

Laboratory Control Sample (LCS)

(LCS) R3874556-1 12/21/22 11:18

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
1,1,2-Trichlorotrifluoroethane	5.00	3.73	74.6	61.0-139	
1,1,2,2-Tetrachloroethane	5.00	5.37	107	68.0-128	
1,1-Dichloroethane	5.00	5.69	114	70.0-127	
1,1-Dichloroethene	5.00	4.96	99.2	65.0-131	
1,1-Dichloropropene	5.00	5.15	103	73.0-125	
1,2,3-Trichlorobenzene	5.00	5.42	108	59.0-139	
1,2,3-Trichloropropane	5.00	5.65	113	67.0-129	
1,2,4-Trichlorobenzene	5.00	5.84	117	62.0-137	
1,2,4-Trimethylbenzene	5.00	5.51	110	70.0-126	
1,2-Dibromo-3-Chloropropane	5.00	4.92	98.4	59.0-130	
1,2-Dibromoethane	5.00	5.39	108	74.0-128	
1,2-Dichlorobenzene	5.00	5.74	115	76.0-124	
1,2-Dichloroethane	5.00	4.95	99.0	65.0-131	
1,2-Dichloropropane	5.00	5.63	113	74.0-125	
1,3,5-Trimethylbenzene	5.00	5.58	112	73.0-127	
1,3-Dichlorobenzene	5.00	5.80	116	76.0-125	
1,3-Dichloropropane	5.00	5.49	110	80.0-125	
1,4-Dichlorobenzene	5.00	5.44	109	77.0-121	
2,2-Dichloropropane	5.00	4.95	99.0	59.0-135	
2-Butanone (MEK)	25.0	25.1	100	30.0-160	
2-Chlorotoluene	5.00	5.25	105	75.0-124	
4-Chlorotoluene	5.00	4.13	82.6	75.0-124	
4-Methyl-2-pentanone (MIBK)	25.0	27.2	109	56.0-143	
Acetone	25.0	26.9	108	10.0-160	
Allyl chloride	25.0	27.6	110	70.0-131	
Benzene	5.00	5.29	106	70.0-123	
Bromobenzene	5.00	5.54	111	73.0-121	
Bromochloromethane	5.00	5.89	118	77.0-128	
Bromodichloromethane	5.00	5.54	111	73.0-121	
Bromoform	5.00	5.62	112	64.0-132	
Bromomethane	5.00	4.05	81.0	56.0-147	
Carbon tetrachloride	5.00	5.13	103	66.0-128	
Chlorobenzene	5.00	5.59	112	76.0-128	
Chlorodibromomethane	5.00	5.78	116	74.0-127	
Chloroethane	5.00	4.41	88.2	61.0-134	
Chloroform	5.00	5.55	111	72.0-123	
Chloromethane	5.00	4.77	95.4	51.0-138	
Dibromomethane	5.00	5.32	106	75.0-122	
Dichlorodifluoromethane	5.00	3.26	65.2	43.0-156	
Dichlorofluoromethane	5.00	5.93	119	65.0-137	

Laboratory Control Sample (LCS)

(LCS) R3874556-1 12/21/22 11:18

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Ethyl ether	5.00	5.68	114	64.0-137	
Ethylbenzene	5.00	5.69	114	74.0-126	
Hexachloro-1,3-butadiene	5.00	6.09	122	57.0-150	
Isopropylbenzene	5.00	5.82	116	72.0-127	
Methyl tert-butyl ether	5.00	6.01	120	66.0-132	
Methylene Chloride	5.00	5.37	107	68.0-123	
Naphthalene	5.00	5.13	103	59.0-130	
Styrene	5.00	5.70	114	72.0-127	
Tetrachloroethene	5.00	5.39	108	70.0-136	
Tetrahydrofuran	5.00	5.31	106	37.0-146	
Toluene	5.00	5.48	110	75.0-121	
Trichloroethene	5.00	5.48	110	76.0-126	
Trichlorofluoromethane	5.00	3.96	79.2	61.0-142	
Vinyl chloride	5.00	4.89	97.8	63.0-134	
Xylenes, Total	15.0	17.3	115	72.0-127	
cis-1,2-Dichloroethene	5.00	5.56	111	73.0-125	
cis-1,3-Dichloropropene	5.00	5.52	110	76.0-127	
n-Butylbenzene	5.00	5.34	107	68.0-135	
n-Propylbenzene	5.00	5.35	107	74.0-126	
p-Isopropyltoluene	5.00	5.38	108	72.0-133	
sec-Butylbenzene	5.00	5.37	107	74.0-130	
tert-Butylbenzene	5.00	5.55	111	75.0-127	
trans-1,2-Dichloroethene	5.00	5.45	109	71.0-125	
trans-1,3-Dichloropropene	5.00	5.68	114	73.0-127	
(S) 4-Bromofluorobenzene			*98.5*	*67.0-138*	
(S) Toluene-d8			*98.7*	*75.0-131*	
(S) 1,2-Dichloroethane-d4			*91.7*	*70.0-130*	

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
J	The identification of the analyte is acceptable; the reported value is an estimate.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Andrea Nord

Email To:
anord@barr.com;datamgt@barr.com;jeloem@b

Project Description:
Elk River Landfill Residential Well

City/State Collected:

Please Circle: PT MT CT ET

Phone: 952-832-2893

Client Project #
900

Lab Project #
WMELKRIVMN-RESIDENT

Collected by (print):
Kevin McGillip

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day X Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Entrs	Analysis / Container / Preservative: V8260 40mlAmb-HCl Elk River Landfill RL's	V8260 40mlAmb-HCl Blk										Remarks	Sample # (lab only)
#876413	grab	GW		12.10.22	16:15	3	X												-01
TRIP BLANK		GW				1		X											

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

(2065 Lebanon Rd Mount Juliet, TN 37122)
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # 156589
A024

Acctnum: WMELKRIVMN
Template: T212305
Prelogin: P936229
PM: 364 - T. Alan Harvill
PB: 45 12-22 tod

Shipped Via: FedEx Ground

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Biossay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: 22272 Quinn St.

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS X FedEx __ Courier _____

Tracking # 5882 7541 8719

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct Bottles used: Y N
Sufficient Volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / Meoh TBR	If preservation required by Login: Date/Time
Kevin McGillip	12.12.22	10:00			
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp: NFH 3°C Bottles Received: 1.8 3	
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 12/14/22 Time: 0910	Hold: Condition: NCF / OK

ANALYTICAL REPORT

December 23, 2022

Revised Report

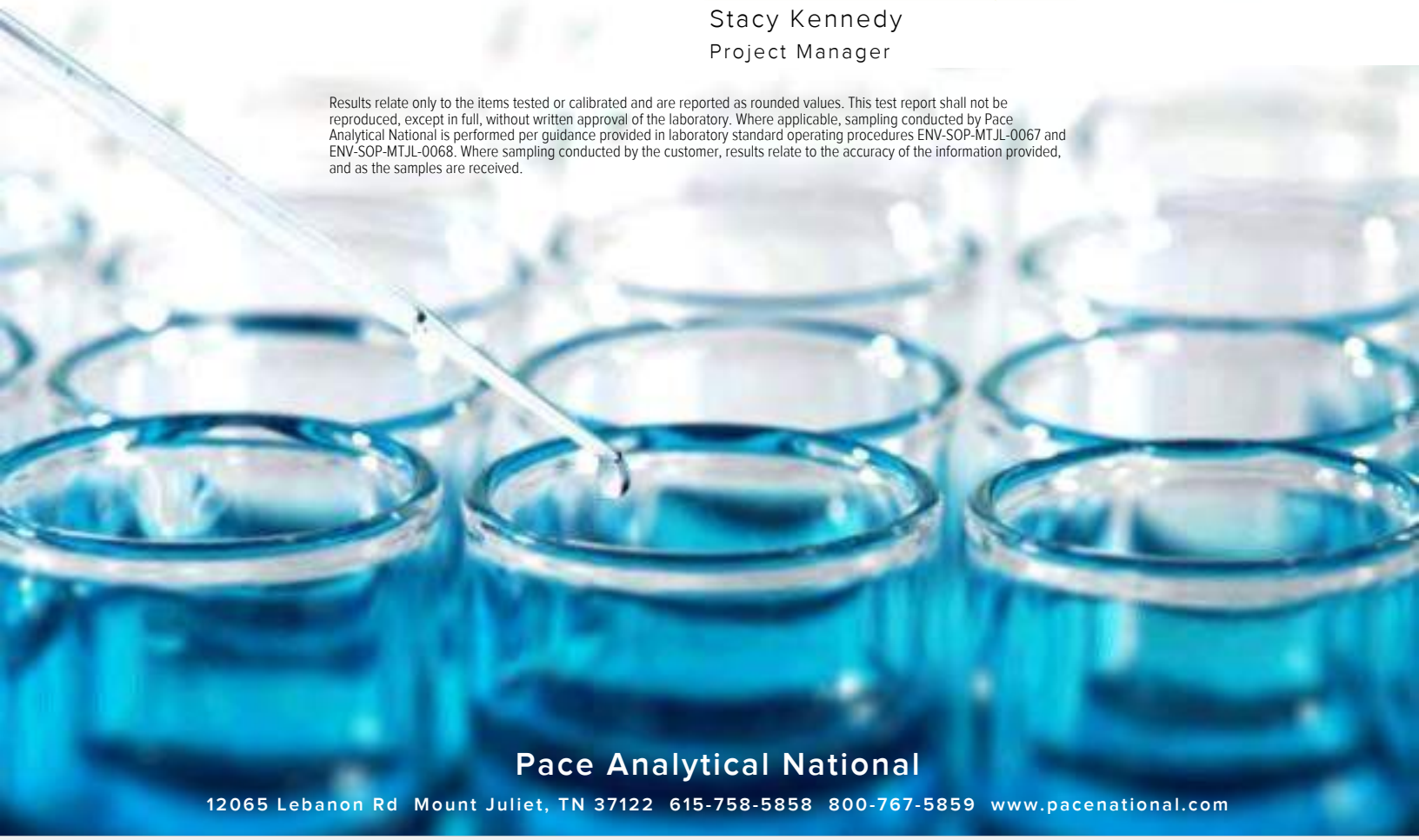
Elk River Landfill

Sample Delivery Group:	L1568315
Samples Received:	12/16/2022
Project Number:	900
Description:	Elk River Landfill Residential Well
Site:	MN02
Report To:	Andrea Nord 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

Stacy Kennedy
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

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TRIP BLANK L1568315-02 7

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SAMPLE SUMMARY

876414 L1568315-01 GW

Collected by: Dean Myers
Collected date/time: 12/14/22 15:45
Received date/time: 12/16/22 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1976062	1	12/19/22 17:56	12/19/22 17:56	GLN	Mt. Juliet, TN

TRIP BLANK L1568315-02 GW

Collected by: Dean Myers
Collected date/time: 12/14/22 00:00
Received date/time: 12/16/22 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1976062	1	12/19/22 13:38	12/19/22 13:38	GLN	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Stacy Kennedy
Project Manager

Report Revision History

Level II Report - Version 1: 12/20/22 11:51

Project Comments

Report reissued to adjust project specific compound list. SK 12/22/22

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Sample Delivery Group (SDG) Narrative

Analyzed from headspace vial.

Batch	Method	Lab Sample ID
WG1976062	8260D	L1568315-02

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG1976062	L1568315-01	1,2,3-Trichlorobenzene, 1,2,4-Trichlorobenzene, Bromomethane and Naphthalene
WG1976062	L1568315-02	1,2,3-Trichlorobenzene, 1,2,4-Trichlorobenzene, Bromomethane and Naphthalene

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG1976062	(LCSD) R3873714-2, L1568315-01, 02	Dichlorofluoromethane

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,1,1-Trichloroethane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,1,2-Trichloroethane	ND		0.750	1	12/19/2022 17:56	WG1976062
1,1,2-Trichlorotrifluoroethane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,1,2,2-Tetrachloroethane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,1-Dichloroethane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,1-Dichloroethene	ND		1.00	1	12/19/2022 17:56	WG1976062
1,1-Dichloropropene	ND		1.00	1	12/19/2022 17:56	WG1976062
1,2,3-Trichlorobenzene	ND	C3	1.00	1	12/19/2022 17:56	WG1976062
1,2,3-Trichloropropane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,2,4-Trichlorobenzene	ND	C3	1.00	1	12/19/2022 17:56	WG1976062
1,2,4-Trimethylbenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
1,2-Dibromo-3-Chloropropane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,2-Dibromoethane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,2-Dichlorobenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
1,2-Dichloroethane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,2-Dichloropropane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,3,5-Trimethylbenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
1,3-Dichlorobenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
1,3-Dichloropropane	ND		1.00	1	12/19/2022 17:56	WG1976062
1,4-Dichlorobenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
2,2-Dichloropropane	ND		1.00	1	12/19/2022 17:56	WG1976062
2-Butanone (MEK)	ND		10.0	1	12/19/2022 17:56	WG1976062
2-Chlorotoluene	ND		1.00	1	12/19/2022 17:56	WG1976062
4-Chlorotoluene	ND		1.00	1	12/19/2022 17:56	WG1976062
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	12/19/2022 17:56	WG1976062
Acetone	ND		10.0	1	12/19/2022 17:56	WG1976062
Allyl chloride	ND		1.00	1	12/19/2022 17:56	WG1976062
Benzene	ND		1.00	1	12/19/2022 17:56	WG1976062
Bromobenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
Bromochloromethane	ND		1.00	1	12/19/2022 17:56	WG1976062
Bromodichloromethane	ND		1.00	1	12/19/2022 17:56	WG1976062
Bromoform	ND		1.00	1	12/19/2022 17:56	WG1976062
Bromomethane	ND	C3	1.00	1	12/19/2022 17:56	WG1976062
Carbon tetrachloride	ND		1.00	1	12/19/2022 17:56	WG1976062
Chlorobenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
Chlorodibromomethane	ND		1.00	1	12/19/2022 17:56	WG1976062
Chloroethane	ND		1.00	1	12/19/2022 17:56	WG1976062
Chloroform	ND		1.00	1	12/19/2022 17:56	WG1976062
Chloromethane	ND		1.00	1	12/19/2022 17:56	WG1976062
Dibromomethane	ND		1.00	1	12/19/2022 17:56	WG1976062
Dichlorodifluoromethane	ND		1.00	1	12/19/2022 17:56	WG1976062
Dichlorofluoromethane	ND	J3	1.00	1	12/19/2022 17:56	WG1976062
Ethyl ether	ND		1.00	1	12/19/2022 17:56	WG1976062
Ethylbenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
Hexachloro-1,3-butadiene	ND		1.00	1	12/19/2022 17:56	WG1976062
Isopropylbenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
Methyl tert-butyl ether	ND		1.00	1	12/19/2022 17:56	WG1976062
Methylene Chloride	ND		1.00	1	12/19/2022 17:56	WG1976062
Naphthalene	ND	C3	1.00	1	12/19/2022 17:56	WG1976062
Styrene	ND		1.00	1	12/19/2022 17:56	WG1976062
Tetrachloroethene	ND		1.00	1	12/19/2022 17:56	WG1976062
Tetrahydrofuran	ND		5.00	1	12/19/2022 17:56	WG1976062
Toluene	ND		1.00	1	12/19/2022 17:56	WG1976062
Trichloroethene	ND		1.00	1	12/19/2022 17:56	WG1976062
Trichlorofluoromethane	ND		1.00	1	12/19/2022 17:56	WG1976062

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Vinyl chloride	ND		1.00	1	12/19/2022 17:56	WG1976062
Xylenes, Total	ND		2.00	1	12/19/2022 17:56	WG1976062
cis-1,2-Dichloroethene	ND		1.00	1	12/19/2022 17:56	WG1976062
cis-1,3-Dichloropropene	ND		1.00	1	12/19/2022 17:56	WG1976062
n-Butylbenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
n-Propylbenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
p-Isopropyltoluene	ND		1.00	1	12/19/2022 17:56	WG1976062
sec-Butylbenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
tert-Butylbenzene	ND		1.00	1	12/19/2022 17:56	WG1976062
trans-1,2-Dichloroethene	ND		1.00	1	12/19/2022 17:56	WG1976062
trans-1,3-Dichloropropene	ND		1.00	1	12/19/2022 17:56	WG1976062
(S) 4-Bromofluorobenzene	*79.9*			*67.0-138*	*12/19/2022 17:56*	WG1976062
(S) Toluene-d8	*95.5*			*75.0-131*	*12/19/2022 17:56*	WG1976062
(S) 1,2-Dichloroethane-d4	*94.9*			*70.0-130*	*12/19/2022 17:56*	WG1976062

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,1,1-Trichloroethane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,1,2-Trichloroethane	ND		0.750	1	12/19/2022 13:38	WG1976062
1,1,2-Trichlorotrifluoroethane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,1,2,2-Tetrachloroethane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,1-Dichloroethane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,1-Dichloroethene	ND		1.00	1	12/19/2022 13:38	WG1976062
1,1-Dichloropropene	ND		1.00	1	12/19/2022 13:38	WG1976062
1,2,3-Trichlorobenzene	ND	C3	1.00	1	12/19/2022 13:38	WG1976062
1,2,3-Trichloropropane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,2,4-Trichlorobenzene	ND	C3	1.00	1	12/19/2022 13:38	WG1976062
1,2,4-Trimethylbenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
1,2-Dibromo-3-Chloropropane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,2-Dibromoethane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,2-Dichlorobenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
1,2-Dichloroethane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,2-Dichloropropane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,3,5-Trimethylbenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
1,3-Dichlorobenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
1,3-Dichloropropane	ND		1.00	1	12/19/2022 13:38	WG1976062
1,4-Dichlorobenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
2,2-Dichloropropane	ND		1.00	1	12/19/2022 13:38	WG1976062
2-Butanone (MEK)	ND		10.0	1	12/19/2022 13:38	WG1976062
2-Chlorotoluene	ND		1.00	1	12/19/2022 13:38	WG1976062
4-Chlorotoluene	ND		1.00	1	12/19/2022 13:38	WG1976062
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	12/19/2022 13:38	WG1976062
Acetone	ND		10.0	1	12/19/2022 13:38	WG1976062
Allyl chloride	ND		1.00	1	12/19/2022 13:38	WG1976062
Benzene	ND		1.00	1	12/19/2022 13:38	WG1976062
Bromobenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
Bromochloromethane	ND		1.00	1	12/19/2022 13:38	WG1976062
Bromodichloromethane	ND		1.00	1	12/19/2022 13:38	WG1976062
Bromoform	ND		1.00	1	12/19/2022 13:38	WG1976062
Bromomethane	ND	C3	1.00	1	12/19/2022 13:38	WG1976062
Carbon tetrachloride	ND		1.00	1	12/19/2022 13:38	WG1976062
Chlorobenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
Chlorodibromomethane	ND		1.00	1	12/19/2022 13:38	WG1976062
Chloroethane	ND		1.00	1	12/19/2022 13:38	WG1976062
Chloroform	ND		1.00	1	12/19/2022 13:38	WG1976062
Chloromethane	ND		1.00	1	12/19/2022 13:38	WG1976062
Dibromomethane	ND		1.00	1	12/19/2022 13:38	WG1976062
Dichlorodifluoromethane	ND		1.00	1	12/19/2022 13:38	WG1976062
Dichlorofluoromethane	ND	J3	1.00	1	12/19/2022 13:38	WG1976062
Ethyl ether	ND		1.00	1	12/19/2022 13:38	WG1976062
Ethylbenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
Hexachloro-1,3-butadiene	ND		1.00	1	12/19/2022 13:38	WG1976062
Isopropylbenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
Methyl tert-butyl ether	ND		1.00	1	12/19/2022 13:38	WG1976062
Methylene Chloride	ND		1.00	1	12/19/2022 13:38	WG1976062
Naphthalene	ND	C3	1.00	1	12/19/2022 13:38	WG1976062
Styrene	ND		1.00	1	12/19/2022 13:38	WG1976062
Tetrachloroethene	ND		1.00	1	12/19/2022 13:38	WG1976062
Tetrahydrofuran	ND		5.00	1	12/19/2022 13:38	WG1976062
Toluene	ND		1.00	1	12/19/2022 13:38	WG1976062
Trichloroethene	ND		1.00	1	12/19/2022 13:38	WG1976062
Trichlorofluoromethane	ND		1.00	1	12/19/2022 13:38	WG1976062

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Vinyl chloride	ND		1.00	1	12/19/2022 13:38	WG1976062
Xylenes, Total	ND		2.00	1	12/19/2022 13:38	WG1976062
cis-1,2-Dichloroethene	ND		1.00	1	12/19/2022 13:38	WG1976062
cis-1,3-Dichloropropene	ND		1.00	1	12/19/2022 13:38	WG1976062
n-Butylbenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
n-Propylbenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
p-Isopropyltoluene	ND		1.00	1	12/19/2022 13:38	WG1976062
sec-Butylbenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
tert-Butylbenzene	ND		1.00	1	12/19/2022 13:38	WG1976062
trans-1,2-Dichloroethene	ND		1.00	1	12/19/2022 13:38	WG1976062
trans-1,3-Dichloropropene	ND		1.00	1	12/19/2022 13:38	WG1976062
(S) 4-Bromofluorobenzene	*93.8*			*67.0-138*	*12/19/2022 13:38*	WG1976062
(S) Toluene-d8	*92.7*			*75.0-131*	*12/19/2022 13:38*	WG1976062
(S) 1,2-Dichloroethane-d4	*93.4*			*70.0-130*	*12/19/2022 13:38*	WG1976062

Method Blank (MB)

(MB) R3873714-3 12/19/22 12:22

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2-Trichloroethane	ND		0.0239	0.100
1,1,2-Trichlorotrifluoroethane	ND		0.0302	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
2-Chlorotoluene	ND		0.0346	0.100
4-Chlorotoluene	ND		0.0180	0.200
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl Chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	1.00
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chlorodibromomethane	ND		0.0245	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500

Method Blank (MB)

(MB) R3873714-3 12/19/22 12:22

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dibromomethane	ND		0.0300	0.200
Dichlorodifluoromethane	ND		0.0644	0.100
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	1.00
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Vinyl chloride	ND		0.0462	0.0500
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 4-Bromofluorobenzene	*91.2*			*67.0-138*
(S) Toluene-d8	*92.3*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*90.6*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3873714-1 12/19/22 10:18 • (LCSD) R3873714-2 12/19/22 10:38

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	4.79	4.92	95.8	98.4	74.0-129			2.68	20
1,1,1-Trichloroethane	5.00	5.17	4.92	103	98.4	69.0-126			4.96	20
1,1,2-Trichloroethane	5.00	4.55	4.38	91.0	87.6	78.0-123			3.81	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3873714-1 12/19/22 10:18 • (LCSD) R3873714-2 12/19/22 10:38

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,2-Trichlorotrifluoroethane	5.00	5.16	4.97	103	99.4	61.0-139			3.75	20
1,1,2,2-Tetrachloroethane	5.00	5.02	5.06	100	101	68.0-128			0.794	20
1,1-Dichloroethane	5.00	4.75	4.66	95.0	93.2	70.0-127			1.91	20
1,1-Dichloroethene	5.00	5.32	5.29	106	106	65.0-131			0.566	20
1,1-Dichloropropene	5.00	5.12	5.09	102	102	73.0-125			0.588	20
1,2,3-Trichlorobenzene	5.00	3.62	3.71	72.4	74.2	59.0-139			2.46	20
1,2,3-Trichloropropane	5.00	4.95	4.91	99.0	98.2	67.0-129			0.811	20
1,2,4-Trichlorobenzene	5.00	3.69	3.91	73.8	78.2	62.0-137			5.79	20
1,2,4-Trimethylbenzene	5.00	5.03	5.06	101	101	70.0-126			0.595	20
1,2-Dibromo-3-Chloropropane	5.00	4.47	4.22	89.4	84.4	59.0-130			5.75	20
1,2-Dibromoethane	5.00	5.00	4.85	100	97.0	74.0-128			3.05	20
1,2-Dichlorobenzene	5.00	4.38	4.68	87.6	93.6	76.0-124			6.62	20
1,2-Dichloroethane	5.00	4.45	4.68	89.0	93.6	65.0-131			5.04	20
1,2-Dichloropropane	5.00	5.00	5.09	100	102	74.0-125			1.78	20
1,3,5-Trimethylbenzene	5.00	4.75	4.77	95.0	95.4	73.0-127			0.420	20
1,3-Dichlorobenzene	5.00	5.04	5.18	101	104	76.0-125			2.74	20
1,3-Dichloropropane	5.00	4.98	4.82	99.6	96.4	80.0-125			3.27	20
1,4-Dichlorobenzene	5.00	4.82	4.56	96.4	91.2	77.0-121			5.54	20
2,2-Dichloropropane	5.00	5.06	4.93	101	98.6	59.0-135			2.60	20
2-Butanone (MEK)	25.0	21.0	19.1	84.0	76.4	30.0-160			9.48	24
2-Chlorotoluene	5.00	5.24	5.61	105	112	75.0-124			6.82	20
4-Chlorotoluene	5.00	5.20	5.27	104	105	75.0-124			1.34	20
4-Methyl-2-pentanone (MIBK)	25.0	22.0	21.9	88.0	87.6	56.0-143			0.456	20
Acetone	25.0	20.9	21.8	83.6	87.2	10.0-160			4.22	31
Allyl chloride	25.0	26.1	26.4	104	106	70.0-131			1.14	20
Benzene	5.00	4.89	4.91	97.8	98.2	70.0-123			0.408	20
Bromobenzene	5.00	4.97	5.02	99.4	100	73.0-121			1.00	20
Bromochloromethane	5.00	4.64	4.70	92.8	94.0	77.0-128			1.28	20
Bromodichloromethane	5.00	5.04	4.97	101	99.4	73.0-121			1.40	20
Bromoform	5.00	4.31	4.26	86.2	85.2	64.0-132			1.17	20
Bromomethane	5.00	3.94	3.88	78.8	77.6	56.0-147			1.53	20
Carbon tetrachloride	5.00	5.29	5.36	106	107	66.0-128			1.31	20
Chlorobenzene	5.00	4.45	4.44	89.0	88.8	76.0-128			0.225	20
Chlorodibromomethane	5.00	4.81	4.92	96.2	98.4	74.0-127			2.26	20
Chloroethane	5.00	4.53	4.67	90.6	93.4	61.0-134			3.04	20
Chloroform	5.00	4.47	4.69	89.4	93.8	72.0-123			4.80	20
Chloromethane	5.00	4.67	4.88	93.4	97.6	51.0-138			4.40	20
Dibromomethane	5.00	4.98	5.03	99.6	101	75.0-122			0.999	20
Dichlorodifluoromethane	5.00	4.25	4.48	85.0	89.6	43.0-156			5.27	20
Dichlorofluoromethane	5.00	5.66	4.58	113	91.6	65.0-137		J3	21.1	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3873714-1 12/19/22 10:18 • (LCSD) R3873714-2 12/19/22 10:38

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Ethyl ether	5.00	4.87	5.02	97.4	100	64.0-137			3.03	20
Ethylbenzene	5.00	4.49	4.55	89.8	91.0	74.0-126			1.33	20
Hexachloro-1,3-butadiene	5.00	4.35	4.58	87.0	91.6	57.0-150			5.15	20
Isopropylbenzene	5.00	4.85	4.82	97.0	96.4	72.0-127			0.620	20
Methyl tert-butyl ether	5.00	5.35	5.21	107	104	66.0-132			2.65	20
Methylene Chloride	5.00	4.92	4.59	98.4	91.8	68.0-123			6.94	20
Naphthalene	5.00	3.47	3.66	69.4	73.2	59.0-130			5.33	20
Styrene	5.00	4.04	4.09	80.8	81.8	72.0-127			1.23	20
Tetrachloroethene	5.00	4.62	4.66	92.4	93.2	70.0-136			0.862	20
Tetrahydrofuran	5.00	4.36	5.10	87.2	102	37.0-146			15.6	24
Toluene	5.00	4.76	4.60	95.2	92.0	75.0-121			3.42	20
Trichloroethene	5.00	5.26	5.08	105	102	76.0-126			3.48	20
Trichlorofluoromethane	5.00	5.57	4.88	111	97.6	61.0-142			13.2	20
Vinyl chloride	5.00	4.82	4.94	96.4	98.8	63.0-134			2.46	20
Xylenes, Total	15.0	14.1	14.2	94.0	94.7	72.0-127			0.707	20
cis-1,2-Dichloroethene	5.00	5.04	5.06	101	101	73.0-125			0.396	20
cis-1,3-Dichloropropene	5.00	4.61	4.52	92.2	90.4	76.0-127			1.97	20
n-Butylbenzene	5.00	4.66	4.73	93.2	94.6	68.0-135			1.49	20
n-Propylbenzene	5.00	4.81	4.89	96.2	97.8	74.0-126			1.65	20
p-Isopropyltoluene	5.00	4.92	4.97	98.4	99.4	72.0-133			1.01	20
sec-Butylbenzene	5.00	5.02	4.96	100	99.2	74.0-130			1.20	20
tert-Butylbenzene	5.00	5.24	5.02	105	100	75.0-127			4.29	20
trans-1,2-Dichloroethene	5.00	5.16	5.28	103	106	71.0-125			2.30	20
trans-1,3-Dichloropropene	5.00	5.16	4.94	103	98.8	73.0-127			4.36	20
(S) 4-Bromofluorobenzene				*87.2*	*88.5*	*67.0-138*				
(S) Toluene-d8				*89.8*	*89.5*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*90.6*	*90.5*	*70.0-130*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
J3	The associated batch QC was outside the established quality control range for precision.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Andrea Nord

Email To:
anord@barr.com;datamgt@barr.com;jeldem@b

Project Description:
Elk River Landfill Residential Well

City/State Collected:

Please Circle:
PT MT CT ET

Phone: 952-832-2893

Client Project #
900

Lab Project #
WMELKRIVMN-RESIDENT

Collected by (print):
Dan Myers

Site/Facility ID #
MN02

P.O. #

Collected by (signature):
Immediately
Packed on Ice N___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
X Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

No. of Cntrs

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	V8260ULLC 40mlAmb-HCl Elk River Landfill RL's	V8260ULLC 40mlAmb-HCl-Blk Elk River Landfill RL's
876414	grab	GW		12-14-22	15:45	3	X	
TRIP BLANK		GW				1		X

Chain of Custody Page ___ of ___

Pace
MT JULIET, TN

SDG # L1562315

H121

Acctnum: WMELKRIVMN
Template: T212305
Prelogin: P936226
PM: 394 - T. Alan Harvill
PB: 15Dec22
Shipped Via: FedEX Ground

Remarks | Sample # (lab only)

-01
-02

Customer : P936226 Weight : 10 LBS
Phone : (815)756-5850 COD :
Sat Del : N DV :
Special : 0.00
Handling : 0.00
0.00 Total : 0.00

Bus: PRIORITY OVERNIGHT
TRCK: 5882 7541 8627

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Biossay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
22130 Quinn Street

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx X Courier

Tracking # 5882 7541 8627

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	12/15/22	10:11	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes / No (HCL / MeoH) TBR

Temp (CMP) 3.8 3.8 Bottles Received: 3

Date: 12-16-22 Time: 9

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING SEALING RECORD
Minnesota Statutes, chapter 103I

Minnesota Well and Boring Sealing No: H 387616
Minnesota Unique Well No. or Waterlevel No.: 655131

WELL OR BORING LOCATION
County Name: Sherburne

Township Name	Township No	Range No	Section No	Fraction (Qtr - Qtr)
Elk River	33	26	4	NW NE SE

Date Sealed: 7-15-22
Date Well or Boring Constructed: 1-9-2001

GPS LOCATION – decimal degrees (to five decimal places)
Latitude: _____ Longitude: _____

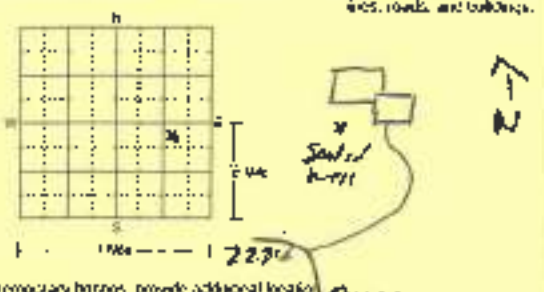
Depth at Time of Sealing: 132 ft. Original Depth: 132 ft.

Numerical Street Address or Fire Number and City of Well or Boring Location
12163 223rd Ave NW, Elk River

AQUIFER(S): [X] Bedrock Aquifer [ ] Multiple/other
WELL/BORING: [X] Water-Supply Well [ ] Env. Well [ ] Test Boring [ ] Other _____

STATIC WATER LEVEL: [X] Measured Date Measured: 7-15-22 [ ] Estimated
41 ft [X] below [ ] above land surface

Show exact location of well or boring in section grid with "X"



Sketch map of well or boring location. Showing property lines, roads, and buildings.

For temporary borings, provide additional location information, as to Section, and geology on a separate page.

CASING TYPE(S): [ ] Steel [X] Plastic [ ] Tile [ ] Other _____

WELLHEAD COMPLETION
Outside: [X] Pitless Adapter/Unit [ ] At Grade [ ] Well Pit [ ] Buried [ ] Other _____
Inside: [ ] Basement Floor [ ] Well House [ ] Well Pit [ ] Direct [ ] Other _____

PROPERTY OWNER'S NAME/COMPANY NAME
Kevin Fredesen
Property owner's mailing address, if different than well location address, entered above

WELL OWNER'S NAME/COMPANY NAME

Well owner's mailing address, if different than property owner's address indicated above

CASING(S)

Diameter		Depth		Set in grouted hole?		Annular space originally grouted?		
4 in.	from 0	to 132 ft.	[X] Yes	[ ] No	[X] Yes	[ ] No	[ ] Unknown
____ in.	from ____	to ____ ft.	[ ] Yes	[ ] No	[ ] Yes	[ ] No	[ ] Unknown
____ in.	from ____	to ____ ft.	[ ] Yes	[ ] No	[ ] Yes	[ ] No	[ ] Unknown

SCREEN/OPEN HOLE: Screen from 132 ft. to 132 ft. Open hole from ____ ft. to ____ ft.

OBSTRUCTIONS: [X] Pump/Pump Pipe [ ] Check Valve/Jet [ ] Debris [ ] Fill [ ] No Obstruction
Type of Obstruction(s) (Describe): 60' - D.P. + Pump
Obstructions removed? [X] Yes [ ] No Describe: Pulled out

PUMP: [ ] Not Present [X] Present, Removed Prior to Sealing [ ] Other _____
Type: Submersible

METHOD USED TO SEAL ANNULAR SPACE BETWEEN 2 CASINGS, OR CASING AND BORE HOLE
[ ] No Annular Space Existing [X] Annular Space Grouted with Tremie Pipe [ ] Casing Perforation/Removal
Casing Diameter
____ in. from ____ to ____ ft. [ ] Perforated [ ] Removal
____ in. from ____ to ____ ft. [ ] Perforated [ ] Removal
Type of Perforator: _____

VARIANCE
Was a variance granted from the MDH for this well? [ ] Yes [X] No If Yes, Explain _____

GROUTING MATERIAL(S)
Grouting Material: High Solids Bentonite Grout 0 to 132 ft. ____ gallons 5 bags
____ from ____ to ____ ft. ____ gallons ____ bags
____ from ____ to ____ ft. ____ gallons ____ bags

GEOLOGICAL MATERIAL	COLOR	HARDNESS OR FORMATION	FROM	TO
Not known, estimated formation log from nearby well or boring				
Rocky Clay	Red		0	18
Sand + Gravel	Brown		18	22
Clay	Tan		22	40
Clay	Gray		40	70
Sand	Brown		70	79
Rocky Sand Clay	Brown		79	89
Rocky Clay	Brown		89	116
Sand	Tan		116	132

OTHER WELLS AND BORINGS
Other unsealed wells located on boring or property? [ ] Yes [X] No How many? _____

REMARKS, SOURCE OF DATA, DIFFICULTIES IN SEALING

LICENSED OR REGISTERED CONTRACTOR CERTIFICATION
This well or boring was sealed in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Able Well, Inc — Licensee Business Name — License or Registration No. 1377
Scott G. Thyse — Certified Representative Signature — Certification No. 972 — Date 7-15-22
Scott A. Asp — Name of Person Sealing Well or Boring

IMPORTANT: GIVE WITH PROPERTY PAPERS. WELL OWNER COPY
H 387616

HEC1434-17 DI 33158 11/19R

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING SEALING RECORD

Minnesota Statutes, chapter 103I

Minnesota Well and Boring Sealing No. H 387579
Minnesota Unique Well No. or Wellogic No.

WELL OR BORING LOCATION

County Name: Sherburne

Township Name	Township No.	Range No.	Section No.	Fraction (use 4 to 8)
Elk River	33	26	4	NW NE SE

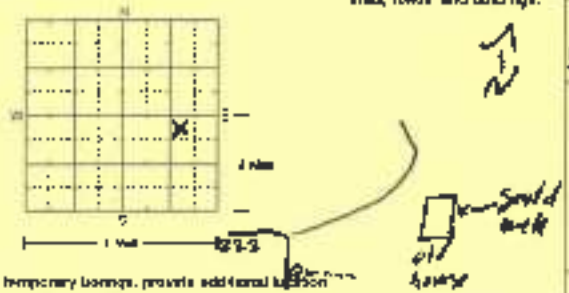
GPS LOCATION – decimal degrees (to four decimal places)

Latitude _____ Longitude _____

Nearest Street Address or Fire Number and City of Well or Boring Location: 12163 223rd Ave. NW, Elk River

Show exact location of well or boring in section grid with "X"

Sketch map of well or boring location, showing property lines, roads and landmarks.



For temporary borings, provide additional location information, a site sketch, and geology on a separate page.

PROPERTY OWNER'S NAME/COMPANY NAME

Kevin Ericksen

Property owner's mailing address (if different than well location address) and telephone

WELL OWNER'S NAME/COMPANY NAME

Well owner's mailing address (if different than property owner's address listed above)

GEOLOGICAL MATERIAL	COLOR	HARDNESS OR FORMATION	FROM	TO
If not known, list type and depth of formation bearing from nearby well or boring				
Sand & Gravel			0	28
Clay			28	39
Sand			39	44
Clay			44	90
Sand			90	100

REMARKS, SOURCE OF DATA, DIFFICULTIES IN SEALING

IMPORTANT: FILE WITH PROPERTY PAPERS. WELL OWNER COPY

H 387579

Date Sealed: 7-15-22

Date Well or Boring Constructed: Unknown

Depth at Time of Sealing: 100 ft.

Original Depth: 100 ft.

AQUIFER(S)
☑ Single Aquifer ☐ Multiaquifer

WELL/BORING
☑ Water-Supply Well ☐ Env. Well
☐ Temp. Boring ☐ Other _____

STATIC WATER LEVEL
☑ Measured Date Measured 7-15-22 ☐ Estimated
45 ft. ☑ below ☐ above land surface

CASING TYPE(S)
☑ Steel ☐ Plastic ☐ Tile ☐ Other _____

WELLHEAD COMPLETION
Outside: Pitless Adapter Unit ☐ At Grade
☑ Vault ☐ Buried
☐ Other _____

Inside: ☐ Basement Offset
☐ Well House
☐ Well Pit
☐ Buried
☐ Other _____

CASING(S)

Diameter	Depth	Set in overburden hole?	Annular space visibly grouted?
4 in. from 6 to 95 ft.		☐ Yes ☑ No	☐ Yes ☐ No ☑ Unknown
_____ in. from _____ to _____ ft.		☐ Yes ☐ No	☐ Yes ☐ No ☐ Unknown
_____ in. from _____ to _____ ft.		☐ Yes ☐ No	☐ Yes ☐ No ☐ Unknown

SCREEN/OPEN HOLE
Screen mfm 95 ft. to 100 ft. Open Hole from _____ to _____ ft.

OBSTRUCTIONS
☑ Rods/Drop Pipe ☐ Check Valve(s) ☐ Debris ☐ Fill ☐ Bentonite/Grout

Type of Obstruction(s) (Describe): 55' - 2 poly pipe + Jet

Obstructions removed? ☑ Yes ☐ No Describe: pulled out

PUMP
☑ Not Present ☐ Present, Removed Prior to Sealing ☐ Other _____

Type: DW Jet pump

METHOD USED TO SEAL ANNULAR SPACE BETWEEN 2 CASINGS, OR CASING AND BORE HOLE
☑ No Annular Space Exists ☐ Annular Space Grouted with Tremie Pipe ☐ Casing Perforated/Removed

Casing Diameter
_____ in. from _____ to _____ ft. ☐ Perforated ☐ Removed
_____ in. from _____ to _____ ft. ☐ Perforated ☐ Removed

Type of Perforator _____

VARIANCE
Was a variance granted from the MDH for this work? ☐ Yes ☑ No If so _____

GROUTING MATERIAL(S)
Grouting Material: High Solids Bentonite from 6 to 100 ft. 4 yards 4 bags
_____ from _____ to _____ ft. _____ yards _____ bags
_____ from _____ to _____ ft. _____ yards _____ bags

OTHER WELLS AND BORINGS
Other unsealed and unused well or boring on property? ☐ Yes ☑ No How many? _____

LICENSED OR REGISTERED CONTRACTOR CERTIFICATION
This well or boring was sealed in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Able Well, Inc. — Licensed Business Name
1377 — Licensed or Registration No.

Certified Representative Signature
972 — Certified Rep. No.
7-15-22 — Date

Scott + Dan

Name of Person Sealing Well or Boring

MDH 4725.17 DII 53169 11/19R

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING SEALING RECORD

Minnesota Statutes, chapter 103I

Minnesota Well and Boring Sealing No. / Minnesota Unique Well No. or W-series No. (Leave blank if not known): **H 387619**

WELL OR BORING LOCATION

County Name: Sherburne

Township Name	Township No.	Range No.	Section No.	Fraction (sm. = q.)
Elk River	33	26	4	SE NW SE

Date Sealed: 11-15-23

Date Well or Boring Constructed: 1970's

GPS LOCATION – decimal degrees (to four decimal places)

Latitude: _____ Longitude: _____

Depth at Time of Sealing: 101 ft. Original Depth: 101 ft.

Numerical Street Address or Fire Number and City of Well or Boring Location: 12183 223rd Ave. NW, Elk River

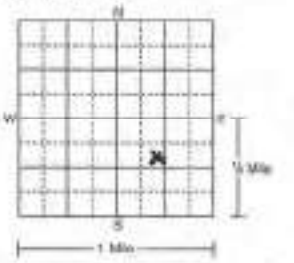
AQUIFER(S): [X] Single Aquifer [ ] Multiaquifer

WELL/BORING: [X] Water-Supply Well [ ] Env. Well [ ] Temp. Boring [ ] Other: _____

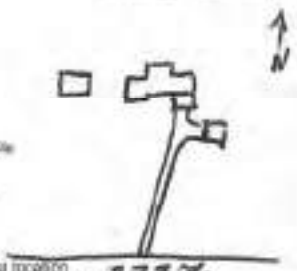
STATIC WATER LEVEL: [ ] Measured Date Measured: _____ [X] Estimated

40 ft. [X] below [ ] above land surface

Show exact location of well or boring in section grid with "X"



Sketch map of well or boring location, showing property lines, roads, and buildings.



For temporary borings, provide additional location information, a site sketch, and geology on a separate page.

CASING TYPE(S): [X] Steel [ ] Plastic [ ] Tile [ ] Other: _____

WELLHEAD COMPLETION

Outside: [X] Pitless Adapter/Unit [ ] At Grade [ ] Well Pit [ ] Buried [ ] Other: _____

Inside: [ ] Basement Offset [ ] Well House [ ] Well Pit [ ] Buried [ ] Other: _____

CASING(S)

Diameter	Depth	Set in oversize hole?	Annular space initially grouted?
4 in. from 0	to 98 ft.	[X] Yes [ ] No	[ ] Yes [ ] No [X] Unknown
_____ in. from _____	to _____ ft.	[ ] Yes [ ] No	[ ] Yes [ ] No [ ] Unknown
_____ in. from _____	to _____ ft.	[ ] Yes [ ] No	[ ] Yes [ ] No [ ] Unknown

SCREEN/OPEN HOLE

Screen from 98 to 101 ft. Open Hole from _____ to _____ ft.

OBSTRUCTIONS: [X] Rods/Drop Pipe [ ] Check Valve(s) [ ] Debris [ ] Fill [ ] No Obstruction

Type of Obstructions (Describe): 1" Sch 80 PVC & Pump ~ 80'

Obstructions removed? [X] Yes [ ] No Describe: pulled out

PUMP: [ ] Not Present [X] Present, Removed Prior to Sealing [ ] Other: _____

Type: Submersible

METHOD USED TO SEAL ANNULAR SPACE BETWEEN 2 CASINGS, OR CASING AND BORE HOLE

[X] No Annular Space Exists [ ] Annular Space Grouted with Thermie Pipe [ ] Casing Perforation/Removal

Casing Diameter

_____ in. from _____ to _____ ft. [ ] Perforated [ ] Removed

_____ in. from _____ to _____ ft. [ ] Perforated [ ] Removed

Type of Perforator: _____

VARIANCE: Was a variance granted from the MDH for this well? [ ] Yes [X] No TN#: _____

GROUTING MATERIAL(S)

Grouting Material: Bentonite from 0 to 101 ft. _____ yards _____ bags

_____ from _____ to _____ ft. _____ yards _____ bags

_____ from _____ to _____ ft. _____ yards _____ bags

OTHER WELLS AND BORINGS: Other unsealed and unused well or boring on property? [ ] Yes [X] No How many? _____

GEOLOGICAL MATERIAL	COLOR	HARDNESS OR FORMATION	FROM	TO
If not known, indicate estimated formation log from nearby well or boring.				
Sand			0	5
Sand + Gravel			5	26
Sandy Clay			26	41
Sand + Gravel			41	52
Clay			52	67
Sand			67	72
Clay			72	74
Sand			74	81
Clay + Gravel			81	116
Sand + Gravel			116	130

REMARKS, SOURCE OF DATA, DIFFICULTIES IN SEALING

LICENSED OR REGISTERED CONTRACTOR CERTIFICATION

This well or boring was sealed in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Able Well, Inc — 1377 (Licensee Business Name / License or Registration No.)

Certified Representative Signature — 972 (Certified Rep. No.) — 11-15-23 (Date)

Scott + Darl (Name of Person Sealing Well or Boring)

MINN. DEPT. OF HEALTH COPY H 387619

HE-01434-17 ID# 53159 11/16R

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING SEALING RECORD

Minnesota Statutes, Chapter 103I

Minnesota Well and Boring Sealing No. H 387618

Minnesota Unique Well No. or Wellmed No.

WELL OR BORING LOCATION

County Name: Sherburne

Township Name: Elk River | Township No: 33 | Range No: 26 | Section No: 4 | Fraction (pick one): NENWSE

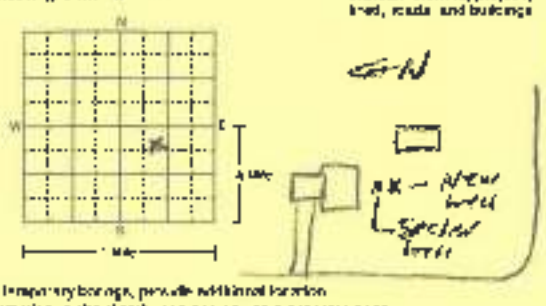
GPS LOCATION (decimal degrees to four decimal places)

Latitude: _____ Longitude: _____

Numerical Street Address or Fire Number and City of Well or Boring Location: 12265 273rd Ave NW, Elk River

Show exact location of well or boring in section grid with "X"

Sketch map of well or boring location showing property lines, roads and buildings



For temporary borings, provide additional location information, a site sketch and geology on a separate page

PROPERTY OWNER'S NAME/COMPANY NAME: Jean Klatke

Property owner's mailing address (if different than property owner's address indicated above):

WELL OWNER'S NAME/COMPANY NAME:

Well owner's mailing address (if different than property owner's address indicated above):

Date Sealed: 10-31-22

Date Well or Boring Constructed: 1970's

Depth at Time of Sealing: 93 ft.

Original Depth: 93 ft.

AQUIFER(S)

(if Single Aquifer | Multiple)

WELL/BORING

☒ Water-Supply Well ☐ Env. Well

☐ Temp. Boring ☐ Other: _____

STATIC WATER LEVEL

☒ Measured Date Measured: 10-21-22 ☐ Estimated

50 ft ☒ Below ☐ Above land surface

CASING TYPE(S)

☒ Steel ☐ Plastic ☐ Tile ☐ Other: _____

WELLHEAD COMPLETION

Outside: ☒ Pitless Adapter/Unit ☐ At Grade ☐ Buried ☐ Well Pit ☐ Other: _____

Inside: ☐ Basement/Other ☐ Well House ☐ Well Pit ☐ Buried ☐ Other: _____

CASING(S)

Diameter	Depth	Set in Original Hole?	Annular space in telly grouted?
4 in. from 0 to 85 ft.		☒ Yes ☐ No	☐ Yes ☐ No ☒ Unknown
____ in. from ____ to ____ ft.		☐ Yes ☐ No	☐ Yes ☐ No ☐ Unknown
____ in. from ____ to ____ ft.		☐ Yes ☐ No	☐ Yes ☐ No ☐ Unknown

SCREEN/OPEN HOLE

Screen from 89 to 93 ft. Open Hole from ____ to ____ ft.

OBSTRUCTIONS

☒ Rock/Drop Pipe ☐ Gravel Wall(s) ☐ Debris ☐ Fill ☐ No Information

Type of Obstructions (Describe): 80' Drop pipe + Sub. pump

Obstructions removed? ☒ Yes ☐ No Describe: pulled out

PUMP

☐ Not Present ☒ Present, Removed Prior to Sealing ☐ Other: _____

Type: Submersible

METHOD USED TO SEAL ANNULAR SPACE BETWEEN 2 CASINGS, OR CASING AND BORE HOLE

☒ No Annular Space Exists ☐ Annular Space Grouted with Tremie Pipe ☐ Casing Perforation/Removal

Casing Diameter:

____ in. from ____ to ____ ft. ☐ Perforated ☐ Removed

____ in. from ____ to ____ ft. ☐ Perforated ☐ Removed

Type of Perforator: _____

VARIANCE

Was a variance granted from the MDH for this well? ☐ Yes ☒ No This: _____

GROUTING MATERIAL(S)

Grouting Material: Bentonite from 0 to 93 ft. ____ yards 4 bags

____ from ____ to ____ ft. ____ yards ____ bags

____ from ____ to ____ ft. ____ yards ____ bags

OTHER WELLS AND BORINGS

Other unsealed and unused well or boring on property? ☐ Yes ☒ No How many? _____

GEOLOGICAL MATERIAL	COLOR	HARDNESS OR FORMATION	FROM	TO
(All known, reliable information for sealing from nearby well or boring)				
Sand + Gravel	Brown		0	5
Clay w/gravel	Brown		5	10
Sand + Gravel	Brown		10	35
Clay	Tan		35	61
Sand	Tan		61	63
Clay	Gray		63	69
Gravel	Tan		69	72
Clay	Gray		72	79
Gravel	White		79	81
Clay + Gravel	Brown		81	95

REMARKS, SOURCE OF DATA, DIFFICULTIES IN SEALING

LICENSED OR REGISTERED CONTRACTOR CERTIFICATION

This well or boring was sealed in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Able Well, Inc. — License or Registration No. 1377

Licensed Business Name

Scott E. Thompson — 972 — 10-27-22

Certified Representative Signature — Certified Rep. No. — Date

Scott Thompson

Name of Person Sealing Well or Boring

IMPORTANT: FILE WITH PROPERTY PAPERS—WELL OWNER COPY H 387618

HE-01604-17 DI-03159

11/19R

WELL OR BORING LOCATION

County Name: Sherburne

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING SEALING RECORD

Minnesota Statutes, Chapter 103I

Minnesota Well and Boring Sealing No: H 387617

Minnesota Unique Well No or Watermaster No: 626780

Township Name: Elk River | Township No: 33 | Range No: 26 | Section No: 4 | Fraction or Block: NW NW SE

Date Sealed: 10-21-22

Date Well or Boring Constructed: 9-21-2001

GPS LOCATION – Datum: degrees (if not decimal degrees):

Latitude: _____ Longitude: _____

Depth at Time of Sealing: 170 ft | Original Depth: 150 ft

Numerical Street Address of Well Number and City of Well or Boring Location:

12269 223rd Ave. NW, Elk River

AQUIFER(S): ☐ Single Aquifer ☐ Multiaquifer

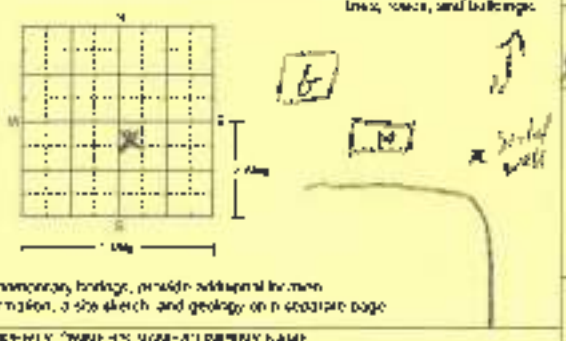
STATIC WATER LEVEL: 10-21-22 | ☒ Measured | Date Measured: 87 | ☐ Estimated | 87 ft | ☒ Below | ☐ Above Land Surface

WELL/BORING: ☒ Water-Supply Well ☐ Dry Well ☐ Temp. Boring ☐ Other: _____

CASING TYPE(S): ☒ Steel ☐ Plastic ☐ Tile ☐ Other: _____

Show exact location of well or boring in section grid with "X"

Sketch map of well or boring location showing property lines, roads, and buildings.



For temporary borings, provide additional location information, a site sketch, and geology on a separate page.

WELLHEAD COMPLETION

Outside: ☒ Pitless Adapter, Manufacturer: ☐ At Grade ☐ Well Pit ☐ Buried ☐ Other: _____

Inside: ☐ Basement Offset ☐ Well House ☐ Well Pit ☐ Buried ☐ Other: _____

PROPERTY OWNER'S NAME/COMPANY NAME

Property owner's mailing address (if different than property address recorded above)

CASING(S)

Diameter		Depth		Sch 40 or Schedule Body?		Annular space naturally grouted?		
4 in.	from 0 ft.	to 146 ft.		☒ Yes	☐ No	☒ Yes	☐ No	☐ Unknown
____ in.	from ____ ft.	to ____ ft.		☐ Yes	☐ No	☐ Yes	☐ No	☐ Unknown
____ in.	from ____ ft.	to ____ ft.		☐ Yes	☐ No	☐ Yes	☐ No	☐ Unknown

WELL OWNER'S NAME/COMPANY NAME

Well owner's mailing address if different than property owner's address recorded above

SCREEN/OPEN HOLE: Screen from 146 ft. to 150 ft. | Open Hole from _____ ft. to _____ ft.

OBSTRUCTIONS: ☒ Pump/Pump Pipe/Drop Pipe ☐ Check Valve(s) ☐ Debris ☐ Fill ☐ No Obstruction

Type of Obstruction(s) Described: Pump + drop pipe - 84' - 1¼"

Obstructions removed? ☒ Yes ☐ No Describe: pulled out

GEOLOGICAL MATERIAL	COLOR	HARDNESS OR FORMATION	FROM	TO
If not known, indicate estimated formation log from nearby well or boring				
Sand	Brown	Soft	0	15
Clay	Gray	Med	15	60
Clay	Gray	Med	60	75
Sand	Brown	Soft	75	88
Clay	Gm/Bn	Med	88	145
Sand	Tan	Soft	145	151

PUMP: ☐ Not Present ☒ Present, Removed Prior to Sealing ☐ Other: _____

Type: Submersible

METHOD USED TO SEAL ANNULAR SPACE BETWEEN CASINGS, OR CASING AND BORE HOLE: ☒ No Annular Space Casing ☐ Annular Space Grouted with Tremie Pipe ☐ Casing Pulled/Removed

Casing Diameter

____ in. from ____ ft. to ____ ft. ☐ Perforated ☐ Removed

____ in. from ____ ft. to ____ ft. ☐ Perforated ☐ Removed

Type of Perforator: _____

VARIANCE: Was a variance granted from the MDH for this well? ☐ Yes ☐ No Type: _____

GROUTING MATERIAL(S)

Grouting Material: Bentonite from 0 to 151 ft. ____ yards 5 bags

____ from ____ to ____ ft. ____ yards ____ bags

____ from ____ to ____ ft. ____ yards ____ bags

OTHER WELLS AND BORINGS

Other unsealed and unused well or boring on property? ☐ Yes ☒ No How many?: _____

REMARKS, SOURCE OF DATA, DIFFICULTIES IN SEALING:

LICENSED OR REGISTERED CONTRACTOR CERTIFICATION

This well or boring was sealed in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Able Well, Inc. — Licensee Business Name

1377 — Licensee or Registration No.

Scott Thompson — Certified Representative Signature

972 — Certified Rep. No.

10-25-22 — Date

Scott Thompson

Name of Person Sealing Well or Boring

IMPORTANT! FILE WITH PROPERTY PAPERS-WELL OWNER COPY

H 387617

HE 01434-17 PDF 99150

11/19R

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING SEALING RECORD

Minnesota Statutes, chapter 1031

Minnesota Well and Boring Sealing No. H 387620
Minnesota Unique Well No. or W-series No. 527979

WELL OR BORING LOCATION

County Name: Sherburne

Township Name	Township No.	Range No.	Section No.	Fraction (nw, → sy)
Elk River	33	26	4	NE SW SE

Date Sealed: 12-10-22

Date Well or Boring Constructed: 6-21-1993

GPS LOCATION – decimal degrees (to four decimal places)

Latitude: _____ Longitude: _____

Numerical Street Address or Fire Number and City of Well or Boring Location: 22272 Quinn St NW, Elk River

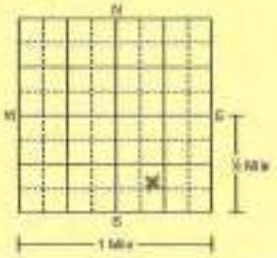
Depth at Time of Sealing: 140 ft. Original Depth: 140 ft.

AQUIFER(S): ☑ Single Aquifer ☐ Multiaquifer

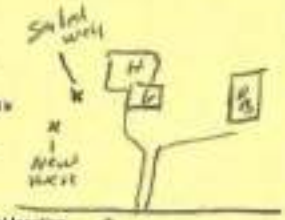
WELL/BORING: ☑ Water-Supply Well ☐ Env. Well ☐ Temp. Boring ☐ Other: _____

STATIC WATER LEVEL: ☑ Measured Date Measured 12-10-22 ☐ Estimated 50 ft. ☑ below ☐ above land surface

Show exact location of well or boring in section grid with "X."



Sketch map of well or boring location, showing property lines, roads, and buildings.



For temporary borings, provide additional location information, a site sketch, and geology on a separate page.

PROPERTY OWNER'S NAME/COMPANY NAME: Paul Hiess

Property owner's mailing address if different than well location address indicated above:

WELL OWNER'S NAME/COMPANY NAME:

Well owner's mailing address if different than property owner's address indicated above:

CASING TYPE(S): ☐ Steel ☑ Plastic ☐ Tile ☐ Other: _____

WELLHEAD COMPLETION

Outside: ☑ Press Adapter/Unit ☐ At Grade ☐ Well Pit ☐ Buried ☐ Other: _____

Inside: ☐ Basement Offset ☐ Well House ☐ Well Pit ☐ Buried ☐ Other: _____

CASING(S)

Diameter	Depth	Set in oversize hole?	Annular space initially grouted?
4 in. from 0	to 135 ft.	☑ Yes ☐ No	☑ Yes ☐ No ☐ Unknown
_____ in. from _____	to _____ ft.	☐ Yes ☐ No	☐ Yes ☐ No ☐ Unknown
_____ in. from _____	to _____ ft.	☐ Yes ☐ No	☐ Yes ☐ No ☐ Unknown

SCREEN/OPEN HOLE

Screen from 135 to 140 ft. Open Hole from _____ to _____ ft.

OBSTRUCTIONS

☑ Rods/Drop Pipe ☐ Check Valve(s) ☐ Debris ☐ Fill ☐ No Obstruction

Type of Obstructions (Describe): Sub. pump + drop pipe

Obstructions removed? ☑ Yes ☐ No Describe: Pulled out

PUMP

☐ Not Present ☑ Present, Removed Prior to Sealing ☐ Other: _____

Type: Submersible

METHOD USED TO SEAL ANNULAR SPACE BETWEEN 2 CASINGS, OR CASING AND BORE HOLE

☐ No Annular Space Exists ☑ Annular Space Grouted with Tremie Pipe ☐ Casing Perforation/Removal

Casing Diameter

_____ in. from _____ to _____ ft. ☐ Perforated ☐ Removed

_____ in. from _____ to _____ ft. ☐ Perforated ☐ Removed

Type of Perforator: _____

VARIANCE

Was a variance granted from the MDH for this well? ☐ Yes ☑ No Tag # _____

GROUTING MATERIAL(S)

Grouting Material: Bentonite from 6 to 140 ft. _____ yards 4½ bags

_____ from _____ to _____ ft. _____ yards _____ bags

_____ from _____ to _____ ft. _____ yards _____ bags

GEOLOGICAL MATERIAL	COLOR	HARDNESS OR FORMATION	FROM	TO
If not known, indicate estimated formation log from nearby well or boring.				
Clay Sand	Brown	Soft	0	10
Silty Sand + Clay	Lt. Brown	Soft	10	74
Clay	Gray	Hard	74	90
Clay + Rocks	Brown	Hard	90	126
Sand	Yellow	Soft	126	140

OTHER WELLS AND BORINGS

Other unsealed and unused well or boring on property? ☐ Yes ☑ No How many? _____

REMARKS, SOURCE OF DATA, DIFFICULTIES IN SEALING

Original well log

LICENSED OR REGISTERED CONTRACTOR CERTIFICATION

This well or boring was sealed in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Able Well, Inc. — Licensee Business Name — 1377 — License or Registration No.

Scott G. Tz — Certified Representative Signature — 972 — Certified Rep. No. — 12-15-22 — Date

Scott + Opal — Name of Person Sealing Well or Boring

IMPORTANT-FILE WITH PROPERTY PAPERS-WELL OWNER COPY H 387620

HE-01434-17 ID# 53159 11/18

Appendix C

Monitoring Well Installation Information

resourceful. naturally.
engineering and environmental consultants

BARR

Technical Memorandum

To: File
From: Jim Eidem P.G. and Kevin McGilp
Subject: 2021 – 2023 Monitoring Well Installation
Date: February 7, 2024
Project: Elk River Landfill, Groundwater Corrective Action Work Plan Implementation

This memorandum describes the installation of four new monitoring wells to enhance the existing monitoring well network at Elk River Landfill (ERL). The monitoring well installations were completed as part of the Groundwater Corrective Action Work Plan (Work Plan) (Barr, 2021), as approved by the Minnesota Pollution Control Agency (MPCA). Monitoring well P-339L identified in the Work Plan could not be installed at the proposed location due to the landowner not granting access for a well installation. Therefore, monitoring well P-342L was installed to the east of the proposed P-339L location. The new monitoring wells P-338L, P-340L, P-341L, and P-342L are generally located west of ERL and are shown on Figure 1.

1 Well Installation

Monitoring wells P-338L and P-340L were installed in September, 2021 by Cascade Drilling, LP. (Cascade) using sonic drilling methods and in conformance with Minnesota Rules 4725 (Well Code). The drilling locations required minor brushing and/or leveling prior to setting up the drill rig. The well bores were advanced to the base of the lower outwash and constructed with 2-inch diameter steel riser casing and 2-inch diameter stainless steel well screens 15 feet in length. The well screens were sand packed with #40 mesh Red Flint sand and bentonite chips were installed on top of the sand packs for an intermediate well seal. The remaining annular space of the wells were grouted with neat cement grout by pumping though a tremie pipe from the top of the bentonite seal to the surface. The sonic drill casing was incrementally removed from the well bore between installation of grout batches. A 6-inch diameter protective steel casing was installed over the riser casing and was fitted with a metal locking cap.

In February 2023, a winter road was constructed over swampy ground to access the location of P-342L. Minor brush clearing was required at the drilling location and the well was installed In March 2023. Monitoring well P-341L was constructed in June, 2023 at a location that did not require any site preparation. Both wells were constructed at the base of the lower outwash by Cascade using sonic drilling methods and were constructed the same as described for P-338L and P-340L above. A summary of the monitoring well construction is provided in Table 1 and the well construction records are in Attachment A.

Soil samples from the boreholes were logged by Barr Engineering Co. (Barr) using methods described in ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures). The

well logs are included in Attachment A. The data collected from these boreholes was used to enhance previous geologic cross sections for the ERL site (Figures 2, 3, and 4)

2 Well Development

The monitoring wells were developed by over pumping and surging using a 2-inch diameter submersible pump. Monitoring wells P-338L was developed more than 48 hours after the placement of the neat cement grout. Wells P-340L, P-341L, and P-342L, were developed after the sand pack and bentonite well seal were placed and before the annular space was grouted. Groundwater was pumped from the wells until the water appeared clear and was free of sediment.

3 Investigation Derived Waste

Investigation derived waste (IDW) included soil cuttings and development water. All soil cuttings from the well drilling were placed in 55-gallon drums. Groundwater produced during well development was containerized in either 55-gallon drums or a portable polyethylene tank. The containerized soil and groundwater were brought to the ERL and was placed or thin spread in an area designated by the site manager.

4 References

Barr Engineering Co. (Barr), 2021. Groundwater Corrective Action Work Plan, Elk River Landfill (SW-74), Elk River, Minnesota, prepared for Elk River Landfill, Inc., March, 2021.

Attachments

Table 1 – Well Construction Summary
Figure 1 – Well Locations
Figure 2 – Geologic Cross Section H'-H''
Figure 3 – Geologic Cross Section P-P'
Figure 4 – Geologic Cross Section Q-Q'
Attachment A - Well Logs and Construction Records

Attachments

Table 1
Monitoring Well Construction Details
Elk River Landfill - Groundwater Corrective Action Work Plan
Elk River, Minnesota

Identification Number	Unique Well ID Number	Installation Date	Well Location Coordinates		Top of Casing Elevation (feet MSL)	Ground Elevation (feet MSL)	TD Elevation (feet MSL)	Total Depth (feet bgs)	Total Depth[1] (feet bTOC)	Construction Details					Comments
			Northing	Easting						Diameter (inches)	Casing Material	Screen Material	Screen Length (feet)	Slot Size (inches)	
P-338L	853139	9/17/2021	246826.8	577160.1	961.13	958.3	859.9	98.4	101.2	2	Steel	Stainless Steel	15	0.010	Base of the lower outwash
P-340L	853140	9/14/2021	250146.2	574958.2	946.43	943.8	840.4	103.4	106	2	Steel	Stainless Steel	15	0.010	Base of the lower outwash
P-341L	877298	6/6/2023	245319.9	578868.8	988.58	986.1	843.6	142.5	145	2	Steel	Stainless Steel	15	0.010	Base of the lower outwash
P-342L	871179	3/6/2023	246081.0	574891.7	947.27	943.9	844.8	99.1	102.5	2	Steel	Stainless Steel	15	0.010	Base of the lower outwash

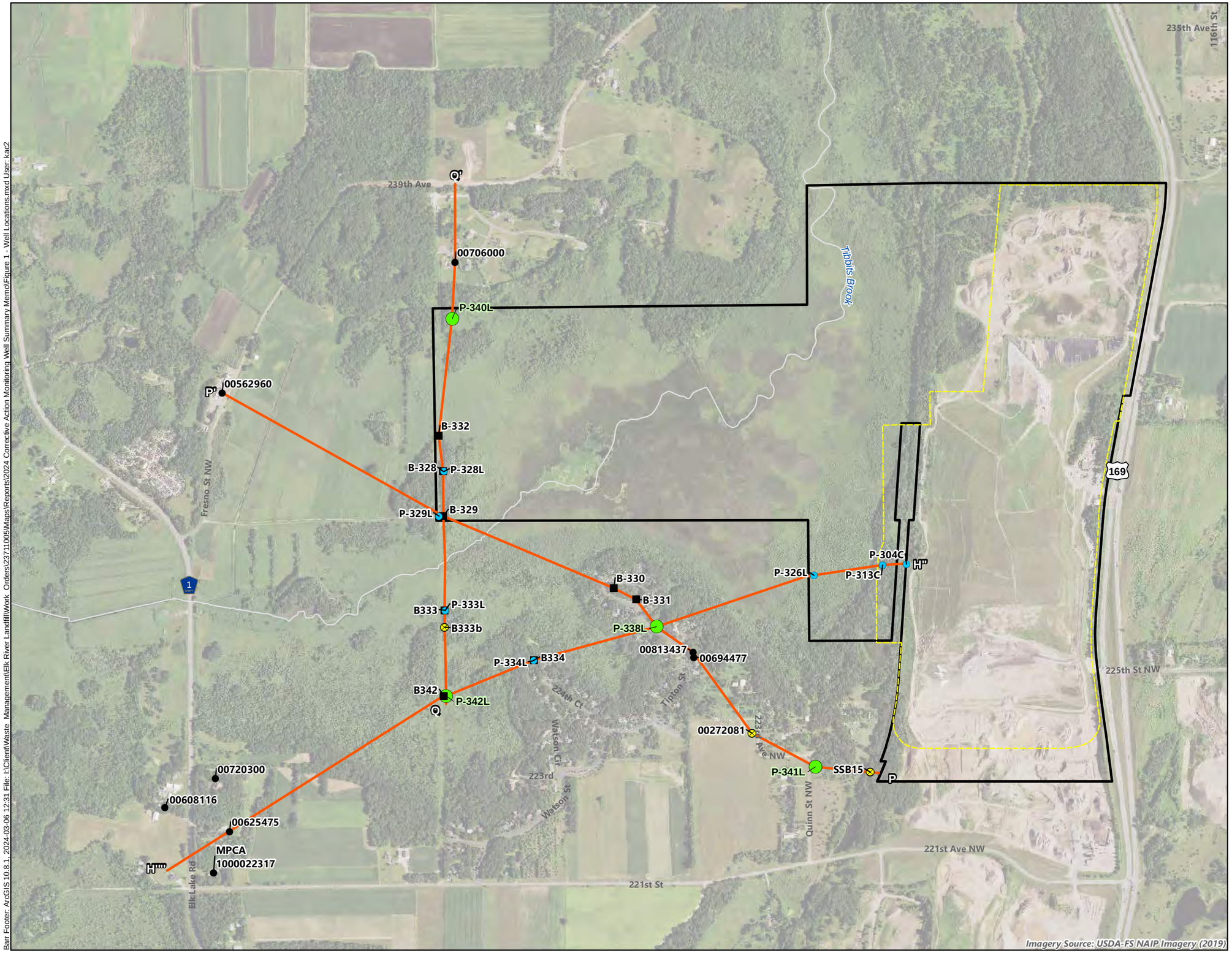
Notes:

[1] Based on field measurement.

MSL - Mean sea level

bgs - Below ground surface

Well Survey Datum: Sherburne County Coordinate System (NAD83 1986 Adjustment). The Elevation Datum is NGVD 29.



Property Boundary

Groundwater Compliance Boundary

Cross Section Location

Monitoring Well (2021-2023)

Vertical Groundwater Profile Boring

Monitoring Well/Piezometer

Residential Well

Soil Boring

Note: Not all wells are shown.

N

Feet

0 1,000 2,000

Figure 1

WELL LOCATIONS
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-06 12:31 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711005\Maps\Reports\2024 Corrective Action Monitoring Well Summary Memo\Figure 1 - Well Locations.mxd User: kac2

Barr Footer: ArcGIS 10.4, 2018-03-27 16:18 File: I:\Projects\23\7111005\Users\kac2\20180102_WP_Cross_Sections\Cross Section H_20180327.mxd User: kac2

P:\Mpls\23 MN\71237111005 ERL - GW Network Development\Work Files\Corrective Action\Implementation\Monitoring Wells\2023\Cross-sections\AI\Figure 5 - Hydrogeologic Cross Section H-H'_20240702.ai User: JCN

H' WEST

H'' EAST

Elevation (ft MSL)

Distance (ft)

Elevation (ft)

S

N

CROSS SECTION H - H'
Note: 7.5x Vertical Exaggeration

1,500 750 0
Feet

666600

B-330

B-331

J. Thompson

M. Barnier (625475)
Thompson (720300)

B342/P-342L

B334/P-334L

P-326L

P-304C

P-313C

B-P304C-6

Rice Lake/Tibbits Brook

Floating Vegetation

UPPER OUTWASH

LOWER OUTWASH

TILL

lk
ow
tl
ow
ow
tl

BEDROCK
(EAU CLAIRE FM.)

EXPLANATION

OUTWASH — Includes the following soil types:
SP: Sand with <5% fines; thin/discontinuous gravel lenses rare to common.
SM: (Where in contact with SP); Silty sand; silt content approximately 30 to 50%.

TILL — Includes the following soil types:
ML: Sandy silt - diamict with approximately 10 to 50% Sand and Gravel; firm to very hard.
CL: Clay textured diamict with varying amounts of sand and gravel; firm to hard.
SM: (Where bounded by ML or CL); Silty sand; silt content approximately 30 to 50%
ML/CL: Silt or clay, <5% sand, massive to thinly bedded

EAU CLAIRE — Eau Claire Formation:
Fine-grained sandstone/siltstone with shale partings present locally.

0 750
Approximate Horizontal Scale in Feet
7.5X Vertical Exaggeration

LEGEND

- Ground Surface (Approximate)
- Geologic Contact (Dashed where approximate)
- October 2023 Groundwater Elevation (Measured in deepest nested well shown on figure)
- Existing Well Screen
- Groundwater Sample Locations
- Approximate/Inferred Extent of Vinyl Chloride Above Health Risk Limits

BARR

Figure 2

HYDROGEOLOGIC CROSS SECTION H"-H'"
Elk River Landfill
Elk River, Minnesota

CROSS SECTION P - P'
Note: 12.5x Vertical Exaggeration

P
SOUTHEAST

P'
NORTHWEST

0 500 1,000
Feet

EXPORTED FROM COREL DRAW.
NO LAYERS MADE FOR UPDATE. TEXT IS CURVES.

Elevation (ft)

Distance (ft)

Approximate Horizontal Scale in Feet
12.5X Vertical Exaggeration

*Geologic contact at base of Lower Outwash taken from P-329L (approx. 150ft West of boring B329) where Till unit is 10ft higher. Underlying groundwater sample was collected from Lower Outwash at boring B329.

LEGEND

- Ground Surface (Approximate)
- Geologic Contact (Dashed where approximate)
- Groundwater Elevation (2016 unless otherwise noted)
- Existing Well Screen
- Former Well Screen
- Groundwater Sample Locations
- Approximate/Inferred Extent of Organics Above Health Risk Limits

EXPLANATION

OUTWASH — Includes the following soil types:
SP: Sand with <5% fines; thin/discontinuous gravel lenses rare to common.
SM: (Where in contact with SP); Silty sand; silt content approximately 30 to 50%.

TILL — Includes the following soil types:
ML: Sandy silt - diamict with approximately 10 to 50% Sand and Gravel; firm to very hard.
CL: Clay textured diamict with varying amounts of sand and gravel; firm to hard.
SM: (Where bounded by ML or CL); Silty sand; silt content approximately 30 - 50%
ML/CL: Silt or clay, <5% sand, massive to thinly bedded

EAU CLAIRE — Eau Claire Formation:
Fine-grained sandstone/siltstone with shale partings present locally.

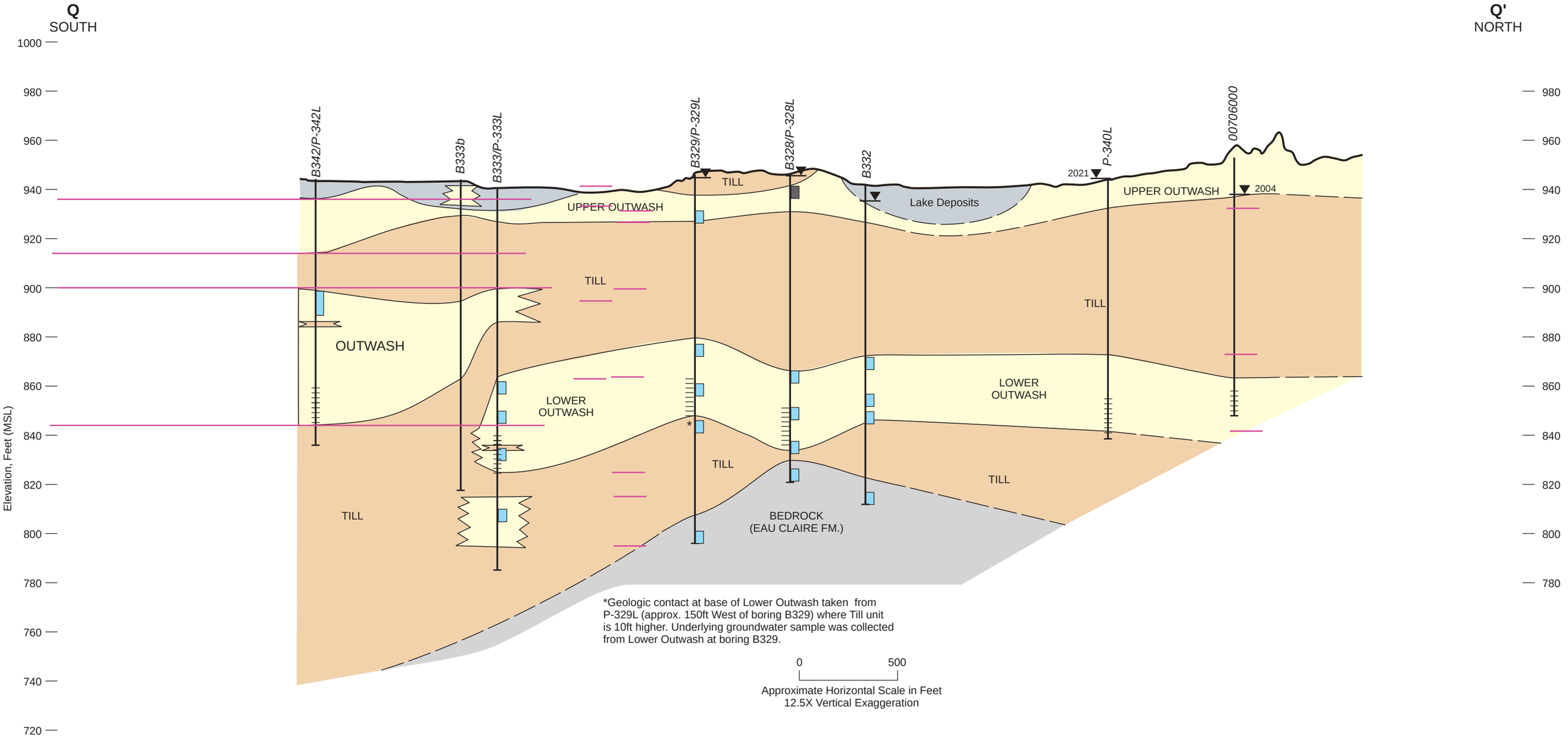
MT. SIMON — Mt. Simon Formation:
Coarse grained quartz sandstone with interbedded siltstone.

Figure 3

HYDROGEOLOGIC CROSS SECTION P-P'
Elk River Landfill
Elk River, Minnesota

Barr Footer: ArcGIS 10.9.1, 2023-10-20 17:44 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711005\Ugeo\GW_CA XS Updates\Cross Section P 500.mxd User: bal

\\barr.com\projects\Mpls\23 MN\71\23711005 ERL, GW Netwrok Development\WorkFiles\Corrective Action\Implementation\Support\Illustrator\Hydrogeologic Cross Section P-P'_20220113.ai User: AKS3



LEGEND

- Ground Surface (Approximate)
- Geologic Contact (Dashed where approximate)
- Groundwater Elevation (2016 unless otherwise noted)
- Existing Well Screen
- Former Well Screen
- Groundwater Sample Locations
- Groundwater Interval Purged Dry

EXPLANATION

- Includes the following soil types:
  SP: Sand with <5% fines; thin/discontinuous gravel lenses rare to common.
  SM: (Where in contact with SP); Silty sand; silt content approximately 30 to 50%.
- Includes the following soil types:
  ML: Sandy silt - diamict with approximately 10 to 50% Sand and Gravel; firm to very hard.
  CL: Clay textured diamict with varying amounts of sand and gravel; firm to hard.
  SM: (Where bounded by ML or CL); Silty sand; silt content approximately 30 - 50%
  ML/CL: Silt or clay, <5% sand, massive to thinly bedded
- Eau Claire Formation:
  Fine-grained sandstone/siltstone with shale partings present locally.

Figure 4

HYDROGEOLOGIC CROSS SECTION Q-Q'
Elk River Landfill
Elk River, Minnesota

\\barr.com\projects\Mpls\23 MN\71\23711005 ERL, GW Network Development\WorkFiles\Corrective Action\Implementation\Support\Illustrator\Hydrogeologic Cross Section Q-Q'_20220113.ai User: AKS3

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-338L

Project:	Elk River Landfill Groundwater Corrective Action	Surface Elevation:	958.3 ft	Top of Casing Elev.:	961.13 ft
Project No.:	23/71-1005.21	Drilling Method:	Sonic	Unique Well No.:	853139
Location:	Elk River, MN	Sampling Method:	Sonic Core		
Coordinates:	N 246,826.8 ft E 577,160.1 ft				
Datum:	Sherburne County Coordinate System	Completion Depth:	115.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		1	SM		SILTY SAND (SM): grass at surface; fine grained; yellowish brown (10YR 5/4); moist; ~15% fines.	6-inch protective casing from 3' ags. to 4' bgs. 2-inch diameter Sch. 40 black steel riser casing from 2.5' ags. to 98.4' bgs.	955
5		2			Color grades to olive gray (5Y 4/2); few medium to coarse grained sand; few roots observed from ~7-8 feet bgs..		950
10		3	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine grained with trace medium to coarse grained; grayish brown (2.5Y 5/2); moist; appears wet below 11 feet bgs; ~10% fines; roots observed at ~10.5 feet bgs.		945
15			SP		POORLY GRADED SAND (SP): fine grained with trace medium to coarse grained; brown (10YR 5/3) with strong brown (7.5YR 4/6) mottles; wet; ~5% fines.		
			SM		SILTY SAND (SM): very fine to fine grained; brown (10YR 5/3); wet; ~15-20% fines.		940
20		4	SP		POORLY GRADED SAND (SP): fine grained with trace medium to coarse grained; brown (10YR 5/3); wet; ~5% fines.		935
25			SP		POORLY GRADED SAND (SP): fine to medium with trace coarse grained; brown (10YR 4/3); wet; trace fines.		930
30		5	SM		SILTY SAND (SM): very fine to fine grained; grayish brown (2.5Y 5/2); wet; ~20% fines.		925
35			SP		POORLY GRADED SAND (SP): fine grained with few to little medium to coarse grained; dark grayish brown (2.5Y 4/2); wet; subangular to subrounded; trace fine gravel at base of unit; <7% fines.		920
40							

Date Boring Started:	9/16/21
Date Boring Completed:	9/17/21
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Mini-sonic

Remarks:
-Well developed more than 48 hours after grouting annular space by surging and overpumping. Approximately 420 gallons purged.
-Final well completion occured on 9-21-2021.

Additional data may have been collected in the field which is not included on this log.

\\EDI-CAD\CAD\GINT\PROJECTS\23711005 ELK RIVER LANDFILL\23711005.21 2021 GW CORRECTIVE ACTION.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-338L

Project:	Elk River Landfill Groundwater Corrective Action	Surface Elevation:	958.3 ft	Top of Casing Elev.:	961.13 ft
Project No.:	23/71-1005.21	Drilling Method:	Sonic	Unique Well No.:	853139
Location:	Elk River, MN	Sampling Method:	Sonic Core		
Coordinates:	N 246,826.8 ft E 577,160.1 ft				
Datum:	Sherburne County Coordinate System	Completion Depth:	115.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
40		6	CL		SANDY LEAN CLAY (CL): ~30% fine to coarse grained sand; dark gray (5Y 4/1); moist; subangular to subrounded; trace to 5% fine gravel; medium plasticity; medium toughness.		
			SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM): medium to coarse grained; dark gray (5Y 4/1); wet; subangular to subrounded; ~20% fine gravel; ~10% fines.		
			CL		SANDY LEAN CLAY (CL): ~30% fine to coarse grained sand; dark gray (5Y 4/1); moist; subangular to subrounded; trace to 5% fine gravel; medium plasticity; medium toughness.		915
			SP-SM		POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM): medium to coarse grained; dark gray (5Y 4/1); wet; subangular to subrounded; ~20% fine gravel; ~10% fines.		
45			CL		LEAN CLAY WITH SAND (CL): ~20% fine to coarse grained sand; very dark gray (5Y 3/1); moist; subangular to subrounded; trace fine gravel; medium plasticity; medium toughness.	– Neat cement grout from ground surface to 91' bgs.	
					SANDY LEAN CLAY (CL): ~30% fine to coarse grained sand; dark gray (5Y 4/1); moist to wet; subangular to subrounded; ~5% fine gravel; trace coarse gravel (up to 1.5"); medium plasticity; medium toughness.		910
50		7					
			CL				905
55							
			SC-CL		CLAYEY SAND TO SANDY LEAN CLAY (SC-CL): ~50% clayey fines; brown (7.5YR 4/2); moist; subangular to subrounded; ~45% fine to coarse grained sand and 5% fine gravel.		900
60		8	SM		SILTY SAND (SM): fine grained with trace medium grained; brown (10YR 4/3); moist; ~30% fines.		
			SP		POORLY GRADED SAND (SP): fine to medium with few coarse grained; brown (10YR 4/3); wet; ~5% fines.		895
65			CL		SANDY LEAN CLAY (CL): ~30% fine to coarse grained sand; brown (7.5YR 4/2); moist; subangular to subrounded; ~30% fine to coarse grained sand and 5% fine gravel; medium plasticity; medium toughness.		
			SC		CLAYEY SAND (SC): fine to medium with some coarse grained; brown (7.5YR 4/2); moist to wet; subangular to subrounded; ~5% fine gravel; ~40% clayey fines.		890
70		9					
			CL		SANDY LEAN CLAY (CL): ~30% fine to coarse grained sand; brown (7.5YR 4/2); moist; subangular to subrounded; ~5% fine gravel.		885
75			SC		CLAYEY SAND (SC): fine to medium with few coarse grained; brown (10YR 4/3); moist to wet; subangular to subrounded; ~5% fine gravel with trace coarse gravel (up to 3").		880
80							

Date Boring Started:	9/16/21
Date Boring Completed:	9/17/21
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Mini-sonic

Remarks:
-Well developed more than 48 hours after grouting annular space by surging and overpumping. Approximately 420 gallons purged.
-Final well completion occured on 9-21-2021.

Additional data may have been collected in the field which is not included on this log.

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Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-338L

Project:	Elk River Landfill Groundwater Corrective Action	Surface Elevation:	958.3 ft	Top of Casing Elev.:	961.13 ft
Project No.:	23/71-1005.21	Drilling Method:	Sonic	Unique Well No.:	853139
Location:	Elk River, MN	Sampling Method:	Sonic Core		
Coordinates:	N 246,826.8 ft E 577,160.1 ft	Completion Depth:	115.0 ft		
Datum:	Sherburne County Coordinate System				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
80		10	SC		CLAYEY SAND (SC): fine to medium with few coarse grained; brown (10YR 4/3); moist to wet; subangular to subrounded; ~5% fine gravel with trace coarse gravel (up to 3"). *(continued)*		
			SC-CL		CLAYEY SAND TO SANDY LEAN CLAY (SC-CL): ~50% clayey fines; brown (7.5YR 4/2); moist; subangular to subrounded; ~45% fine to coarse grained sand and 5% fine gravel.		875
85		11					870
90			SP		POORLY GRADED SAND (SP): fine to medium with little coarse grained; brown (10YR 4/3); wet; subangular to subrounded; ~5% fine gravel; ~5% fines.	Bentonite well seal from 91' to 96' bgs.	865
95		12				Red Flint Sand #40 mesh filter pack from 96' to 115' bgs.	860
100		13					855
105			SP		POORLY GRADED SAND (SP): fine to medium with little coarse grained; dark gray (2.5Y 4/1); wet; subangular to subrounded; ~5% fine gravel with trace coarse gravel (up to 2"); <7% fines.	2-inch diameter Sch. 40 stainless steel, 0.010 slot well screen from 98.4' to 113.4' bgs.	
110		14	SP		POORLY GRADED SAND WITH GRAVEL (SP): fine to medium with little to some coarse grained; dark grayish brown (2.5Y 4/2); wet; ~15% fine to coarse gravel (up to 3"); subangular to subrounded with a few rounded clasts; <7% fines.		850
			CL		SANDY LEAN CLAY (CL): ~30% fine to coarse grained sand; brown (7.5YR 4/2); moist; subangular to subrounded; ~5% fine gravel.	6-inch diameter borehole.	845
115					End of well 115.0 feet		
120							840

Date Boring Started:	9/16/21
Date Boring Completed:	9/17/21
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Mini-sonic

Remarks:
-Well developed more than 48 hours after grouting annular space by surging and overpumping. Approximately 420 gallons purged.
-Final well completion occured on 9-21-2021.

Additional data may have been collected in the field which is not included on this log.

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MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING CONSTRUCTION RECORD
Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO. 853139

WELL OR BORING LOCATION

County Name: Sherburne

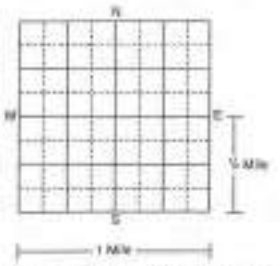
Township Name	Township No.	Range No.	Section No.	Fraction (qtr. → lg.)
Elk River	33	26	4	SE SE NW

WELL/BORING DEPTH (completed): 114 ft. | DATE WORK COMPLETED: 9-17-21

GPS LOCATION — decimal degrees (to four decimal places). Latitude _____ Longitude _____

House Number, Street Name, City, and ZIP Code of Well Location: Outlot D, 225th Ct Elk River 55330

Show exact location of well/boring in section grid with "X". Sketch map of well/boring location. Showing property lines, roads, buildings, and direction.



GEF MAP

DRILLING METHOD: ☐ Cable Tool ☐ Auger ☐ Other ☐ Driven ☐ Rotary ☒ Rotasonic ☐ Dual Rotary

DRILLING FLUID: N/A

WELL HYDROFRACTURED? ☐ Yes ☒ No From _____ ft. To _____ ft.

USE: ☐ Domestic ☐ Noncommunity PWS ☐ Community PWS ☐ Elevator ☒ Monitoring ☐ Irrigation ☐ Dewatering ☐ Heating/Cooling ☐ Industry/Commercial ☐ Remedial ☐ _____

CASING MATERIAL: ☒ Steel ☐ Plastic — Drive Shoe? ☐ Yes ☒ No — ☒ Threaded ☐ Welded ☐ _____

CASING Diameter / Weight / Specifications

2 in. To 99 ft.	lbs./ft.	SCH 40	6 in. To 114 ft.
in. To ft.	lbs./ft.		in. To ft.
in. To ft.	lbs./ft.		in. To ft.

HOLE DIAM.

SCREEN: YES — Make: Johnson — Type: SS — Slot/Gauze: .010 — Set between: 114 ft. and 99 ft.

OPEN HOLE From _____ ft. To _____ ft. — Diam. 24" — Length 15' — FITTINGS: Tee

STATIC WATER LEVEL: 15 ft. ☒ Below ☐ Above land surface — Date measured: 9-17-21 — Dry hole ☐ Yes ☒ No

PUMPING LEVEL (below land surface): N/A ft. after _____ hrs. pumping _____ g.p.m.

WELLHEAD COMPLETION: ☐ Pitless/adaptor manufacturer _____ Model _____ ☒ Casing protection Retop ☒ 12 in. above grade ☐ At-grade ☐ Well House ☐ Hand Pump

GROUT INFORMATION (specify bentonite, cement-sand, neat-cement, concrete, cuttings, or other)

Material: Neat Cmt	From 91	To 0 ft.	15	☐ Yds. ☒ Bags
Material:	From	To ft.		☐ Yds. ☐ Bags
Material:	From	To ft.		☐ Yds. ☐ Bags

Driven casing seal: From _____ To _____ Bags — One bag = 94 lbs. cement or 50 lbs. bentonite

NEAREST KNOWN SOURCE OF CONTAMINATION: Well is _____ feet _____ direction from _____ type: _____ Well disinfected upon completion? ☐ Yes ☒ No

PUMP: ☒ Not installed Date installed _____ Manufacturer's name _____ Model Number _____ HP _____ Volts _____ Length of drop pipe _____ ft. Capacity _____ g.p.m. Type: ☐ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ _____

ABANDONED WELLS: Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

VARIANCE: Was a variance granted from the MDH for this well? ☐ Yes ☒ No TN# _____

WELL CONTRACTOR CERTIFICATION

This well was drilled under my supervision and in accordance with Minnesota Rules, chapter 4725. The information contained in this report is true to the best of my knowledge.

Cascade Drilling — Lic. or Reg. No. 3267
Licensee Business Name

Bell Berg — 2657 — 11-4-21
Certified Representative Signature — Certified Rep. No. — Date

Roy Buckenberger
Name of Driller

WELL OWNER'S NAME/COMPANY NAME: Elk River Landfill Inc

Well/boring owner's mailing address if different than property owner's address indicated above: 22460 Hwy 169 NW, Elk River, MN 55330

PROPERTY OWNER'S NAME/COMPANY NAME: Ridges of Rice HOA

Property owner's mailing address if different than well location address indicated above: 12656 224th Ct NW, Elk River, MN 55330

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Sand	BR	S	0	50
Silty Sand	BR	S	58	68
Sand + Silt	~~BR~~ GR	S	68	102
Sand	GR	S	102	114

Use a second sheet, if needed.

REMARKS, ELEVATION, SOURCE OF DATA, etc.: 17-21-1056 P-338 L

MINN DEPT. OF HEALTH COPY 853139

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-340L

Project:	Elk River Landfill Groundwater Corrective Action	Surface Elevation:	943.8 ft	Top of Casing Elev.:	946.43 ft
Project No.:	23/71-1005.21	Drilling Method:	Sonic	Unique Well No.:	853140
Location:	Elk River, MN	Sampling Method:	Sonic Core		
Coordinates:	N 250,146.2 ft E 574,958.2 ft	Completion Depth:	105.0 ft		
Datum:	Sherburne County Coordinate System				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0			OL/OH		ORGANIC SOIL (OL/OH): sandy; very dark brown (10YR 2/2); moist; abundant small roots.		
		1	SM		SILTY SAND (SM): very fine to fine grained; brown (10YR 5/3); moist; ~15-20% fines; becomes mottled with very dark gray (2.5Y 3/1) below 5 feet bgs.	6-inch protective casing from 3' ags. to 4' bgs. 2-inch diameter Sch. 40 black steel riser casing from 2.5' ags to 88.4' bgs.	940
5							
10		2					935
			CL		SANDY LEAN CLAY (CL): dark gray (5Y 4/1); moist; subangular to subrounded; ~20% fine to coarse grained sand; trace to 5% fine gravel; trace coarse gravel; medium plasticity; medium toughness.		930
15							
20		3					925
25			SC-CL		CLAYEY SAND TO SANDY LEAN CLAY (SC-CL): ~50% clayey fines; brown (7.5YR 4/2); moist to wet; subangular to subrounded; ~40-45% fine to coarse grained sand and 5-10% fine to coarse gravel (up to 3").		920
30		4					915
35					Lens of Silty Sand (SM) from approximately 36-38 feet bgs.; fine to medium with few coarse grained; dark grayish brown (10YR 4/2); wet; subangular to subrounded; ~20% fines.		910
40							905

Date Boring Started:	9/14/21
Date Boring Completed:	9/14/21
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Mini-sonic

Remarks:
-Well developed prior to grouting annular space by surging and overpumping. Approximately 520 gallons purged.
-Final well completion occured on 9-21-2021.

Additional data may have been collected in the field which is not included on this log.

\\EDI-CAD\CAD\GINT\PROJECTS\23711005 ELK RIVER LANDFILL\23711005.21 2021 GW CORRECTIVE ACTION.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-340L

Project:	Elk River Landfill Groundwater Corrective Action	Surface Elevation:	943.8 ft	Top of Casing Elev.:	946.43 ft
Project No.:	23/71-1005.21	Drilling Method:	Sonic	Unique Well No.:	853140
Location:	Elk River, MN	Sampling Method:	Sonic Core		
Coordinates:	N 250,146.2 ft E 574,958.2 ft	Completion Depth:	105.0 ft		
Datum:	Sherburne County Coordinate System				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
40		5				Neat cement grout from ground surface to 80' bgs.	
					Lens of Silty Sand (SM) from approximately 43.3-44 feet bgs.; fine to medium with little coarse grained; brown (7.5YR 4/2); wet; subangular to subrounded; ~20-25% fines.		900
45							
							895
50		6					
			SM-SC		SILTY TO CLAYEY SAND (SM-SC): fine to medium with few coarse grained; brown (7.5YR 4/2); moist to wet; subangular to subrounded; ~5-10% fine gravel; trace coarse gravel; ~40% fines.		890
55			SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine to coarse grained; dark grayish brown (10YR 4/2); wet; subangular to subrounded; ~5% fine gravel increases with depth to ~10-15%; some coarse gravel below ~57 feet bgs; ~10% fines.		
							885
60		7	SM		SILTY SAND (SM): fine to medium with trace coarse grained; brown (7.5YR 4/2); moist to wet; subangular to subrounded; ~5% fine gravel; ~40% fines.		
					Lens of Silt (ML) from approximately 64-64.4 feet bgs; brown (7.5YR 4/2); moist to wet; rapid dilatancy.		880
65							
							875
70		8					
			SP		POORLY GRADED SAND (SP): fine to medium with few coarse grained; brown (10YR 4/3); wet; subangular to subrounded; a little coarse grained sand with trace to 5% fine gravel below 101 feet bgs; coarse gravel (5-6 pieces) at base; trace fines; The 75-85' and 85-95' sample intervals fell out during extraction and were not recovered. Core barrel sample residuals recovered from these intervals are consistant with poorly graded sand as described. Driller reported heaving sands for these intervals.		870
75							
							865
80							

Date Boring Started:	9/14/21
Date Boring Completed:	9/14/21
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Mini-sonic

Remarks:
-Well developed prior to grouting annular space by surging and overpumping. Approximately 520 gallons purged.
-Final well completion occured on 9-21-2021.

Additional data may have been collected in the field which is not included on this log.

\\EDI-CAD\CAD\GINT\PROJECTS\23711005 ELK RIVER LANDFILL\23711005.21 2021 GW CORRECTIVE ACTION.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-340L

Project:	Elk River Landfill Groundwater Corrective Action	Surface Elevation:	943.8 ft	Top of Casing Elev.:	946.43 ft
Project No.:	23/71-1005.21	Drilling Method:	Sonic	Unique Well No.:	853140
Location:	Elk River, MN	Sampling Method:	Sonic Core		
Coordinates:	N 250,146.2 ft E 574,958.2 ft	Completion Depth:	105.0 ft		
Datum:	Sherburne County Coordinate System				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
80		9			POORLY GRADED SAND (SP): fine to medium with few coarse grained; brown (10YR 4/3); wet; subangular to subrounded; a little coarse grained sand with trace to 5% fine gravel below 101 feet bgs; coarse gravel (5-6 pieces) at base; trace fines; The 75-85' and 85-95' sample intervals fell out during extraction and were not recovered. Core barrel sample residuals recovered from these intervals are consistant with poorly graded sand as described. Driller reported heaving sands for these intervals. *(continued)*	Bentonite well seal from 80' to 85' bgs.	860
85						Red Flint Sand #40 mesh filter pack from 88.4' to 105' bgs.	855
90		10	SP				850
95						Sch. 40 stainless steel, 0.010 slot well screen from 88.4' to 103.4' bgs.	845
100		11					840
105			CL		SANDY LEAN CLAY (CL): brown to dark brown (7.5YR 3.5/2); moist to wet; subangular to subrounded; ~40% fine to coarse grained sand and 5% mostly fine gravel with trace coarse gravel (up to 1.75"); medium plasticity; medium toughness.	6-inch diameter borehole	835
110					End of well 105.0 feet		830
115							825
120							

Date Boring Started:	9/14/21
Date Boring Completed:	9/14/21
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Mini-sonic

Remarks:
-Well developed prior to grouting annular space by surging and overpumping. Approximately 520 gallons purged.
-Final well completion occured on 9-21-2021.

Additional data may have been collected in the field which is not included on this log.

\\EDI-CAD\CAD\GINT\PROJECTS\23711005 ELK RIVER LANDFILL\23711005.21 2021 GW CORRECTIVE ACTION.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

WELL OR BORING LOCATION

County Name: Sherburne

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING CONSTRUCTION RECORD
Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO.: 853140

Township Name	Township No.	Range No.	Section No.	Fraction (qtr. — smallest to largest)
Elk River	34	26	33	NW SW SW

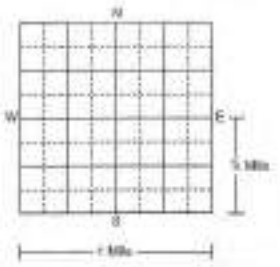
WELL/BORING DEPTH (completed): 103 ft.

DATE WORK COMPLETED: 9-14-21

GPS LOCATION — decimal degrees (to four decimal places). Latitude _____ Longitude _____

House Number, Street Name, City, and ZIP Code of Well Location: 22460 Hwy 169, Elk River 55330

Show exact location of well/boring in section grid with "X." Sketch map of well/boring location. Showing property lines, roads, buildings, and direction.



SEE MAP

PROPERTY OWNER'S NAME/COMPANY NAME: Elk River Landfill INC

Property owner's mailing address if different than well location address indicated above.
22460 Hwy 169 NW
Elk River, MN 55330

WELL OWNER'S NAME/COMPANY NAME: Same

Well/boring owner's mailing address if different than property owner's address indicated above.
Same

DRILLING METHOD: ☐ Cable Tool ☐ Auger ☐ Other ☐ Driven ☐ Rotary ☐ Dual Rotary ☒ Reverse

DRILLING FLUID: N/A

WELL HYDROFRACTURED? ☐ Yes ☒ No From _____ ft. To _____ ft.

USE: ☐ Domestic ☒ Monitoring ☐ Heating/Cooling ☐ Noncommunity PWS ☐ Irrigation ☐ Industry/Commercial ☐ Community PWS ☐ Dewatering ☐ Remedial ☐ Elevator ☐ _____

CASING MATERIAL: ☒ Steel ☐ Plastic — Drive Shoe? ☐ Yes ☒ No — ☒ Threaded ☐ Welded ☐ _____

HOLE DIAM.

CASING: Diameter / Weight / Specifications

Diameter	Weight	Specifications	Hole Diam.
2 in. To 88 ft.	_____ lbs./ft.	SCH 40	6 in. To 103 ft.
_____ in. To _____ ft.	_____ lbs./ft.	_____	_____ in. To _____ ft.
_____ in. To _____ ft.	_____ lbs./ft.	_____	_____ in. To _____ ft.

SCREEN: YES — Make: Johnson — Type: SS — Slot/Gauze: .010 — Set between 103 ft. and 88 ft. — Diam. 2" — Length 15' — FITTINGS T+C

OPEN HOLE: From _____ ft. To _____ ft.

STATIC WATER LEVEL: Ground ft. ☒ Below ☐ Above land surface — Date measured 9-14-21 — Dry hole ☐ Yes ☒ No

PUMPING LEVEL (below land surface): N/A ft. after _____ hrs. pumping _____ g.p.m.

WELLHEAD COMPLETION: ☐ Pitless adapter manufacturer: _____ Model: _____ ☒ Casing protection: Protop 10 in. above grade ☐ At-grade ☐ Well House ☐ Hand Pump

GROUT INFORMATION (specify bentonite, cement-sand, neat cement, concrete, cuttings, or other)

Material	From	To		
Neat cement	81 ft.	0 ft.	☐ Yds.	☒ Bags
_____	_____ ft.	_____ ft.	☐ Yds.	☐ Bags
_____	_____ ft.	_____ ft.	☐ Yds.	☐ Bags

Driven casing seal: From _____ To _____ Bags — One bag = 94 lbs. cement or 50 lbs. bentonite

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
SAND	BR	S	0	52
Silty SAND	BR	S	52	67
SAND + Silt	GR	S	67	93
SAND	GR	S	93	103

Use a second sheet, if needed.

NEAREST KNOWN SOURCE OF CONTAMINATION: Well is _____ feet _____ direction from _____ type

Well disinfected upon completion? ☐ Yes ☒ No

PUMP: ☒ Not installed — Date installed _____ — Manufacturer's name _____ — Model Number _____ HP _____ Volts _____ — Length of drop pipe _____ ft. Capacity _____ g.p.m. — Type: ☐ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ _____

ABANDONED WELLS: Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

VARIANCE: Was a variance granted from the MDH for this well? ☐ Yes ☒ No TNI _____

REMARKS, ELEVATION, SOURCE OF DATA, etc.
11-21-1056
P 340 L

WELL CONTRACTOR CERTIFICATION

This well was drilled under my supervision and in accordance with Minnesota Rules, chapter 4725. The information contained in this report is true to the best of my knowledge.

Cascade Drilling — 3267
Licensee Business Name — Lic. or Reg. No.

Bill Berg — 2651 — 11-4-21
Certified Representative Signature — Certified Reg. No. — Date

Roy Buckenberger
Name of Driller

MINN DEPT. OF HEALTH COPY

853140

ID #33903

HE-01205-16 (Rev.3/19)

Barr Engineering Co.
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-341L

Project:	Elk River Landfill, 2023 Groundwater Corrective Action	Surface Elevation:	986.1 ft	
Project No.:	23/71-1005.23	Drilling Method:	Sonic	Unique Well No.: 877298
Location:	Elk River, MN	Sampling Method:	4" Sonic Core	
Coordinates:	N 245,319.9 ft E 578,868.8 ft			
Datum:	Sherburne County Coordinate System	Completion Depth:	145.0 ft	

Depth, feet	Sample No.	USCS	LITHOLOGIC DESCRIPTION
0		SM	SILTY SAND (SM): grass and roots at surface: fine grained with trace medium to coarse grained sand and fine gravel; brown (7.5YR 4/3); moist; subangular to subrounded; approximately 20% fines decrease with depth. [topsoil].
5	1	SP-SM	POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained with ~10-15% coarse grained fraction; trace-5% fine gravel; dark yellowish brown (10YR 4/4); moist; subangular to subrounded; approximately 10% fines. [outwash].
10	2		POORLY GRADED SAND (SP): fine grained with ~10% medium and trace coarse grained sand and fine gravel; brown (10YR 5/3); moist; subangular to subrounded; approximately 5% fines. [outwash].
15	3		
20			20-22 feet - dark yellowish brown (10YR 4/4) lens containing ~15% coarse grained sand fraction and 10% fine gravel.
25	4	SP	26-27 feet - dark yellowish brown (10YR 4/4) lens containing ~15% coarse grained sand fraction and 10% fine gravel.
30			
35	5		
40			

WELL OR PIEZOMETER CONSTRUCTION DETAIL

- PRO. CASING
  - Diameter: **6"**
  - Type: **Sch. 40 Steel**
  - Interval: **3' ags - 4' bgs**
- RISER CASING
  - Diameter: **2"**
  - Type: **Sch. 40 Steel**
  - Interval: **2.5' ags-127.5' bgs**
- GROUT
  - Type: **Neat Cement**
  - Interval: **0'-120.5'**
- SEAL
  - Type: **Bentonite**
  - Interval: **120.5'-124.8'**
- SANDPACK
  - Type: **#40 Red Flint**
  - Interval: **124.8'-142.5'**
- SCREEN
  - Diameter: **2"**
  - Type: **Stainless Steel**
  - Interval: **127.5'-142.5'**

Elevation, feet: 985, 980, 975, 970, 965, 960, 955, 950

Date Boring Started:	6/1/23 12:30 pm
Date Boring Completed:	6/6/23 10:00 am
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Tracked mini-sonic

Remarks:

Additional data may have been collected in the field which is not included on this log.

M:\GIN\PROJECTS\23711005 ELK RIVER LANDFILL\23711005.23 2023 GROUNDWATER.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Co.
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-341L

Project:	Elk River Landfill, 2023 Groundwater Corrective Action	Surface Elevation:	986.1 ft	
Project No.:	23/71-1005.23	Drilling Method:	Sonic	Unique Well No.: 877298
Location:	Elk River, MN	Sampling Method:	4" Sonic Core	
Coordinates:	N 245,319.9 ft E 578,868.8 ft			
Datum:	Sherburne County Coordinate System	Completion Depth:	145.0 ft	

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	Elevation, feet
40					POORLY GRADED SAND (SP): fine to medium grained with ~10% coarse grained fraction; 5% fine gravel; dark yellowish brown (10YR 4/4); wet; subangular to subrounded; trace to 5% fines. [outwash].	945
45		6	SP		POORLY GRADED SAND WITH GRAVEL (SP): medium to coarse grained with ~20% fine grained fraction; ~15-20% fine gravel; dark yellowish brown (10YR 4/4); wet; subangular to subrounded; trace to 5% fines. [outwash].	940
50			SP		POORLY GRADED SAND (SP): fine to medium grained with ~5% coarse grained fraction; trace fine gravel; brown (10YR 4/3); wet; subangular to subrounded; approximately 5% fines. [outwash].	935
55		7	SP		53 feet - 1" thick, brown (10YR 5/3), laminated silt lens. 54.6 feet - 1" thick, brown (10YR 5/3), laminated silt lens. 58 feet - 1" thick, brown (10YR 5/3), laminated silt lens.	930
60			ML		SILT (ML): gray (5Y 5/1); moist to wet; cohesive; low plasticity; slow dilatancy; low toughness; strong HCl reaction; [lacustrine deposit].	925
65		8				920
70			CL		SANDY LEAN CLAY (CL): ~30% fine to coarse grained sand; ~5-10% fine gravel; very dark gray (5Y 3/1); moist; hard; abundant carbonate gravel; medium plasticity; medium toughness; strong HCl reaction; [till]. 70-72.5 feet - dark gray (5Y 4/1) bed of poorly graded sand with silt and gravel (SP-SM); fine to medium grained with ~20% coarse grained fraction and ~15% fine gravel; ~10% fines; appears wet; abundant carbonates. [outwash lens].	915
75		9				910
80						

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: **6"**
Type: **Sch. 40 Steel**
Interval: **3' ags - 4' bgs**

RISER CASING
Diameter: **2"**
Type: **Sch. 40 Steel**
Interval: **2.5' ags-127.5' bgs**

GROUT
Type: **Neat Cement**
Interval: **0'-120.5'**

SEAL
Type: **Bentonite**
Interval: **120.5'-124.8'**

SANDPACK
Type: **#40 Red Flint**
Interval: **124.8'-142.5'**

SCREEN
Diameter: **2"**
Type: **Stainless Steel**
Interval: **127.5'-142.5'**

Date Boring Started:	6/1/23 12:30 pm
Date Boring Completed:	6/6/23 10:00 am
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Tracked mini-sonic

Remarks:

Additional data may have been collected in the field which is not included on this log.

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Barr Engineering Co.
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-341L

Project:	Elk River Landfill, 2023 Groundwater Corrective Action	Surface Elevation:	986.1 ft	
Project No.:	23/71-1005.23	Drilling Method:	Sonic	Unique Well No.: 877298
Location:	Elk River, MN	Sampling Method:	4" Sonic Core	
Coordinates:	N 245,319.9 ft E 578,868.8 ft			
Datum:	Sherburne County Coordinate System	Completion Depth:	145.0 ft	

Depth, feet	Sample Type & Recovery	Sample No.	USCS	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
80			CL			905
				CLAYEY SAND (SC): ~55% fine to medium grained sand with ~10% coarse grained fraction; ~5% fine and trace coarse gravel; ~40% clayey fines; brown (7.5YR 4/2); moist to wet; soft; cohesive; low plasticity; low toughness; weak HCl reaction; [till].	PRO. CASING Diameter: 6" Type: Sch. 40 Steel Interval: 3' ags - 4' bgs	
85		10	SC			900
					RISER CASING Diameter: 2" Type: Sch. 40 Steel Interval: 2.5' ags-127.5' bgs	
90			SM	SILTY SAND (SM): fine to medium grained with ~10% coarse grained fraction; ~5% fine gravel; brown (7.5YR 4/2); wet; subangular to subrounded; approximately 15% fines [outwash].		895
			SP	POORLY GRADED SAND (SP): fine to medium grained with ~10-15% coarse grained fraction; 5-10% fine and trace coarse gravel; brown (7.5YR 4/2); wet; subangular to subrounded; two cobbles (3" & 4") present at ~92 feet bgs; trace fines. [outwash].	GROUT Type: Neat Cement Interval: 0'-120.5'	
95		11				890
			SM	SILTY SAND (SM): fine to medium grained with trace fine gravel at bottom; brown (7.5YR 4/2); wet; subangular to subrounded; approximately 40% fines. [outwash].	SEAL Type: Bentonite Interval: 120.5'-124.8'	
				SILTY TO CLAYEY SAND WITH GRAVEL: (SM/SC); approximately 50% sand/gravel and 50% silty to clayey fines; cohesive; hard; brown (7.5YR 4/2); moist; subangular to subrounded; fine to medium grained sand with ~15% coarse grained fraction; ~15% fine and trace coarse gravel; low to medium plasticity; low toughness; weak HCl reaction; [till].	SANDPACK Type: #40 Red Flint Interval: 124.8'-142.5'	
100						885
					SCREEN Diameter: 2" Type: Stainless Steel Interval: 127.5'-142.5'	
105		12				880
110			SP	POORLY GRADED SAND (SP): fine grained with ~15% medium to coarse grained fraction; trace fine gravel; grayish brown (2.5Y 5/2); wet; subangular to subrounded; approximately 5% fines. [outwash].		875
115		13				870
			SP	POORLY GRADED SAND (SP): fine to medium grained with ~10% coarse grained fraction; ~5% fine gravel; light olive brown (2.5Y 5/4); wet; subangular to subrounded; approximately 5% fines; several fining upwards sequences observed. [outwash].		
120						

Date Boring Started:	6/1/23 12:30 pm
Date Boring Completed:	6/6/23 10:00 am
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Tracked mini-sonic

Remarks:

Additional data may have been collected in the field which is not included on this log.

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Barr Engineering Co.
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-341L

Project:	Elk River Landfill, 2023 Groundwater Corrective Action	Surface Elevation:	986.1 ft	
Project No.:	23/71-1005.23	Drilling Method:	Sonic	Unique Well No.: 877298
Location:	Elk River, MN	Sampling Method:	4" Sonic Core	
Coordinates:	N 245,319.9 ft E 578,868.8 ft			
Datum:	Sherburne County Coordinate System	Completion Depth:	145.0 ft	

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	Elevation, feet
120					POORLY GRADED SAND (SP): fine to medium grained with ~10% coarse grained fraction; ~5% fine gravel; light olive brown (2.5Y 5/4); wet; subangular to subrounded; approximately 5% fines; several fining upwards sequences observed. [outwash]. *(continued)*	865
125		14			125-127 feet - ~20% coarse grained sand fraction; ~5-10% fine and trace coarse gravel; trace fines.	860
130			SP		131.5-132.5 feet - ~20% coarse grained sand fraction; ~5-10% fine and trace coarse gravel; trace fines.	855
135		15			136-137.5 feet - a few coarse gravel pieces throughout interval.	850
140					140-141 feet - ~20% coarse grained sand fraction; ~5% fine and trace to 5% coarse gravel; one 3" cobble; ~5% fines; oxidized rusty brown at base.	845
		16	CL		SAND LEAN CLAY (CL): ~65% clayey fines; ~30% fine to coarse grained sand; trace to 5% fine gravel; very dark gray (5Y 3/1); moist; subangular to subrounded; very hard; abundant carbonates; medium to high plasticity; medium toughness; strong HCl reaction; [till].	
145					End of well 145.0 feet	840
150						835
155						830
160						

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: **6"**
Type: **Sch. 40 Steel**
Interval: **3' ags - 4' bgs**

RISER CASING
Diameter: **2"**
Type: **Sch. 40 Steel**
Interval: **2.5' ags-127.5' bgs**

GROUT
Type: **Neat Cement**
Interval: **0'-120.5'**

SEAL
Type: **Bentonite**
Interval: **120.5'-124.8'**

SANDPACK
Type: **#40 Red Flint**
Interval: **124.8'-142.5'**

SCREEN
Diameter: **2"**
Type: **Stainless Steel**
Interval: **127.5'-142.5'**

Date Boring Started:	6/1/23 12:30 pm
Date Boring Completed:	6/6/23 10:00 am
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Tracked mini-sonic

Remarks:

Additional data may have been collected in the field which is not included on this log.

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MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING CONSTRUCTION RECORD

Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO. 877298

WELL OR BORING LOCATION

County Name: SHERBURNE

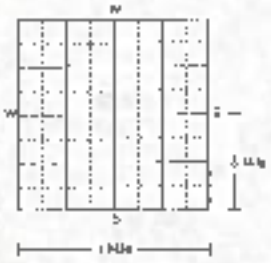
Township Name	Township No.	Range No.	Section No.	Fraction (sm. — sq.)
Elk River	33 N	25 W	4	NW SE SE

GPS LOCATION — decimal degrees (6 to 8 decimal places)

Latitude _____ Longitude _____

House Number, Street Name, City, and ZIP Code of Well Location: Rural Vacant (Dawn St NW) Elk River

Show exact location of well/boring in section grid with "X". Sketch map of well/boring location. Show property lines, roads, buildings, and direction.



See MAP

PROPERTY OWNER'S NAME/COMPANY NAME: Elk River Landfill INC

Property owner's mailing address (if different than well location address indicated above):

22460 HWY 169 NW
Elk River, MN 55330

WELL OWNER'S NAME/COMPANY NAME: Same

Well/boring owner's mailing address (if different than property owner's address indicated above): Same

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Top Soil	BL	S	0	6
Sand	G	S	6	31
Sand & Clay	BR	M	31	34
Sand & Gravel	BR	M	34	142.5

(Use a separate sheet, if needed)

REMARKS, ELEVATION, SOURCE OF DATA, etc.

117-23-1026
P-341 L

MNN DEPT OF HEALTH COPY 877298

WELL/BORING DEPTH (completed): 142.5

DATE WORK COMPLETED: 6-5-23

DRILLING METHOD: ☐ Cable Tool ☐ Auger ☐ Other ☐ Driven ☐ Rotary ☒ Dual Rotary

DRILLING FLUID: N/A

WELL HYDROFRACTURED? ☐ Yes ☒ No From _____ ft. To _____ ft.

USE: ☐ Domestic ☐ Noncommunity PWS ☐ Community PWS ☐ Elevator ☒ Monitoring ☐ Irrigation ☐ Dewatering ☐ Heating/Cooling ☐ Industry/Commercial ☐ Remedial ☐ _____

CASING MATERIAL: ☒ Steel ☐ Plastic ☐ _____ Drive Shoe? ☐ Yes ☒ No ☒ Threaded ☐ Welded

CASING: Diameter 2 in. To 122.5 ft. Weight _____ lbs./ft. Specifications SCH 40

WELL HOUSE: 6 in. To 18 in.

SCREEN: YES Make Johnson Type SS Diameter 2 in. Slot/Gauge .010 Length 15 ft. Set between 142.5 ft. and 122.5 ft. FITTINGS T&C

OPEN HOLE: From _____ ft. To _____ ft.

STATIC WATER LEVEL: 39 ft. ☒ Below ☐ Above land surface. Date measured 6-5-23 Dry hole? ☒ Yes ☐ No

PUMPING LEVEL (below land surface): _____ ft. after _____ hrs. pumping _____ gpm

WELLHEAD COMPLETION: Flowstand or pump manufacturer _____ Model _____ Casing protection: ☒ 12" above grade ☐ At grade ☐ Well Pit/Pit ☐ Inhibited Pump

GROUT INFORMATION (specify bentonite, cement, sand, neat cement, concrete, cuttings, or other)

	From	To		
Material: Neat Cement	120 ft.	0 ft.	17	☐ Yds. ☒ Bags
Material: _____	_____ ft.	_____ ft.	_____	☐ Yds. ☐ Bags
Material: _____	_____ ft.	_____ ft.	_____	☐ Yds. ☐ Bags

Grout casing seal: From _____ To _____ Bags. One bag = 94 lbs. cement or 50 lbs. bentonite

NEAREST KNOWN SOURCE OF CONTAMINATION: Well is _____ feet _____ direction from _____ type

Well disinfected upon completion? ☐ Yes ☒ No

PUMP: ☒ Not installed ☐ Date installed _____

Manufacturer's name _____

Model Number _____ HP _____ Volts _____

Length of drop pipe _____ ft. Capacity _____ gpm

Type: ☐ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ _____

ABANDONED WELLS: Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

VARIANCE: Was a variance granted from the MDH for this well? ☐ Yes ☒ No If Yes, explain _____

WELL CONTRACTOR CERTIFICATION

This well was drilled under my supervision and in accordance with Minnesota Rules, chapter 4725. The information contained in this report is true to the best of my knowledge.

Cascade Drilling LP — 3267
Licensee Business Name — Lic. or Reg. No.

Brad Berg — 2657 — 6/13/23
Certified Representative Signature — Certification No. — Date

Travis Wm. Hoffer
Name of Driller

TC-01225-18 (Rev. 2/18)

Barr Engineering Co.
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-342L

Project:	Elk River Landfill, 2023 Groundwater Corrective Action	Surface Elevation:	943.9 ft	
Project No.:	23/71-1005.23	Drilling Method:	Sonic	Unique Well No.: 871179
Location:	Elk River, MN	Sampling Method:	4" Sonic Core	
Coordinates:	N 246,081.0 ft E 574,891.7 ft			
Datum:	Sherburne County Coordinate System	Completion Depth:	110.0 ft	

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	Elevation, feet
0					Ice, reed sedge with some organic soil.	
		1	PT		PEAT (PT): fibric grading to sapric at the base; top 3" frozen then wet; soft; [wetland deposit].	
5						940
		2	SM		SILTY SAND (SM): fine grained with ~5% medium to coarse grained fraction; dark olive gray (5Y 3/2); wet; loose; approximately 30% fines. [fine alluvium].	
10						935
		3	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine grained with trace to 5% medium and trace coarse grained fractions; dark gray (5Y 4/1); wet; approximately 10% fines. [fine alluvium/outwash].	
15						930
		4				
20						925
		5				
25						920
30		6	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained with ~trace to 5% coarse grained fraction and ~5% gravel; gray (5Y 4/1); wet; subangular to subrounded; abundant carbonate gravel; approximately 5-10% fines. [outwash].	915
					LEAN TO FAT CLAY (CL/CH): ~85% fines with ~10% fine grained sand and ~5% fine gravel; very dark gray (5Y3/1); moist; firm; high plasticity; high toughness; weak HCl reaction; [till].	
35			CL/CH		Below ~34 feet clay becomes leaner and sand content increases to ~20% fine to coarse grained.	910
40						905

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: **6"**
Type: **Sch. 40 Steel**
Interval: **3.5' ags-3.5' bgs**

RISER CASING
Diameter: **2"**
Type: **Sch. 40 Steel**
Interval: **3' ags-85' bgs**

GROUT
Type: **Neat Cement**
Interval: **0'-78'**

SEAL
Type: **Bentonite**
Interval: **78'-83'**

SANDPACK
Type: **#40 Red Flint**
Interval: **83'-110'**

SCREEN
Diameter: **2"**
Type: **Stainless Steel**
Interval: **84.1'-99.1'**

Date Boring Started:	3/3/23 8:00 am
Date Boring Completed:	3/7/23 12:05 pm
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Tracked mini-sonic

Remarks: Boring B342 is located approximately 21 feet west, southwest of monitoring well.

Additional data may have been collected in the field which is not included on this log.

M:\GIN\PROJECTS\23711005 ELK RIVER LANDFILL\23711005.23 2023 GROUNDWATER.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Co.
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-342L

Project:	Elk River Landfill, 2023 Groundwater Corrective Action	Surface Elevation:	943.9 ft	
Project No.:	23/71-1005.23	Drilling Method:	Sonic	Unique Well No.: 871179
Location:	Elk River, MN	Sampling Method:	4" Sonic Core	
Coordinates:	N 246,081.0 ft E 574,891.7 ft			
Datum:	Sherburne County Coordinate System	Completion Depth:	110.0 ft	

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	Elevation, feet
40		7	CL/CH		LEAN TO FAT CLAY (CL/CH): ~85% fines with ~10% fine grained sand and ~5% fine gravel; very dark gray (5Y3/1); moist; firm; high plasticity; high toughness; weak HCl reaction; [till]. *(continued)*	
					POORLY GRADED SAND (SP): fine to medium grained with ~5% coarse grained fraction; trace fine gravel; brown (10YR 4/3); wet; subangular to subrounded; approximately 5% fines. [outwash].	
45			SP			900
50		8			50 feet - lens with ~20% coarse grained sand fraction and 25% fine to coarse gravel with two 3.5" cobbles.	
					Below 51.5 feet - medium to coarse grained with ~15% fine grained sand fraction and trace coarse gravel.	895
			CL		SANDY LEAN CLAY (CL): ~65% fines with ~30% mostly fine sand and ~5% fine gravel; gray (5Y 4/1); moist; hard; subangular to subrounded gravel; [till].	
55			SP		POORLY GRADED SAND (SP): fine to medium grained with ~5% coarse grained fraction; trace fine gravel; grayish brown (2.5Y 5/2); wet; subangular to subrounded; approximately 5% fines. [outwash].	890
60		9	CL		SANDY LEAN CLAY (CL): ~65% fines with ~30% mostly fine sand and ~5% fine gravel; gray (5Y 4/1); moist; hard; a few interbeded sand stringers; subangular to subrounded gravel; [till].	885
					POORLY GRADED SAND (SP): fine to medium grained with ~15% coarse grained fraction; ~5% fine gravel; grayish brown (2.5Y 5/2); wet; subangular to subrounded; approximately 5% fines. [outwash].	
65						880
					66-77 feet - ~10% coarse grained sand fraction; trace to 5% fine gravel.	
70		10	SP			875
75						870
80						865

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: **6"**
Type: **Sch. 40 Steel**
Interval: **3.5' ags-3.5' bgs**

RISER CASING
Diameter: **2"**
Type: **Sch. 40 Steel**
Interval: **3' ags-85' bgs**

GROUT
Type: **Neat Cement**
Interval: **0'-78'**

SEAL
Type: **Bentonite**
Interval: **78'-83'**

SANDPACK
Type: **#40 Red Flint**
Interval: **83'-110'**

SCREEN
Diameter: **2"**
Type: **Stainless Steel**
Interval: **84.1'-99.1'**

Date Boring Started:	3/3/23 8:00 am
Date Boring Completed:	3/7/23 12:05 pm
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Tracked mini-sonic

Remarks: Boring B342 is located approximately 21 feet west, southwest of monitoring well.

Additional data may have been collected in the field which is not included on this log.

M:\GIN\PROJECTS\23711005 ELK RIVER LANDFILL\23711005.23 2023 GROUNDWATER.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Co.
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF WELL P-342L

Project:	Elk River Landfill, 2023 Groundwater Corrective Action	Surface Elevation:	943.9 ft	
Project No.:	23/71-1005.23	Drilling Method:	Sonic	Unique Well No.: 871179
Location:	Elk River, MN	Sampling Method:	4" Sonic Core	
Coordinates:	N 246,081.0 ft E 574,891.7 ft			
Datum:	Sherburne County Coordinate System	Completion Depth:	110.0 ft	

Depth, feet	Sample No.	USCS	LITHOLOGIC DESCRIPTION
80	11		POORLY GRADED SAND (SP): fine to medium grained with ~15% coarse grained fraction; ~5% fine gravel; grayish brown (2.5Y 5/2); wet; subangular to subrounded; approximately 5% fines. [outwash]. *(continued)*
			82 feet - 0.4' thick lens of very dark gray (5Y 3/1), very hard, moist, fat clay (CH).
85			
			87.5-88.5 feet - lens of fine grained silty sand (SM) with trace fine gravel; ~20% fines; wet.
		SP	88.5 feet - 0.4' thick lens of very dark gray (5Y 3/1), hard, moist, fat clay (CH).
90	12		
			90.7-91.7 feet - lens of fine grained silty sand (SM) with trace fine gravel; ~20% fines; wet.
95			
			97-98.5 feet - ~20% coarse grained fraction and ~10-15% fine to coarse gravel.
		SM	SILTY SAND (SM): fine grained with ~15% medium to coarse grained fraction; trace fine gravel; grayish brown (2.5Y 5/2); wet; subangular to subrounded; approximately 15% fines [outwash].
100	13		CLAYEY SAND (SC): ~60% sand and gravel, ~40% fines; fine to medium grained with ~10% coarse grained fraction; ~10% fine gravel; dark grayish brown (2.5Y 4/2); moist; subangular to subrounded gravel; firm; cohesive; low plasticity; low toughness; [till].
		SC	
105			
	14		
110			End of well 110.0 feet
115			
120			

WELL OR PIEZOMETER CONSTRUCTION DETAIL

PRO. CASING
Diameter: **6"**
Type: **Sch. 40 Steel**
Interval: **3.5' ags-3.5' bgs**

RISER CASING
Diameter: **2"**
Type: **Sch. 40 Steel**
Interval: **3' ags-85' bgs**

GROUT
Type: **Neat Cement**
Interval: **0'-78'**

SEAL
Type: **Bentonite**
Interval: **78'-83'**

SANDPACK
Type: **#40 Red Flint**
Interval: **83'-110'**

SCREEN
Diameter: **2"**
Type: **Stainless Steel**
Interval: **84.1'-99.1'**

Elevation, feet: 860, 855, 850, 845, 840, 835, 830, 825

Date Boring Started:	3/3/23 8:00 am
Date Boring Completed:	3/7/23 12:05 pm
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Tracked mini-sonic

Remarks: Boring B342 is located approximately 21 feet west, southwest of monitoring well.

Additional data may have been collected in the field which is not included on this log.

M:\GIN\PROJECTS\23711005 ELK RIVER LANDFILL\23711005.23 2023 GROUNDWATER.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING CONSTRUCTION RECORD
Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO.: 871179

WELL OR BORING LOCATION

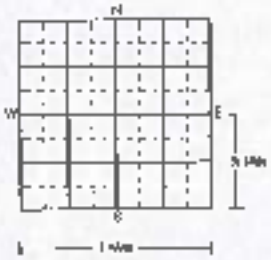
County Name: Sherburne

Township Name	Township No.	Range No.	Section No.	Fractions — (e.g. NW NW SW)
Elk River	33	26	4	NW NW SW

GPS LOCATION — decimal degrees (6 or more decimal places)
Latitude _____ Longitude _____

House Number, Street Name, City, and ZIP Code of Well Location
Tipton St NW + 227th Ave, Elk River 55330

Show exact location of well/boring in section grid with "X"



Sketch map of well/boring location. Showing property lines, roads, buildings, and direction

SEE map

PROPERTY OWNER'S NAME/COMPANY NAME
Ridges of Rice Lake HOA

Property owner's mailing address (if different than well location address indicated above)
12648 224th Ct NW
Elk River, MN 55330

WELL OWNER'S NAME/COMPANY NAME
Elk River Landfill Inc

Well/boring owner's mailing address (if different than property owner's address indicated above)
22460 Hwy 169 NW
Elk River, MN 55330

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Top Soil	BL	S	0	7
Sand	GR	S	7	35
Sand + Clay	BR	M	35	44
Sand	BR	M	44	100

Use a second sheet, if needed

REMARKS, ELEVATION, SOURCE OF DATA, etc.
117-23-1002
P-342L

MINN DEPT OF HEALTH COPY 871179

WELL/BORING DEPTH (completed): 108 ft
DATE WORK COMPLETED: 3-7-23

DRILLING METHOD
☐ Cable Tool ☐ Driven ☐ Dual Rotary
☐ Auger ☐ Rotary ☒ Reverse
☐ Other

DRILLING FLUID: N/A
WELL HYDROFRACTURED? ☐ Yes ☒ No
From _____ ft. To _____ ft.

USE
☐ Domestic ☒ Monitoring ☐ Heating/Cooling
☐ Non-community PWS ☐ Irrigation ☐ Industrial/Commercial
☐ Community PWS ☐ Dewatering ☐ Remedial
☐ Elevator ☐ _____

CASING MATERIAL: ☒ Steel ☐ Plastic
Drive Shoe? ☐ Yes ☒ No
☒ Threaded ☐ Welded ☐ _____

CASING (Outside)
2 in. To 85 ft. Weight _____ lbs./ft. Specifications: SCH 40
_____ in. To _____ ft. _____ lbs./ft. _____
_____ in. To _____ ft. _____ lbs./ft. _____

HOLE DIAM.
6 in. To 108 ft.
_____ in. To _____ ft.
_____ in. To _____ ft.

SCREEN: YES
Make: Johnson
Type: SS
Diameter: .010
Set between 108 ft. and 85 ft.

OPEN HOLE
From _____ ft. To _____ ft.
Diam. 6
Length 15
FITTINGS: T&C

STATIC WATER LEVEL: 0 ft. ☒ Flow ☐ Above land surface
Date measured 3-7-23 Dry hole ☐ Yes ☒ No

PUMPING LEVEL (below land surface)
N/A ft. after _____ hrs. pumping _____ gpm

WELLHEAD COMPLETION
☐ Pitless adapter manufacturer _____ Model _____
☒ Casing protector: Flat top ☒ Yes ☐ No, at least 12 in. above grade
☐ At-grade ☐ Well House ☐ Hand Pump

GROUT INFORMATION (specify Bentonite, cement/sand, neat cement, concrete, or other)
Material: Neat Cement From 78 ft. To 0 ft. 14 ☐ Yds ☒ Bags
Material _____ From _____ To _____ ft. _____ ☐ Yds ☐ Bags
Material _____ From _____ To _____ ft. _____ ☐ Yds ☐ Bags
Down-coring seal From _____ To _____ Bags
One bag = 94 lbs. cement or 50 lbs. bentonite

NEAREST KNOWN SOURCE OF CONTAMINATION
Well is _____ feet _____ direction from _____ type
Well disinfected upon completion? ☐ Yes ☒ No

PUMP
☒ Not installed Date installed _____
Manufacturer's name _____
Model Number _____ HP _____ Volts _____
Length of drop pipe _____ ft. Capacity _____ gpm
Type: ☐ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ _____

ABANDONED WELLS
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

VARIANCE
Was a variance granted from the MDH for this well? ☐ Yes ☒ No If Yes, attach

WELL CONTRACTOR CERTIFICATION
This well was drilled under my supervision and in accordance with Minnesota Rules, chapter 4725. The information contained in this report is true to the best of my knowledge.

Cascade Drilling — 3267
Licensed Business Name — License or Reg. No.

Bill Berg — 2657 — 3/16/23
Certified Representative Signature — Certified Rep. No. — Date

Jeremy Trieplke
Name of Driller

MDH 6109 (Rev. 3/19)

Barr Engineering Co.
4300 MarketPointe Drive Suite 200
Minneapolis, MN 55435
Telephone: 952-832-2600

LOG OF BORING B342

Project:	Elk River Landfill, 2023 Groundwater Corrective Action	Surface Elevation:	943.9 ft
Project No.:	23/71-1005.23	Drilling Method:	Sonic
Location:	Elk River, MN	Sampling Method:	Blind Drill
Coordinates:	N 246,082.2 ft E 574,870.3 ft	Completion Depth:	55.0 ft
Datum:	Sherburne County Coordinate System		

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	Elevation, feet
0					Boring blind drilled for installation of a temporary well screened 45-55 ft. bgs. See Log of Well P-342L for lithology description.	940
5						935
10						930
15						925
20						920
25						915
30						910
35						905
40						900
45						895
50						890
55					End of boring 55.0 feet	885
60						

Date Boring Started:	3/7/23 12:05 pm
Date Boring Completed:	3/7/23 4:30 pm
Logged By:	KAM
Drilling Contractor:	Cascade Drilling
Drill Rig:	Tracked mini-sonic

Remarks: Boring B342 is located approximately 21 feet west, southwest of monitoring well P-342L.

Temporary well screen set 45-55 ft. bgs. Boring permanently sealed with neat cement grout after water sample collection.

Additional data may have been collected in the field which is not included on this log.

M:\GIN\PROJECTS\23711005 ELK RIVER LANDFILL\23711005.23 2023 GROUNDWATER.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Appendix D

Groundwater Monitoring Data (2021-2023)

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-17C	P-17C	P-17C	P-17C	P-17C	P-17C	P-17C	P-22L	P-22L	P-22L	P-22L	P-22L	P-22L	P-22L	P-29C	P-29C	P-29C
					Date	7/13/2021	10/20/2021		4/14/2022	5/10/2022	7/14/2022	11/03/2022	7/24/2023	4/22/2021	7/12/2021	10/20/2021	4/13/2022	5/10/2022	7/14/2022	11/02/2022	7/24/2023	4/21/2021	7/12/2021	10/15/2021
					Sample Type	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U J4	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5		< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U H	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75		< 0.750 U	< 0.750 U	< 0.750 U	--	< 0.750 U	< 0.750 U	< 0.750 U H	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	--	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	4.68	3.66	4.79
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0		< 1.00 U	< 1.00 U C3	< 1.00 U C3	--	< 1.00 U	< 1.00 U J3	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U C4 J4	< 1.00 U	< 1.00 U C4 H	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	--	< 1.00 U C4 J4	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U C4	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05		< 1.00 U	< 1.00 U C3	< 1.00 U C3	--	< 1.00 U C3	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25		< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U H	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C5	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	0.286	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5		< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U H	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94			< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5		2.54	2.39	2.45	--	2.10	2.63	2.44 H	2.16	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U J4	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000		< 10.0 U C5	< 10.0 U C3	< 10.0 U C3	--	< 10.0 U	< 10.0 U C5 J4	< 10.0 U H	< 10.0 U C5	< 10.0 U J4	< 10.0 U C3	< 10.0 U C3	--	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U C3	< 10.0 U
Allyl chloride	NA	ug/l	30 HRL94	7.5		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5		1.09	1.14	1.05	--	0.889	1.07	0.963 H	1.08	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C5 J4
Bromobenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U C3	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U J3 H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25		< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U H	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0		4.09	3.66	3.53	--	2.38	3.33	3.13 H	4.03	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16			< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Chlorotoluene, o	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C5	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0		4.31	4.02	3.96	--	2.75	4.62	3.74 H	2.27	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17			< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	4.75	3.77	5.81
Ethyl benzene	NA	ug/l	40 HRL23	12.5		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0		27.1	21.5	20.3	--	19.0	25.0	25.8 H	30.7	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	18.7	13.3	17.6
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25		< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U H	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0		< 10.0 U	< 10.0 U C3	< 10.0 U C3	--	< 10.0 U	< 10.0 U	< 10.0 U H	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0		< 5.00 U	< 5.00 U C3	< 5.00 U C3	--	< 5.00 U	< 5.00 U	< 5.00 U H	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	--	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5		< 1.00 U	< 1.00 U C3	< 1.00 U C3	--	< 1.00 U C3	< 1.00 U J3 J4	< 1.00 U H	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	--	< 1.00 U C3	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U
Propylbenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18			6.59	< 5.00 U C3	< 5.00 U C3	--	6.74	6.28 C5	5.10 H	< 5.00 U	< 5.00 U C3	< 5.00 U C3	< 5.00 U C3	--	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U C3	< 5.00 U
Toluene	NA	ug/l	70 HRL23	50.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1		< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U H	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0		< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U H	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05		< 0.0500 U	**0.227**	**0.263**	--	0.175	< 0.0500 U	**0.216 H**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	--	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.813**	**0.840**	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75		< 2.00 U	< 2.00 U	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U H	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-17C	P-17C		P-17C	P-17C	P-17C	P-17C	P-17C	P-22L	P-22L	P-22L	P-22L	P-22L	P-22L	P-22L	P-22L	P-29C	P-29C	P-29C
					Date	7/13/2021	10/20/2021		4/14/2022	5/10/2022	7/14/2022	11/03/2022	7/24/2023	4/22/2021	7/12/2021	10/20/2021	4/13/2022	5/10/2022	7/14/2022	11/02/2022	7/24/2023	4/21/2021	7/12/2021	10/15/2021
					Sample Type	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Effective Date			11/13/2023	07/23/2015																				
Exceedance Key			**Bold**	Underline																				
General Parameters																								
Alkalinity, total, as CaCO3	NA	mg/l				1000	--	--	1100	--	1050	1070	1090	277	246	--	154	--	162	126	187	--	477	--
Anions	NA	meq/l				31.4	--	--	--	--	34.3	--	30.2	6.66	6.20	--	--	--	--	--	5.34	--	11.6	--
Carbon, total organic	NA	mg/l				68.7	--	--	40.0	--	54.0	50.4	41.4	--	< 1.00 U	--	1.86	--	1.48 B	3.16	< 1.00 U	--	--	--
Cations	NA	meq/l				33.3	--	--	--	--	32.5	--	28.0	10.4	5.90	--	--	--	--	--	5.22	--	11.3	--
Chloride	NA	mg/l				400	--	--	423	--	466	434	297	33.3	36.6	--	38.1	--	41.9	36.1	33.5	--	53.8	--
Dissolved oxygen, field test kit						--	--	--	5	--	4	4	--	--	--	--	--	--	< 1	< 1	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l				4.3	6	--	5.7	4.3	5.0	15.2	2.4	1.3	0.8	0.7	0.5	0.6	0.4	0.7	1.1	1.1	1.4	3
Ethane	NA	mg/l				0.0011	--	--	0.0012	--	0.00095 J	0.00084 J	< 0.00017 U	--	< 0.0010	--	< 0.0010 U	--	0.00024 J	< 0.00017 U	< 0.00017 U	--	--	--
Ethylene	NA	mg/l				< 0.0010	--	--	< 0.0010 U	--	< 0.00024 U	< 0.00024 U	< 0.00024 U	--	< 0.0010	--	< 0.0010 U	--	< 0.00024 U	< 0.00024 U	< 0.00024 U	--	--	--
Iron, ferrous, FE II, field	NA	mg/l				13.5	--	--	3.3 >	--	12.0	2.03	> 3.30	--	0.50	--	--	--	12.0	0.07	0.05	--	--	--
Manganese II, field	NA	mg/l				300	--	--	--	--	--	0.167	0.361	--	1.1	--	--	--	--	0.008	0.150	--	--	--
Methane	NA	mg/l				1.9	--	--	0.88	--	1.1	0.93	0.74	--	0.22	--	2.1	--	0.29	0.26	0.0026 J	--	--	--
Nitrogen, ammonia, as N	NA	mg/l				30.0	--	--	--	--	7.62	--	38.6	< 0.100 U	< 0.100 U	--	--	--	--	--	< 0.100 U	--	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	NA	mg/l				--	--	--	--	--	--	--	--	< 0.100 U	< 0.100 U	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL			< 1.00 U	--	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U T8	< 1.00 U	--	--	--
pH, field	NA	pH units				6.4	6.54	--	6.63	6.71	6.63	6.70	6.51	6.4	7.5	7.44	7.89	7.93	8.55	9.03	7.72	7.17	7.69	6.6
Redox (oxidation potential), field	NA	mV				-37	-129.4	--	-85	-97	-111	-151	-82	-29	33	-99.6	-114	-88	-97	-40	-123	89.4	129.3	40
Solids, total dissolved	NA	mg/l				1770	--	--	--	--	1690	--	1610	315	319 Q	--	--	--	--	--	292 B	--	591 Q	--
Solids, total suspended	NA	mg/l				--	--	--	--	--	--	--	--	77.8 J3	180 J3	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm				3117	3221	--	3165	3295	3399	3317	2350	720	522	294	218	365	485	345	504	1028	274	1040
Sulfate, as SO4	NA	mg/l				< 5.00 U	--	--	< 5.00 U	--	5.33	< 5.00 U	< 5.00 U	8.60	17.6	--	< 5.00 U	--	23.6	< 5.00 U	31.2	--	25.0	--
Sulfide, as S^{2-}	NA	mg/l				0.08	--	--	0.10	--	0.15	0.03	0.05	--	0.81	--	--	--	0.65	0.01	0.02	--	--	--
Temperature, field	NA	deg C				16.1	15.3	--	13.8	19.3	15.6	16.1	16.1	11.5	13	11.1	9.3	10.1	13.5	10.4	11.4	10.9	14.5	12.7
Turbidity, field	NA	NTU				37.3	28.3	--	14.9	15	29.9	22.2	23.7	13.1	19.7	17.1	17.5	19.5	11.9	5.3	4.8	11.8	14.3	7.3
Metals																								
Arsenic	Dissolved	ug/l		2.5		23.4	--	--	--	--	23.3	--	21.2	< 2.00 U	< 2.00 U	--	--	--	--	--	< 2.00 U	--	< 2.00 U	--
Boron	Dissolved	ug/l	**500 RAA17**	250.0		**4030**	--	--	--	--	**3410**	--	**5100**	< 200 U	< 200 U	--	--	--	--	--	< 200 U	--	< 200 U	--
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)			--	--	--	--	--	--	--	--	< 2.00 U	< 2.00 U	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l				162	--	--	--	--	161	--	132	73.1	58.1	--	--	--	--	--	50.1	--	143	--
Chromium	Dissolved	ug/l	100 CR HRL93	25.0		< 4.00 U	--	--	--	--	< 4.00 U	--	< 4.00 U	< 4.00 U	< 4.00 U	--	--	--	--	--	< 4.00 U	--	< 4.00 U	--
Copper	Dissolved	ug/l				--	--	--	--	--	--	--	--	< 10.0 U	< 10.0 U	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l				15300	--	--	--	--	14100	--	13400	97900	206	--	--	--	--	--	< 100 U	--	1100	--
Lead	Dissolved	ug/l				--	--	--	--	--	--	--	--	< 10.0 U	< 10.0 U	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l				105	--	--	--	--	102	--	89.2	34.8	32.9	--	--	--	--	--	30.3	--	46.1	--
Manganese	Dissolved	ug/l	**100 HRL23**			--	--	--	--	--	--	--	--	**475**	72.1	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l				--	--	--	--	--	--	--	--	< 0.200 U	< 0.200 U	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l				22.3	--	--	--	--	27.4	--	28.1	4.35	3.04	--	--	--	--	--	1.66	--	2.73	--
Sodium	Dissolved	mg/l				355	--	--	--	--	340	--	296	4.95	4.54	--	--	--	--	--	4	--	5.09	--
Zinc	Dissolved	ug/l	2000 HRL94	500.0		11.8	--	--	--	--	< 10.0 U	--	12.1	20.8	< 10.0 U	--	--	--	--	--	< 10.0 U	--	< 10.0 U	--

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

			Location	P-29C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-301C	P-301C	P-301C	P-301C
			Date	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/20/2023	4/21/2021	7/12/2021	10/15/2021	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/20/2023	4/22/2021	7/12/2021	10/15/2021	4/11/2022
			Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																		
Effective Date			11/13/2023	07/23/2015																		
Exceedance Key			**Bold**	Underline																		
Volatile Organic Compounds																						
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U J3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	3.94	4.26	4.14	2.18	3.01	3.05	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U C3	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	< 1.00 U	< 1.00 U	< 1.00 U	0.262	0.245	0.520	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U J4	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U J4	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U J4	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		3.93	4.25	3.83	3.93	2.98	3.17	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.99	1.55	1.83	1.67
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	15.4	15.4	14.0	13.2	13.6	8.79	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		< 5.00 U	< 5.00 U C5 J3	< 5.00 U	< 5.00 UC5J3J4	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U J3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	**0.581**	**0.632**	**0.617**	0.150	< 0.0500 U	**0.414**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	0.124	< 0.0500 U	< 0.0500 U	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	**P-29C**	**P-29C**	**P-29C**	**P-29C**	**P-29C**	**P-29C**	**P-29D**	**P-29D**	**P-29D**	**P-29D**	**P-29D**	**P-29D**	**P-29D**	**P-29D**	**P-301C**	**P-301C**	**P-301C**	**P-301C**
				Date	**4/11/2022**	**7/12/2022**	**10/27/2022**	**4/18/2023**	**7/18/2023**	**10/20/2023**	**4/21/2021**	**7/12/2021**	**10/15/2021**	**4/11/2022**	**7/12/2022**	**10/27/2022**	**4/18/2023**	**7/18/2023**	**10/20/2023**	**4/22/2021**	**7/12/2021**	**10/15/2021**	**4/11/2022**
				Sample Type	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																			
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
General Parameters																							
Alkalinity, total, as CaCO3	NA	mg/l			--	457	--	--	469	--	--	195	--	--	176	--	--	180	--	--	511	--	--
Anions	NA	meq/l			--	9.14	--	--	11.9	--	--	3.95	--	--	3.52	--	--	3.64	--	--	11.0	--	--
Carbon, total organic	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cations	NA	meq/l			--	11.7	--	--	12.0	--	--	3.57	--	--	3.65	--	--	3.38	--	--	13.6	--	--
Chloride	NA	mg/l			--	63.9	--	--	70.4	--	--	< 1.00 U	--	--	< 1.00 U	--	--	< 1.00 U	--	--	26.7	--	--
Dissolved oxygen, field test kit					--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l			1.6	0.9	1.9	0.2	1.5	0.6	0.3	0.2	0.8	0.5	0.4	0.8	0.2	0.7	0.2	1.3	0.5	2.1	0.3
Ethane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylene	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron, ferrous, FE II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	NA	mg/l			--	0.459	--	--	< 0.100 U	--	--	0.152	--	--	0.564	--	--	< 0.100 U	--	--	< 0.100 U	--	--
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, field	NA	pH units			7.22	7.24	7.30	7.19	6.79	7.22	8.46	8.2	7.15	8.68	8.25	8.37	8.25	7.53	8.27	7.69	7.29	6.52	7.43
Redox (oxidation potential), field	NA	mV			-96	-82	-49	-109	-73	-105	-140.5	117.9	31	-190	-98	-90	-141	-77	-134	-116.3	94.8	101	-113
Solids, total dissolved	NA	mg/l			--	576	--	--	625	--	--	181 Q	--	--	191	--	--	179	--	--	736 Q	--	--
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			1113	959	947	1186	1035	998	311	317	337	322	340	315	305	323	316	863	378	1143	1016
Sulfate, as SO4	NA	mg/l			--	26.2	--	--	26.7	--	--	< 5.00 U	--	--	< 5.00 U	--	--	< 5.00 U	--	--	140	--	--
Sulfide, as S^{2-}	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	NA	deg C			11.7	12.8	11.1	11.0	12.1	12	10.4	12.3	11.7	11.5	11.9	11.9	10.5	12.0	12.1	11.4	11.7	10.7	10.5
Turbidity, field	NA	NTU			32.4	29.9	25.5	19.1	44.5	15.9	2.5	6.7	2	6.7	8.0	5.9	4.5	7.1	2.3	43.3	8.5	12.1	10.3
Metals																							
Arsenic	Dissolved	ug/l		2.5	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	5.21	--	--
Boron	Dissolved	ug/l	**500 RAA17**	250.0	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l			--	149	--	--	147	--	--	41.5	--	--	44.7	--	--	38.5	--	--	149	--	--
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			--	1420	--	--	2660	--	--	119	--	--	295	--	--	138	--	--	890	--	--
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l			--	46.1	--	--	47.1	--	--	15.3	--	--	14.3	--	--	14.7	--	--	69.5	--	--
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l			--	2.87	--	--	3.64	--	--	1.29	--	--	1.24	--	--	1.36	--	--	2.52	--	--
Sodium	Dissolved	mg/l			--	9.31	--	--	12.8	--	--	4.48	--	--	4.64	--	--	4.74	--	--	7.23	--	--
Zinc	Dissolved	ug/l	2000 HRL94	500.0	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	P-301C 7/12/2022 N	P-301C 11/01/2022 N	P-301C 4/18/2023 N	P-301C 7/19/2023 N	P-301C 10/20/2023 N	P-301L 4/23/2021 N	P-301L 7/13/2021 N	P-301L 10/15/2021 N	P-301L 4/11/2022 N	P-301L 7/12/2022 N	P-301L 11/01/2022 N	P-301L 4/18/2023 N	P-301L 7/19/2023 N	P-301L 10/20/2023 N	P-302C 4/22/2021 N	P-302C 7/12/2021 N	P-302C 10/15/2021 N	P-302C 4/14/2022 N	P-302C 7/14/2022 N
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.04	1.05	1.04
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C4	< 1.00 U
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	0.629 C5 J4	0.388	0.659 C5	0.721	0.568
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	0.140	< 0.100 U	0.148	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U J4
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C5 J4	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C5 J4	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		1.80	1.92	2.22	2.33	2.97	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	4.39	3.53	5.60	4.02	4.76
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	< 1.00 U	< 1.00 U	1.34	1.61	1.42	1.73	2.05	< 1.00 U	1.08	1.70	1.47	1.76	1.99	1.58	34.1	28.1	42.6	39.5	36.9
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	1.21	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		< 5.00 U C5 J3	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C5 J3	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U C5
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	0.139	0.174	< 0.0500 U	< 0.0500 U	**0.226**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.820**	**0.891**	**0.882**	**0.409**	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	P-301C 7/12/2022 N	P-301C 11/01/2022 N	P-301C 4/18/2023 N	P-301C 7/19/2023 N	P-301C 10/20/2023 N	P-301L 4/23/2021 N	P-301L 7/13/2021 N	P-301L 10/15/2021 N	P-301L 4/11/2022 N	P-301L 7/12/2022 N	P-301L 11/01/2022 N	P-301L 4/18/2023 N	P-301L 7/19/2023 N	P-301L 10/20/2023 N	P-302C 4/22/2021 N	P-302C 7/12/2021 N	P-302C 10/15/2021 N	P-302C 4/14/2022 N	P-302C 7/14/2022 N
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
General Parameters																							
Alkalinity, total, as CaCO3	NA	mg/l			521	--	--	531	--	--	308	--	--	281	--	--	326	--	--	844	--	710	705
Anions	NA	meq/l			14.3	--	--	13.7	--	--	7.65	--	--	7.34	--	--	7.74	--	--	23.0	--	--	22.0
Carbon, total organic	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	19.7	--	23.3	23.9
Cations	NA	meq/l			14.7	--	--	13.2	--	--	7.37	--	--	7.42	--	--	7.41	--	--	21.8	--	--	23.0
Chloride	NA	mg/l			27.2	--	--	25.3	--	--	38.6	--	--	46.7	--	--	33.0	--	--	196	--	292	281
Dissolved oxygen, field test kit					--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.4	1
Dissolved oxygen, field YSI	NA	mg/l			0.5	2.8	0.8	0.6	1	0.5	0.5	0.9	0.8	0.9	0.7	0.5	0.7	0.8	1.5	2.0	2.5	0.5	1.3
Ethane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0045	--	< 0.0010 U	0.00090 J
Ethylene	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.0010	--	< 0.0010 U	< 0.00024 U
Iron, ferrous, FE II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.2	--	0.94	5.8
Manganese II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.8	--	--	--
Methane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.56	--	21	32
Nitrogen, ammonia, as N	NA	mg/l			0.408	--	--	< 0.100 U	--	--	< 0.100 U	--	--	0.285	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 1.00 U	--	< 1.00 U	< 1.00 U
pH, field	NA	pH units			7.42	7.40	7.30	7.15	7.21	7.5	7.52	7.93	8.2	7.77	7.46	7.45	7.25	7.36	7.11	6.75	6.71	7.11	7.27
Redox (oxidation potential), field	NA	mV			-69	-99	-85	-58	-65	35.2	175.8	93	-107	-67	-64	-79	-67	-70	-122.8	33	78	-130	-92
Solids, total dissolved	NA	mg/l			752	--	--	680	--	--	383	--	--	371	--	--	400	--	--	1160 Q	--	--	< 10.0 U
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			1234	1152	1185	1153	1195	664	311	624	609	771	694	684	699	719	1878	1811	7700	1992	2107
Sulfate, as SO4	NA	mg/l			149	--	--	115	--	--	19.8	--	--	19.2	--	--	14.1	--	--	28.7	--	7.06	13.4
Sulfide, as S^{2-}	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.18	--	0.11	0.30
Temperature, field	NA	deg C			11.0	11.0	10.0	15.3	15.3	9.6	11.2	10.1	11.8	12.5	10.2	10.1	10.7	10.7	13.5	13.9	13.1	12.3	13.7
Turbidity, field	NA	NTU			19.3	4.2	5.7	6.5	7.2	1.6	2.4	6	2.8	4.7	1.9	1.7	4.0	2.1	18.1	51.3	3.6	4.0	37.1
Metals																							
Arsenic	Dissolved	ug/l		2.5	4.95	--	--	4.72	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	9.74	--	--	10.3
Boron	Dissolved	ug/l	**500 RAA17**	250.0	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	**597**	--	--	**799**
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l			168	--	--	148	--	--	91.8	--	--	93.6	--	--	92.4	--	--	172	--	--	177
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			1360	--	--	1420	--	--	221	--	--	260	--	--	232	--	--	13600	--	--	14000
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l			71	--	--	65.8	--	--	30.5	--	--	30.2	--	--	30.4	--	--	125	--	--	124
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l			2.56	--	--	2.67	--	--	2.55	--	--	2.17	--	--	2.42	--	--	4.96	--	--	5.34
Sodium	Dissolved	mg/l			7.54	--	--	8	--	--	4.84	--	--	4.64	--	--	5.23	--	--	55.1	--	--	77
Zinc	Dissolved	ug/l	2000 HRL94	500.0	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	P-302C 11/03/2022 N	P-302C 4/24/2023 N	P-302C 7/20/2023 N	P-302C 10/18/2023 N	P-304C 4/22/2021 N	P-304C 7/12/2021 N	P-304C 10/15/2021 N	P-304C 4/14/2022 N	P-304C 7/14/2022 N	P-304C 11/03/2022 N	P-304C 4/24/2023 N	P-304C 7/20/2023 N	P-304C 10/18/2023 N	P-305C 4/21/2021 N	P-305C 7/12/2021 N	P-305C 10/15/2021 N	P-305C 4/11/2022 N	P-305C 7/13/2022 N
Effective Date			11/13/2023	07/23/2015																		
Exceedance Key			**Bold**	Underline																		
Volatile Organic Compounds																						
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U C3	< 0.500 UH	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 UH	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	1.00	2.50	< 1.00 UH	< 1.00 U	1.71	1.12	1.37	< 1.00 U	< 1.00 U	< 1.00 U	1.08	< 1.00 U	< 1.00 U	< 1.00 U	1.21	1.65	1.21	< 1.00 U
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U C4	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U C4
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	0.536	< 0.250 U	0.498 H	0.466	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	< 1.00 U	< 0.100 U	0.192 H	0.209	1.12	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	0.543	0.757	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 UH	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U	< 10.0 U	< 10.0 UH	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U J4
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 UH	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C5 J4	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C5 J4	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U J3	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 UH	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	1.71 C5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH J4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	6.46	< 1.00 UH	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		3.48	13.7	4.31 H	4.12	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.24	1.85	1.03	< 1.00 U
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	37.8	10.4	35.3 H	25.6	33.2	18.1	28.4	8.13	10.7	11.9	5.73	9.02	12.0	3.96	7.51	11.0	7.14	4.73
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U C3	< 0.250 UH	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 UH	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 UH	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	1.00	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		< 5.00 U	< 5.00 U	< 5.00 UH	< 5.00 UC5J3J4	11.4	5.21 C3	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 UC5J3J4	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U C5 J3
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 UH	< 0.100 U	0.214	0.245	0.212	0.102	0.204	0.227	0.198	0.180	0.206	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	**0.481**	**0.253**	**0.743 H**	**0.469 C3**	< 0.0500 U	< 0.0500 U	< 0.0500 U	0.0910	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.296**	< 0.0500 U C3	< 0.0500 U	< 0.0500 U	< 0.0500 U	0.0900	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 UH	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-302C	P-302C	P-302C	P-302C	P-304C	P-304C	P-304C	P-304C	P-304C	P-304C	P-304C	P-304C	P-305C	P-305C	P-305C	P-305C	P-305C
					Date	11/03/2022	4/24/2023	7/20/2023	10/18/2023	4/22/2021	7/12/2021	10/15/2021	4/14/2022	7/14/2022	11/03/2022	4/24/2023	7/20/2023	10/18/2023	4/21/2021	7/12/2021	10/15/2021	4/11/2022	7/13/2022
					Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Effective Date			11/13/2023	07/23/2015																		
Exceedance Key			**Bold**	Underline																		
General Parameters																						
Alkalinity, total, as CaCO3	NA	mg/l				709	750	748	791	--	872	--	521	643	693	747	688	737	--	382	--	--	293
Anions	NA	meq/l				--	--	21.5	--	--	19.2	--	--	14.3	--	--	15.5	--	--	9.83	--	--	7.56
Carbon, total organic	NA	mg/l				23.3	22.7	18.4	18.9	--	9.93	--	4.82	7.17	6.84	7.56	6.71	8.82	--	--	--	--	--
Cations	NA	meq/l				--	--	21.5	--	--	17.2	--	--	14.7	--	--	15.5	--	--	9.29	--	--	7.63
Chloride	NA	mg/l				284	269	212 E	208	--	45.1	--	21.0	30.5	34.6	37.3	32.5	39.9	--	72.5	--	--	53.8
Dissolved oxygen, field test kit						2	< 1	--	--	--	--	--	0	5	2	< 1	--	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l				1.5	0.1	0.6	0.5	2.2	4.0	3.4	0.1	6.3	26	0.1	0.5	0.5	1.5	1.2	3.4	0.6	1.7
Ethane	NA	mg/l				0.00090 J	0.00079 HJ	< 0.0034 U	< 0.0450 U	--	< 0.0010	--	< 0.0010 U	0.00026 J	0.00038 J	0.00042 HJ	< 0.0034 U	< 0.0450 U	--	--	--	--	--
Ethylene	NA	mg/l				< 0.00024 U	< 0.00024 UH	< 0.0048 U	< 0.0396 U	--	< 0.0010	--	< 0.0010 U	< 0.00024 U	< 0.00024 U	< 0.00024 UH	< 0.0048 U	< 0.0396 U	--	--	--	--	--
Iron, ferrous, FE II, field	NA	mg/l				2.49	> 3.30	> 3.30	2.75	--	2.99	--	> 3.3	1.84	1.05	> 3.30	> 3.30	3.12	--	--	--	--	--
Manganese II, field	NA	mg/l				0.147	0.123	0.222	0.126	--	10.0	--	--	--	0.571	0.654	0.586	0.556	--	--	--	--	--
Methane	NA	mg/l				20	25 EH	34	27.0 1b	--	0.083	--	0.83	0.18	0.11	0.72 H	0.071 J	0.204 1b	--	--	--	--	--
Nitrogen, ammonia, as N	NA	mg/l				--	--	< 0.100 U	--	--	< 0.100 U	--	--	0.205 P1	--	--	< 0.100 U	--	--	< 0.100 U	--	--	0.493
Nitrogen, nitrate + nitrite, as N	NA	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	--	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--	--	--	--
pH, field	NA	pH units				7.13	7.07	6.87	7.03	6.76	6.7	6.32	7.06	6.95	6.76	6.69	6.49	6.55	7.69	7.53	6.85	7.51	7.89
Redox (oxidation potential), field	NA	mV				-142	-117	-111	-77	-64.5	77	93	-93	-10	-55	-65	-55	-54	-79.1	116.8	73	-151	-178
Solids, total dissolved	NA	mg/l				--	--	1100	--	--	904 Q	--	--	743	--	--	749	--	--	484 Q	--	--	382
Solids, total suspended	NA	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm				1949	1872	1500	1715	1483	1535	1787	1003	1319	1292	1309	1112	977	556	327	950	719	679
Sulfate, as SO4	NA	mg/l				13.7	17.6	26.4	24.6	--	22.2	--	19.0	28.5	29.4	40.0	38.4	34.1	--	7.73	--	--	8.65
Sulfide, as S^{2-}	NA	mg/l				0.02	0.02	0.03	0.02	--	0.50	--	> 0.80	0.40	0.14	0.06	0.04	0.02	--	--	--	--	--
Temperature, field	NA	deg C				13.4	13.5	13.6	13.2	9.9	10.8	10.9	9.7	13.7	10.5	9.8	10.6	10.6	11.5	12.7	12.5	12.4	12.7
Turbidity, field	NA	NTU				4.2	4	17.9	2.5	27.1	12.9	9.6	193	23.4	12.8	9	13.1	8.3	4.9	5.7	6	7.9	22.9
Metals																							
Arsenic	Dissolved	ug/l		2.5		--	--	10.5	--	--	2.72	--	--	3.36	--	--	2.61	--	--	6.29	--	--	5.71
Boron	Dissolved	ug/l	**500 RAA17**	250.0		--	--	**720**	--	--	**609**	--	--	402	--	--	363	--	--	333	--	--	206
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l				--	--	163	--	--	187	--	--	159	--	--	171 O1 V	--	--	74.8	--	--	59.7
Chromium	Dissolved	ug/l	100 CR HRL93	25.0		--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U
Copper	Dissolved	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l				--	--	13200	--	--	4560	--	--	3880	--	--	6200 O1	--	--	3160	--	--	2850
Lead	Dissolved	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l				--	--	116	--	--	68.8	--	--	61.4	--	--	62.2	--	--	52.2	--	--	44.2
Manganese	Dissolved	ug/l	**100 HRL23**			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l				--	--	5.54	--	--	2.28	--	--	2.17	--	--	2.31	--	--	2.32	--	--	2.14
Sodium	Dissolved	mg/l				--	--	74	--	--	44.9	--	--	35	--	--	35 O1	--	--	25	--	--	19.7
Zinc	Dissolved	ug/l	2000 HRL94	500.0		--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	P-305C 11/01/2022 N	P-305C 4/18/2023 N	P-305C 7/19/2023 N	P-305C 10/20/2023 N	P-308C 7/13/2021 N	P-308C 7/13/2022 N	P-308C 7/19/2023 N	P-308L 7/13/2021 N	P-308L 10/20/2021 N	P-308L 4/14/2022 N	P-308L 7/14/2022 N	P-308L 11/03/2022 N	P-308L 4/24/2023 N	P-308L 7/24/2023 N	P-309C 7/12/2021 N	P-309C 7/13/2022 N	P-309C 7/19/2023 N	P-311D 4/23/2021 N	P-311D 7/15/2021 N
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	1.53	< 1.00 U	1.10	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	9.13	1.75	13.3	12.0	1.60	9.48	9.48	4.70	6.36	4.49	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U C4	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U J4	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U C4	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U J4	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C5	< 0.250 U	< 0.250 U	0.319	0.379	< 0.250 U	< 0.250 U	0.250	< 0.250 U	0.371	0.282 C5	< 0.250 U J4	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	< 1.00 U	< 0.100 U	0.166	0.282	< 1.00 U	< 1.00 U	< 0.100 U	2.13	1.07	2.36	2.37	< 1.00 U	< 0.100 U	1.83	1.92	2.91	1.36	< 1.00 U	< 1.00 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C5	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U J4
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	1.27	1.19	0.860	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.62	1.64	1.46	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	4.90	< 1.00 U	< 1.00 U	2.34 C5	< 1.00 U	1.15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	3.86	3.23	1.92	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.36	< 1.00 U	2.48	1.72 C5	< 1.00 U	1.90	1.48	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		1.57	< 1.00 U	< 1.00 U	1.02	< 1.00 U	< 1.00 U	< 1.00 U	9.49	7.65	14.3	12.7	3.53	8.99	9.13	4.22	4.83	3.26	< 1.00 U	< 1.00 U
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	10.6	< 1.00 U	8.30	6.69	29.3	29.7	24.4	28.1	16.2	35.5	31.5	12.4	27.7	26.9	30.4	38.9	32.2	< 1.00 U	< 1.00 U
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.18	1.06	1.53	1.22	< 1.00 U	1.02	1.26	< 1.00 U C3	1.17	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		< 5.00 U	< 5.00 U J3 J4	< 5.00 U C5	< 5.00 U	< 5.00 U	12.9 C5 J3	7.63 C5	7.11	< 5.00 U C3	5.99	5.16 C5	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U C3	< 5.00 U C5 J3	< 5.00 U C5	< 5.00 U	< 5.00 U
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	0.0910	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.209**	0.111	**0.922**	**0.603**	**1.22**	**1.52**	**0.344**	< 0.0500 U	**1.09**	**0.372**	**0.439**	**0.235**	< 0.0500 U	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	P-305C	P-305C	P-305C	P-305C	P-308C	P-308C	P-308C	P-308L	P-308L	P-308L	P-308L	P-308L	P-308L	P-309C	P-309C	P-309C	P-311D	P-311D
				Date	11/01/2022	4/18/2023	7/19/2023	10/20/2023	7/13/2021	7/13/2022	7/19/2023	7/13/2021	10/20/2021	4/14/2022	7/14/2022	11/03/2022	4/24/2023	7/24/2023	7/12/2021	7/13/2022	7/19/2023	4/23/2021	7/15/2021
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																			
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
General Parameters																							
Alkalinity, total, as CaCO3	NA	mg/l			--	--	353	--	1210	1080	1100	640	--	603	610	337	609	592	636	649	699	--	190
Anions	NA	meq/l			--	--	9.61	--	24.3	35.5	35.3	--	--	--	14.5	--	--	13.1	20.8	20.9	22.8	--	3.88
Carbon, total organic	NA	mg/l			--	--	--	--	--	--	--	5.42	--	3.43	4.81	2.08	3.61 H	3.84	--	--	--	--	--
Cations	NA	meq/l			--	--	9.31	--	39.9	35.7	35.2	--	--	--	15.0	--	--	13.3	19.5	21.0	22.1	--	3.71
Chloride	NA	mg/l			--	--	87.0	--	603	487	470	75.8	--	54.0	68.2	41.7	45.6	39.8	278	272	308	--	< 1.00 U
Dissolved oxygen, field test kit					--	--	--	--	--	--	--	--	--	0.6	4	< 1	< 1	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l			3.3	0.5	0.9	0.5	8.3	2.0	1.8	3.5	0.9	0.4	3.6	0.8	0.1	0.8	1.5	1.0	0.9	0.3	0.8
Ethane	NA	mg/l			--	--	--	--	--	--	--	< 0.0010	--	< 0.0010 U	0.00035 J	< 0.00017 U	0.00048 HJ	< 0.00017 U	--	--	--	--	--
Ethylene	NA	mg/l			--	--	--	--	--	--	--	< 0.0010	--	< 0.0010 U	< 0.00024 U	< 0.00024 U	< 0.00024 UH	< 0.00024 U	--	--	--	--	--
Iron, ferrous, FE II, field	NA	mg/l			--	--	--	--	--	--	--	2.00	--	1.49	1.19	1.50	1.00	> 3.30	--	--	--	--	--
Manganese II, field	NA	mg/l			--	--	--	--	--	--	--	12.0	--	--	--	0.052	0.257	0.304	--	--	--	--	--
Methane	NA	mg/l			--	--	--	--	--	--	--	0.57	--	1.2	0.92	2.8	0.91 H	1.3	--	--	--	--	--
Nitrogen, ammonia, as N	NA	mg/l			--	--	< 0.100 U	--	3.71	3.71	3.84	--	--	--	0.178	--	--	< 0.100 U	0.161	0.128	< 0.100 U	--	0.114
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	--	--	--	--	--	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--	--	--	--
pH, field	NA	pH units			7.35	7.79	7.15	7.48	6.67	6.78	6.51	6.87	6.98	7.25	7.02	7.76	6.97	6.97	6.95	6.95	6.66	7.65	7.49
Redox (oxidation potential), field	NA	mV			-138	-150	-57	-99	183.8	-92	-90	-65	-148.3	-96	-86	-177	-155	-117	117	-106	-91	-47.7	111
Solids, total dissolved	NA	mg/l			--	--	512	--	2180	1670 J3	1960	--	--	--	728	--	--	647 B	1080	1030	1240	--	184
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			947	493	845	873	84	3349	3227	1277	840	1211	1302	788	776	1083	82	2025	2129	334	345
Sulfate, as SO4	NA	mg/l			--	--	5.33	--	< 5.00 U	6.02	< 5.00 U	15.1	--	17.1	19.1	< 5.00 U	13.6	8.66	9.47	13.2	8.24	--	< 5.00 U
Sulfide, as S^{2-}	NA	mg/l			--	--	--	--	--	--	--	0.08	--	0.08	0.75	0.04	> 0.80	0.06	--	--	--	--	--
Temperature, field	NA	deg C			12.8	12.2	13.1	13	16.1	16.5	16.2	24.5	13.8	7.1	18.2	15.5	14.4	18.6	14	14.0	14.2	8.7	9.2
Turbidity, field	NA	NTU			4.0	24.3	4.9	19.9	4.4	9.0	7.9	47.3	13	17.3	8.9	4.9	19.1	7.5	28.4	39.2	35.3	1	1.2
Metals																							
Arsenic	Dissolved	ug/l		2.5	--	--	5.95	--	32.7	34.5	33.0	--	--	--	< 2.00 U	--	--	< 2.00 U	28.4	30.9	32.6	--	< 2.00 U
Boron	Dissolved	ug/l	**500 RAA17**	250.0	--	--	450	--	**3380**	**3210**	**3310**	--	--	--	< 200 U	--	--	< 200 U	**1300**	**1340**	**1470**	--	< 200 U
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l			--	--	71.0	--	176	157	148	--	--	--	179	--	--	133	164	178	176	--	45.2
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	--	--	< 4.00 U	--	< 4.00 U	< 4.00 U	< 4.00 U	--	--	--	< 4.00 U	--	--	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	--	< 4.00 U
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			--	--	3520	--	15400	13800	13400	--	--	--	735	--	--	9860	9250	13400	16800	--	1450
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l			--	--	51.8	--	127	106	100	--	--	--	68.2	--	--	67.1	81.7	82.9	82.6	--	14.1
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l			--	--	2.47	--	9.67	9.24	9.74	--	--	--	3.28	--	--	3.72	5.09	5.37	5.8	--	1.61
Sodium	Dissolved	mg/l			--	--	30.2	--	457	425	433	--	--	--	7.87	--	--	17.3	95.9	108	133	--	4.64
Zinc	Dissolved	ug/l	2000 HRL94	500.0	--	--	< 10.0 U	--	< 10.0 U	< 10.0 U	< 10.0 U	--	--	--	< 10.0 U	--	--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--	< 10.0 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	P-311D 10/20/2021 N	P-311D 5/10/2022 N	P-311D 7/13/2022 N	P-311D 10/31/2022 N	P-311D 4/18/2023 N	P-311D 7/19/2023 N	P-311D 10/20/2023 N	P-311L 4/23/2021 N	P-311L 7/13/2021 N	P-311L 10/20/2021 N	P-311L 2/07/2022 N	P-311L 4/11/2022 N	P-311L 7/13/2022 N	P-311L 9/07/2022 N	P-311L 10/31/2022 N	P-311L 4/18/2023 N	P-311L 7/19/2023 N	P-311L 10/20/2023 N
Effective Date			11/13/2023	07/23/2015																		
Exceedance Key			**Bold**	Underline																		
Volatile Organic Compounds																						
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	2.41	1.95	2.02	1.70	1.03	1.35	< 1.00 U	1.41	1.59	1.30	< 1.00 U
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U C4 J4	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U C3	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U C5 J4	< 10.0 U J3 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.29	1.12	1.22	1.04	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	2.48	2.16	2.92	2.21	1.04	1.37	< 1.00 U	1.43	1.66	1.05	< 1.00 U
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	2.11	2.08	2.29	1.90	< 1.00 U	1.77	1.03	2.21	2.28	2.13	1.04
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		< 5.00 U C3	< 5.00 U	< 5.00 U J3	< 5.00 U	< 5.00 U J3 J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U C5 J3	< 5.00 U J3 J4	< 5.00 U	< 5.00 UC5J3J4	< 5.00 U C5	< 5.00 U
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	0.0810	< 0.0500 U	< 0.0500 U	0.0630	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	P-311D	P-311D	P-311D	P-311D	P-311D	P-311D	P-311D	P-311L	P-311L	P-311L	P-311L	P-311L	P-311L	P-311L	P-311L	P-311L	P-311L
				Date	10/20/2021	5/10/2022	7/13/2022	10/31/2022	4/18/2023	7/19/2023	10/20/2023	4/23/2021	7/13/2021	10/20/2021	2/07/2022	4/11/2022	7/13/2022	9/07/2022	10/31/2022	4/18/2023	7/19/2023	10/20/2023
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																		
Effective Date			11/13/2023	07/23/2015																		
Exceedance Key			**Bold**	Underline																		
General Parameters																						
Alkalinity, total, as CaCO3	NA	mg/l			--	--	177	--	--	190	--	--	351	--	--	--	360	--	--	--	389	--
Anions	NA	meq/l			--	--	3.63	--	--	3.85	--	--	8.27	--	--	--	8.64	--	--	--	9.14	--
Carbon, total organic	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cations	NA	meq/l			--	--	3.66	--	--	3.61	--	--	8.00	--	--	--	8.96	--	--	--	8.84	--
Chloride	NA	mg/l			--	--	< 1.00 U	--	--	< 1.00 U	--	--	26.3	--	--	--	34.5	--	--	--	34.9	--
Dissolved oxygen, field test kit					--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l			0.6	0.7	1.0	0.7	0.3	1.3	0.7	0.7	0.5	0.9	1.1	1.1	0.8	1.2	1.4	0.6	1.0	0.9
Ethane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylene	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron, ferrous, FE II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	NA	mg/l			--	--	0.536	--	--	< 0.100 U	--	--	< 0.100 U	--	--	--	0.443	--	--	--	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, field	NA	pH units			6.66	7.61	7.60	7.50	7.54	7.62	7.6	7.5	7.36	6.78	7.39	7.65	7.55	7.47	7.36	7.39	7.48	7.38
Redox (oxidation potential), field	NA	mV			-121.9	-125	15	--	-92	-27	-80	84.5	163.8	1	-64	-50	-25	55	-21	-78	-45	-50
Solids, total dissolved	NA	mg/l			--	--	184	--	--	182 J3	--	--	408	--	--	--	448	--	--	--	465	--
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			338	347	383	364	335	359	350	696	88	725	730	783	829	859	789	777	811	805
Sulfate, as SO4	NA	mg/l			--	--	< 5.00 U	--	--	< 5.00 U	--	--	24.4	--	--	--	22.9	--	--	--	18.1	--
Sulfide, as S^{2-}	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	NA	deg C			8.7	9.6	10.0	10.6	9.0	9.3	9	8.4	10.2	9.4	8.3	10.1	10.2	10.7	10.4	9.0	9.2	9.2
Turbidity, field	NA	NTU			7.1	1.2	0.9	0.9	0.7	1.5	0.9	47.1	29.5	35.5	38.3	43.3	91.1	81.1	41.1	37.7	56.1	4.03
Metals																						
Arsenic	Dissolved	ug/l		2.5	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	--	< 2.00 U	--	--	--	< 2.00 U	--
Boron	Dissolved	ug/l	**500 RAA17**	250.0	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	--	< 200 U	--	--	--	< 200 U	--
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l			--	--	46.2	--	--	45.2	--	--	101	--	--	--	111	--	--	--	111	--
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	--	< 4.00 U	--	--	--	< 4.00 U	--
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			--	--	1230	--	--	1260	--	--	802	--	--	--	9370	--	--	--	937	--
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l			--	--	13.2	--	--	13.1	--	--	32.3	--	--	--	34	--	--	--	35.6	--
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l			--	--	1.23	--	--	1.29	--	--	1.7	--	--	--	1.83	--	--	--	1.86	--
Sodium	Dissolved	mg/l			--	--	4.41	--	--	4.51	--	--	4.89	--	--	--	5.79	--	--	--	6.51	--
Zinc	Dissolved	ug/l	2000 HRL94	500.0	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	--	26.5	--	--	--	< 10.0 U	--

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-315L
				Date	4/21/2021	7/13/2021	10/19/2021	4/14/2022	7/14/2022	11/02/2022	4/24/2023	7/20/2023	10/17/2023	4/22/2021	7/15/2021	10/19/2021	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/17/2023	4/22/2021
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																			
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	3.89	4.20	3.10	2.26	3.43	3.05	2.63	4.74	2.55	6.06	3.83	3.85	3.29	2.84	2.79	1.67	1.99	1.89	< 1.00 U
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U C3
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U C5 J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	0.298 C5 J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	1.17	1.47	1.18	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	1.62	0.615	2.22	1.63	1.62	< 1.00 U	< 1.00 U	< 1.00 U	0.418	0.459	0.491	< 1.00 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U C5 J4	< 10.0 U C3	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U J4
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		3.48	3.12	3.27	2.24	3.40	2.83	< 1.00 U	4.20	3.40	3.77	2.59	3.10	1.98	1.69	1.67	< 1.00 U	1.14	1.61	< 1.00 U
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	14.2	14.5	10.8	9.44	12.3	11.3	10.1	16.9	10.0	25.9	17.3	15.8	14.9	13.1	12.8	10.4	11.1	10.3	< 1.00 U
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	17.4 C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	10.1 C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		17.7	18.5	11.0 C3	15.4	17.6 C5	12.1	16.1 C5	12.3	18.4 C3	24.3	20.4	12.7 C3	15.8	13.1 C5 J3	7.53	5.33 C5J3J4	7.90 C5	6.71 C3	< 5.00 U C3
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	0.127	< 0.100 U	< 0.100 U	0.134	0.121	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	**0.271**	< 0.0500 U	**0.292**	0.0920	< 0.0500 U	**0.405**	< 0.0500 U	**0.299**	0.172	< 0.0500 U	< 0.0500 U	**0.451**	**0.210**	**0.789**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-315L
				Date	4/21/2021	7/13/2021	10/19/2021	4/14/2022	7/14/2022	11/02/2022	4/24/2023	7/20/2023	10/17/2023	4/22/2021	7/15/2021	10/19/2021	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/17/2023	4/22/2021
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																			
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
General Parameters																							
Alkalinity, total, as CaCO3	NA	mg/l			--	749	--	586	545	561	562	568	547	--	776	--	--	667	--	--	707	--	194
Anions	NA	meq/l			--	17.6	--	--	13.3	--	--	14.0	--	--	17.8	--	--	16.0	--	--	16.3	--	3.95
Carbon, total organic	NA	mg/l			--	6.33	--	3.82	4.26	2.88	3.72	4.13	3.62	--	--	--	--	--	--	--	--	--	--
Cations	NA	meq/l			--	17.1	--	--	13.7	--	--	14.6	--	--	17.8	--	--	16.2	--	--	15.8	--	3.87
Chloride	NA	mg/l			--	83.9	--	67.6	68.2	71.9	70.6	79.9	74.0	--	62.0	--	--	41.6	--	--	37.5	--	< 1.00 U
Dissolved oxygen, field test kit					--	--	--	1.8	1	< 1	< 1	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l			0.9	1.6	2.1	2.3	1.5	0.8	0.5	0.9	0.6	1.5	1.7	2.8	0.8	1.9	2.0	0.4	0.9	0.7	0.9
Ethane	NA	mg/l			--	< 0.0010	--	< 0.0010 U	0.00037 J	0.00065 J	0.00042 HJ	< 0.0034 U	--	--	--	--	--	--	--	--	--	--	--
Ethylene	NA	mg/l			--	< 0.0010	--	< 0.0010 U	< 0.00024 U	< 0.00024 U	< 0.00024 UH	< 0.0048 U	--	--	--	--	--	--	--	--	--	--	--
Iron, ferrous, FE II, field	NA	mg/l			--	2.60	--	0.63	2.50	2.19	0.94	1.41	0.80	--	--	--	--	--	--	--	--	--	--
Manganese II, field	NA	mg/l			--	16.0	--	--	--	0.506	0.161	0.151	0.222	--	--	--	--	--	--	--	--	--	--
Methane	NA	mg/l			--	0.91	--	0.24	0.59	0.5	0.38 H	0.26	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	NA	mg/l			--	< 0.100 U	--	--	0.239	--	--	< 0.100 U	--	--	< 0.100 U	--	--	0.552	--	--	< 0.100 U	--	< 0.100 U
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.100 U
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	< 1.00 U	--	< 1.00 U Q	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	--	--	--	--	--	--	--	--	--
pH, field	NA	pH units			6.85	6.97	6.56	6.78	7.05	7.01	7.06	6.89	6.83	6.8	6.91	7.02	6.76	6.74	6.82	6.67	6.43	6.64	7.05
Redox (oxidation potential), field	NA	mV			-5.8	54	-44.2	-36	-30	-100	-93	-12	-47	152.3	-1.8	-85.5	-61	-52	-52	-78	-41	-42	95
Solids, total dissolved	NA	mg/l			--	860	--	--	696	--	--	685	--	--	852	--	--	810	--	--	840	--	193
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.50
Specific conductance @ 25 ºC, field	NA	umhos/cm			1271	1413	1292	1256	1400	1101	815	1099	1014	1475	1465	1473	1362	1403	1352	1340	1363	1319	349
Sulfate, as SO4	NA	mg/l			--	12.6	--	25.0	24.3	28.4	25.0	19.7	25.2	--	25.4	--	--	70.7	--	--	51.8	--	< 5.00 U
Sulfide, as S^{2-}	NA	mg/l			--	0.72	--	0.02	0.30	> 0.80	0.59	0.30	0.29	--	--	--	--	--	--	--	--	--	--
Temperature, field	NA	deg C			8.6	11.8	9.4	6.6	12.5	9.8	8.3	13	9.2	8.5	12	10.8	8.4	9.2	9.0	8.4	9.5	9.2	11.2
Turbidity, field	NA	NTU			6.3	37.9	15.6	11.3	67.2	69.5	3.4	21.9	8.2	17.8	23.5	35.8	7.4	20.1	17.1	1.1	17.3	1.5	23.3
Metals																							
Arsenic	Dissolved	ug/l		2.5	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	2.78
Boron	Dissolved	ug/l	**500 RAA17**	250.0	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	< 200 U
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 2.00 U
Calcium	Dissolved	mg/l			--	202	--	--	159	--	--	175	--	--	209	--	--	201	--	--	193	--	37.7
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	< 4.00 U
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 10.0 U
Iron	Dissolved	ug/l			--	3520	--	--	2900	--	--	4880	--	--	12100	--	--	3930	--	--	5930	--	1420
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 10.0 U
Magnesium	Dissolved	mg/l			--	70.4	--	--	58.6	--	--	64	--	--	77.3	--	--	65.1	--	--	63.3	--	14.2
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**100**
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.200 U
Potassium	Dissolved	mg/l			--	3.12	--	--	2.62	--	--	2.43	--	--	3.09	--	--	2.75	--	--	2.83	--	2.78
Sodium	Dissolved	mg/l			--	24.2	--	--	17.7	--	--	9.09	--	--	11.8	--	--	13.7	--	--	14.5	--	15.9
Zinc	Dissolved	ug/l	2000 HRL94	500.0	--	< 10.0 U	--	--	< 10.0 U	--	--	11.2	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	< 10.0 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	P-315L	P-315L	P-315L	P-315L	P-315L	P-315L	315-OWA	315-OWA	315-OWA	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C2
				Date	7/15/2021	10/20/2021	4/12/2022	7/12/2022	4/18/2023	7/18/2023	7/15/2021	7/12/2022	7/18/2023	4/21/2021	7/12/2021	10/19/2021	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/20/2023	4/21/2021
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																			
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.03
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U C4	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U C4	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 1.00 U	< 1.00 U	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	< 1.00 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U J4	< 10.0 U C5	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U C5 J4	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U C3	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.04	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	4.48	3.88	4.60	3.46	4.09	4.67	3.76	1.40	3.00	3.09
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	9.36	7.65	7.38	12.4	11.1	13.4	11.2	7.09	4.01	10.5
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U	12.0 C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J3	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U C3	< 5.00 U	< 5.00 U C5 J3	< 5.00 U	< 5.00 UC5J3J4	< 5.00 U C5	< 5.00 U	< 5.00 U
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.515**	**0.424**	**0.438**	< 0.0500 U	**0.217**	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.240**	0.134
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	P-315L	P-315L	P-315L	P-315L	P-315L	P-315L	315-OWA	315-OWA	315-OWA	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C2
				Date	7/15/2021	10/20/2021	4/12/2022	7/12/2022	4/18/2023	7/18/2023	7/15/2021	7/12/2022	7/18/2023	4/21/2021	7/12/2021	10/19/2021	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/20/2023	4/21/2021
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																			
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
General Parameters																							
Alkalinity, total, as CaCO3	NA	mg/l			200	--	--	186	--	193	39.8	38.7	54.8	--	501	--	--	432	--	--	234	--	--
Anions	NA	meq/l			4.09	--	--	3.72	--	3.88	0.975	1.03	1.41	--	13.5	--	--	8.64	--	--	7.09	--	--
Carbon, total organic	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cations	NA	meq/l			3.92	--	--	3.77	--	3.68	0.987	1.23	1.50	--	12.7	--	--	12.0	--	--	5.29	--	--
Chloride	NA	mg/l			< 1.00 U	--	--	< 1.00 U	--	< 1.00 U	2.51	3.15	3.49	--	99.1	--	--	95.2	--	--	82.4	--	--
Dissolved oxygen, field test kit					--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l			1.2	0.5	0.5	1.9	0.8	1.5	4.8	6.0	5.9	2.8	0.9	5	1.6	1.0	2.1	0.4	0.9	0.4	2.5
Ethane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylene	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron, ferrous, FE II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	NA	mg/l			0.125	--	--	0.297	--	< 0.100 U	< 0.100 U	0.216	< 0.100 U	--	< 0.100 U	--	--	0.268	--	--	< 0.100 U	--	--
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, field	NA	pH units			6.73	7.21	7.39	7.33	7.30	7.05	6.33	7.50	6.45	7.28	7.09	6.73	7.35	7.32	7.32	7.24	6.93	7.16	7.39
Redox (oxidation potential), field	NA	mV			131.8	-178.5	-111	88	-35	-43	186.8	45	--	128	182.9	-68.5	-113	-74	-90	-121	-49	-103	-39.8
Solids, total dissolved	NA	mg/l			199	--	--	183	--	200	80.0	89.0 B	104	--	680 Q	--	--	584	--	--	383	--	--
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			376	354	365	352	355	449	99	198	190	1137	372	1135	1100	1038	1089	1049	1013	1050	931
Sulfate, as SO4	NA	mg/l			< 5.00 U	--	--	< 5.00 U	--	< 5.00 U	5.19	8.00	10.5	--	32.8	--	--	21.1	--	--	< 5.00 U	--	--
Sulfide, as S^{2-}	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	NA	deg C			9	8.5	8.7	10.5	10.0	12.2	7.6	10.9	10.9	9.6	11.3	11.4	10.4	15.0	10.6	10.0	14.8	11.4	10.2
Turbidity, field	NA	NTU			18.4	12.9	11	20.3	16.3	19.5	115	147	101	0.8	4.7	5.2	21.5	21.3	17.7	6.1	27.3	4.1	3.6
Metals																							
Arsenic	Dissolved	ug/l		2.5	2.78	--	--	2.29	--	2.63	< 2.00 U	< 2.00 U	< 2.00 U	--	7.23	--	--	< 2.00 U	--	--	< 2.00 U	--	--
Boron	Dissolved	ug/l	**500 RAA17**	250.0	< 200 U	--	--	< 200 U	--	< 200 U	< 200 U	< 200 U	< 200 U	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l			36.9	--	--	37.5	--	38.6	10.6	12.1	17.5	--	153	--	--	142	--	--	32.9	--	--
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	< 4.00 U	--	--	< 4.00 U	--	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			1130	--	--	353	--	171	153	4510	118	--	1630	--	--	665	--	--	2270	--	--
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l			14.2	--	--	13.6	--	12.7	3.13	3.31	4.82	--	53.4	--	--	53.8	--	--	39.1	--	--
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l			3.07	--	--	2.38	--	2.14	3.04	2.87	3.84	--	2.52	--	--	3.09	--	--	2.53	--	--
Sodium	Dissolved	mg/l			18.1	--	--	16.3	--	14.9	2.74	2.66	2.98	--	12.1	--	--	7.72	--	--	6.5	--	--
Zinc	Dissolved	ug/l	2000 HRL94	500.0	< 10.0 U	--	--	< 10.0 U	--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320L	P-320L	P-320L	P-320L	P-320L	P-320L	P-320L	P-320L	P-321L	P-321L
					Date	7/12/2021	10/19/2021	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/20/2023	4/21/2021	7/12/2021	10/19/2021	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/20/2023	4/21/2021	7/12/2021
					Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5		< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75		< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	2.62	2.04	2.17	2.43	2.23	2.49	1.98	1.84	1.42	3.39	2.18
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0		< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0		< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05		< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25		< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	0.155	0.121	0.154	< 1.00 U	< 1.00 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5		< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000		< 10.0 U C3	< 10.0 U C3	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U C5	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3
Allyl chloride	NA	ug/l	30 HRL94	7.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5		< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0		< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l				< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25		< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l				< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3
Chlorotoluene, o	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0		< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17			2.59	3.42	3.39	1.89	2.76	2.51	2.63	2.88	2.53	2.15	2.67	2.22	2.19	2.28	1.82	1.43	1.64	4.17	3.30
Ethyl benzene	NA	ug/l	40 HRL23	12.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0		8.61	9.12	6.79	3.03	4.88	3.49	9.64	7.29	12.5	9.45	10.9	10.5	10.3	9.83	7.87	7.99	5.91	10.1	9.21
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25		< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0		< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0		< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15		< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5		< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Propylbenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18			< 5.00 U C3	< 5.00 U C3	< 5.00 U	< 5.00 U C5 J3	< 5.00 U	< 5.00 U UC5J3J4	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U C5	< 5.00 U	< 5.00 U J3	< 5.00 U	< 5.00 U J3 J4	< 5.00 U	< 5.00 U	< 5.00 U C3
Toluene	NA	ug/l	70 HRL23	50.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1		< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0		< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05		< 0.0500 U	0.0860	**0.308**	**0.455**	**0.345**	**0.334**	0.0630	< 0.0500 U	**0.409**	**0.296**	**0.200**	**0.327**	**0.772**	**0.401**	**0.417**	< 0.0500 U	**0.212**	**0.565**	**0.423**
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75		< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	P-320C2 7/12/2021 N	P-320C2 10/19/2021 N	P-320C2 4/11/2022 N	P-320C2 7/12/2022 N	P-320C2 10/27/2022 N	P-320C2 4/18/2023 N	P-320C2 7/18/2023 N	P-320C2 10/20/2023 N	P-320L 4/21/2021 N	P-320L 7/12/2021 N	P-320L 10/19/2021 N	P-320L 4/11/2022 N	P-320L 7/12/2022 N	P-320L 10/27/2022 N	P-320L 4/18/2023 N	P-320L 7/18/2023 N	P-320L 10/20/2023 N	P-321L 4/21/2021 N	P-321L 7/12/2021 N
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
General Parameters																							
Alkalinity, total, as CaCO3	NA	mg/l			411	--	--	435	--	--	418	--	--	436	--	--	262	--	--	390	--	--	450
Anions	NA	meq/l			10.8	--	--	11.4	--	--	10.8	--	--	10.3	--	--	6.90	--	--	9.35	--	--	12.2
Carbon, total organic	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.60
Cations	NA	meq/l			10.3	--	--	11.4	--	--	7.91	--	--	9.69	--	--	8.80	--	--	8.70	--	--	11.9
Chloride	NA	mg/l			76.6	--	--	54.4	--	--	72.1	--	--	39.0	--	--	45.2	--	--	42.4	--	--	94.1
Dissolved oxygen, field test kit					--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l			0.5	0.8	1.7	1.5	2.4	0.2	0.7	0.8	1.7	0.9	0.8	1.1	1.4	0.8	0.3	1.0	0.7	1.3	2.6
Ethane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.0010
Ethylene	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.0010
Iron, ferrous, FE II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.90
Manganese II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.1
Methane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.38
Nitrogen, ammonia, as N	NA	mg/l			< 0.100 U	--	--	0.312	--	--	< 0.100 U	--	--	< 0.100 U	--	--	0.516	--	--	< 0.100 U	--	--	< 0.100 U
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 1.00 U
pH, field	NA	pH units			7.35	6.92	7.29	7.50	7.28	7.17	6.98	7.24	7.27	7.26	6.87	7.31	7.36	7.36	7.17	6.62	7.29	7.23	6.4
Redox (oxidation potential), field	NA	mV			157	-136.7	-110	-62	-77	-84	-55	-99	4.6	161.7	-107.5	-98	-45	-49	-65	-30	-66	-69	91
Solids, total dissolved	NA	mg/l			552 Q	--	--	588	--	--	585	--	--	507 Q	--	--	335	--	--	479	--	--	651
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			357	1006	1123	1130	1057	1050	1103	940	853	867	905	895	831	835	828	697	837	972	1046
Sulfate, as SO4	NA	mg/l			19.8	--	--	56.1	--	--	19.5	--	--	24.0	--	--	18.7	--	--	16.9	--	--	28.8
Sulfide, as S^{2-}	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.08
Temperature, field	NA	deg C			11.9	11.9	10.4	15.3	10.6	10.0	14.9	11.8	10.1	12	12	10.2	14.8	11.3	10.2	15.5	11.7	10.7	11.9
Turbidity, field	NA	NTU			3.8	6.6	3.7	53.2	43.3	4.3	63.2	3	3.6	26.5	24.6	17	90.3	29.9	9.2	79.3	6.1	1.5	2.0
Metals																							
Arsenic	Dissolved	ug/l		2.5	< 2.00 U	--	--	5.26	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U
Boron	Dissolved	ug/l	**500 RAA17**	250.0	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l			126	--	--	140	--	--	81.2	--	--	123	--	--	106	--	--	107	--	--	141
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			370	--	--	2600	--	--	4110	--	--	1360	--	--	2150	--	--	3710	--	--	810
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l			44.2	--	--	48.2	--	--	40.6	--	--	39.6	--	--	38.5	--	--	35.6	--	--	50.1
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l			2.73	--	--	2.31	--	--	2.42	--	--	2.36	--	--	2.44	--	--	2.73	--	--	2.94
Sodium	Dissolved	mg/l			8.09	--	--	7.64	--	--	6.99	--	--	4.45	--	--	4.53	--	--	4.81	--	--	14.1
Zinc	Dissolved	ug/l	2000 HRL94	500.0	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	P-321L	P-321L	P-321L	P-321L	P-321L	P-321L	P-321L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-323L	P-323L	P-323L
				Date	10/19/2021	4/14/2022	7/15/2022	11/03/2022	4/24/2023	7/20/2023	10/18/2023	4/22/2021	7/15/2021	10/19/2021	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/17/2023	4/21/2021	7/12/2021	10/19/2021
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																			
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U J3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	2.89	2.91	3.33	2.67	2.21	2.56	1.90	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	10.6	7.84	8.19
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C4
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C4
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	0.662 C5 J4	0.390	0.472
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	0.322	0.336	0.379	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	5.58	5.96	5.37
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U C5	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U C3	< 10.0 U C5
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	< 1.00 U	< 1.00 U C5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		4.22	4.34	4.27	3.26	2.74	2.79	2.56	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	5.62	4.06	4.87
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	11.2	11.6	9.73	8.22	6.81	8.52	5.67	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	35.4	25.7	25.2
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.00	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U C3	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		< 5.00 U C5	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 UC5J3J4	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U C3	19.6	11.4 C3	17.4 C5
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	**0.955**	**0.949**	**0.925**
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	**0.415**	**0.434**	< 0.0500 U	**0.446**	**0.334**	**0.482**	**0.219 C3**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.225**	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

					Location	P-321L	P-321L	P-321L	P-321L	P-321L	P-321L	P-321L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-323L	P-323L	P-323L
					Date	10/19/2021	4/14/2022	7/15/2022	11/03/2022	4/24/2023	7/20/2023	10/18/2023	4/22/2021	7/15/2021	10/19/2021	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/17/2023	4/21/2021	7/12/2021	10/19/2021
					Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																				
Effective Date			11/13/2023	07/23/2015																				
Exceedance Key			**Bold**	Underline																				
General Parameters																								
Alkalinity, total, as CaCO3	NA	mg/l			--	431	392	391	420	413	413	--	328	--	--	330	--	--	430	--	--	797	--
Anions	NA	meq/l			--	--	9.95	--	--	10.7	--	--	7.20	--	--	7.44	--	--	9.90	--	--	19.0	--
Carbon, total organic	NA	mg/l			--	3.84	2.20 B	2.06	2.76 B	2.20	2.32	--	--	--	--	--	--	--	--	--	--	5.24	--
Cations	NA	meq/l			--	--	9.94	--	--	10.6	--	--	7.08	--	--	7.48	--	--	9.61	--	--	17.9	--
Chloride	NA	mg/l			--	76.8	51.7	57.7	69.2	63.3	65.1	--	12.5	--	--	18.9	--	--	35.7	--	--	93.3	--
Dissolved oxygen, field test kit					--	0.6	3	< 1	< 1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l			0.3	1.1	3.2	0.8	0.3	0.9	0.7	0.5	0.8	0.7	0.1	1.0	0.9	0.4	0.9	0.8	0.7	3.8	1.1
Ethane	NA	mg/l			--	< 0.0010 U	0.00017 J	< 0.00017 U	0.00039 HJ	< 0.0034 U	< 0.0450 U	--	--	--	--	--	--	--	--	--	--	< 0.0010	--
Ethylene	NA	mg/l			--	< 0.0010 U	< 0.00024 U	< 0.00024 U	< 0.00024 UH	< 0.0048 U	< 0.0396 U	--	--	--	--	--	--	--	--	--	--	< 0.0010	--
Iron, ferrous, FE II, field	NA	mg/l			--	0.72	0.80	1.04	2.13	1.19	0.81	--	--	--	--	--	--	--	--	--	--	1.52	--
Manganese II, field	NA	mg/l			--	--	--	0.212	0.270	0.250	0.219	--	--	--	--	--	--	--	--	--	--	11.8	--
Methane	NA	mg/l			--	0.45	0.5	0.38	0.19 H	0.24	0.199 1b	--	--	--	--	--	--	--	--	--	--	0.067	--
Nitrogen, ammonia, as N	NA	mg/l			--	--	0.148	--	--	< 0.100 U	--	--	< 0.100 U	--	--	0.403	--	--	< 0.100 U	--	--	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--	--	--	--	--	--	--	--	--	< 1.00 U	--
pH, field	NA	pH units			6.85	7.23	7.25	7.18	7.24	6.99	7.13	7.43	7.5	7.08	8.13	7.81	7.80	7.60	6.95	7.16	6.76	6.35	6.49
Redox (oxidation potential), field	NA	mV			-100.7	-98	-20	-50	-71	-78	-54	-106	-1.2	-77.7	-234	-25	-19.5	-150	-46	-72	-41.6	104	-81.9
Solids, total dissolved	NA	mg/l			--	--	558	--	--	556	--	--	360	--	--	353	--	--	497	--	--	922	--
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			995	1052	970	910	935	576	759	781	288	815	413	692	623	752	875	993	1571	1470	1549
Sulfate, as SO4	NA	mg/l			--	28.9	31.2	29.1	31.5	32.6	33.2	--	14.6	--	--	15.1	--	--	14.4	--	--	23.3	--
Sulfide, as S^{2-}	NA	mg/l			--	0.07	0.07	0.16	0.10	0.07	0.07	--	--	--	--	--	--	--	--	--	--	0.35	--
Temperature, field	NA	deg C			11.7	11.2	12	12.0	11.9	12.1	11.9	8.2	13.6	9.8	7.6	15.0	8.8	8.5	9.8	10.5	8.7	10.5	10.4
Turbidity, field	NA	NTU			3.6	3.2	2.6	4.0	3.5	2	2.5	2.1	5.3	19.1	15.7	5.4	11.9	19.7	13.5	4	63.5	9.3	12.1
Metals																								
Arsenic	Dissolved	ug/l		2.5	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--
Boron	Dissolved	ug/l	**500 RAA17**	250.0	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	290	--
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l			--	--	119	--	--	128	--	--	79.0	--	--	78.0	--	--	112	--	--	196	--
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			--	--	626	--	--	800	--	--	2720	--	--	1010	--	--	1650	--	--	3010	--
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l			--	--	41	--	--	46	--	--	34.2	--	--	39.9	--	--	44.4	--	--	71.4 V	--
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l			--	--	2.86	--	--	2.91	--	--	1.89	--	--	1.97	--	--	2.07	--	--	3.8	--
Sodium	Dissolved	mg/l			--	--	12.8	--	--	8.86	--	--	4.09	--	--	5.05	--	--	5.19	--	--	45.8	--
Zinc	Dissolved	ug/l	2000 HRL94	500.0	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	P-323L 4/14/2022 N	P-323L 7/15/2022 N	P-323L 11/03/2022 N	P-323L 4/24/2023 N	P-323L 7/20/2023 N	P-323L 10/18/2023 N	P-324L 4/22/2021 N	P-324L 7/15/2021 N	P-324L 10/19/2021 N	P-324L 4/11/2022 N	P-324L 7/12/2022 N	P-324L 10/27/2022 N	P-324L 4/18/2023 N	P-324L 7/18/2023 N	P-324L 10/20/2023 N	P-325L 4/22/2021 N	P-325L 7/13/2021 N	P-325L 10/15/2021 N	P-325L 4/13/2022 N
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U J3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	7.67	7.67	7.27	6.71	6.50	5.59	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	7.87	6.70	7.88	4.88
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C4
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	0.433	0.364	0.376	0.351	0.374	0.337	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	0.336 C5 J4	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	4.86	4.47	4.31	3.14	3.18	2.97	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	2.04	1.96	2.19	2.03
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C5 J4	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.46	1.54	1.85	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		4.07	4.28	3.31	3.04	3.29	3.68	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	9.51	8.77	12.0	4.30
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	22.7	27.1	26.4	22.2	24.4	18.3	2.22	2.35	2.66	1.60	1.55	1.27	< 1.00 U	< 1.00 U	< 1.00 U	34.9	29.9	35.3	15.7
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	1.11	1.03	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.05	1.19	1.31	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		12.9	13.3 C5	10.9	9.77	14.4	12.3 C5J3J4	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U	23.6	21.0	18.7	11.6 J3
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	**0.811**	**0.888**	**0.758**	**0.669**	**0.707**	**0.871**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	**0.650**	< 0.0500 U	**0.218**	< 0.0500 U	**0.285**	0.189 C3	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.774**	**0.708**	**0.983**	**0.277**
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-323L	P-323L	P-323L	P-323L	P-323L	P-323L	P-324L	P-324L	P-324L	P-324L	P-324L	P-324L	P-324L	P-324L	P-325L	P-325L	P-325L	P-325L
					Date	4/14/2022	7/15/2022	11/03/2022	4/24/2023	7/20/2023	10/18/2023	4/22/2021	7/15/2021	10/19/2021	4/11/2022	7/12/2022	10/27/2022	4/18/2023	7/18/2023	10/20/2023	4/22/2021	7/13/2021	10/15/2021	4/13/2022
					Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
General Parameters																							
Alkalinity, total, as CaCO3	NA	mg/l				705	700	699	730	680	696	--	315	--	--	297	--	--	290	--	--	642	--	622
Anions	NA	meq/l				--	17.5	--	--	17.4	--	--	6.85	--	--	6.70	--	--	6.76	--	--	17.0	--	--
Carbon, total organic	NA	mg/l				5.22	6.93	5.27	6.36	6.19	6.65	--	--	--	--	--	--	--	--	--	--	9.81	--	7.11
Cations	NA	meq/l				--	17.7	--	--	17.4	--	--	7.57	--	--	6.76	--	--	6.85	--	--	16.2	--	--
Chloride	NA	mg/l				92.9	107	112	115	118	122	--	18.9	--	--	27.0	--	--	34.1	--	--	128	--	108
Dissolved oxygen, field test kit						0	4	2	< 1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.5
Dissolved oxygen, field YSI	NA	mg/l				0.1	4	2.8	0.1	0.9	0.6	0.6	0.8	0.2	1.3	0.8	0.7	0.2	0.8	0.5	1	4.8	0.8	0.5
Ethane	NA	mg/l				< 0.0010 U	0.00039 J	0.00054 J	0.00078 HJ	< 0.0034 U	< 0.0450 U	--	--	--	--	--	--	--	--	--	--	< 0.0010	--	< 0.0010 U
Ethylene	NA	mg/l				< 0.0010 U	< 0.00024 U	< 0.00024 U	< 0.00024 UH	< 0.0048 U	< 0.0396 U	--	--	--	--	--	--	--	--	--	--	< 0.0010	--	< 0.0010 U
Iron, ferrous, FE II, field	NA	mg/l				1.35	2.45	1.99	1.63	1.95	2.58	--	--	--	--	--	--	--	--	--	--	1.45	--	--
Manganese II, field	NA	mg/l				--	--	0.506	0.500	0.452	0.490	--	--	--	--	--	--	--	--	--	--	10.9	--	--
Methane	NA	mg/l				0.076	0.063	0.066	0.058 H	0.058 J	0.223	--	--	--	--	--	--	--	--	--	--	0.17	--	1.1
Nitrogen, ammonia, as N	NA	mg/l				--	0.178	--	--	< 0.100 U	--	--	< 0.100 U	--	--	0.548 J3	--	--	< 0.100 U	--	--	< 0.100 U	--	--
Nitrogen, nitrate + nitrite, as N	NA	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL			< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--	--	--	--	--	--	--	--	--	< 1.00 U	--	< 1.00 U
pH, field	NA	pH units				6.79	6.73	6.77	6.8	6.59	6.64	7.76	7.77	7.15	7.88	7.82	7.48	7.62	6.86	7.18	7.05	6.9	6.99	7.53
Redox (oxidation potential), field	NA	mV				-61	-62	-57	-64	-58	-5	-161.2	59.7	-197.4	-212	-115	-124	-167	-78	-125	62	30	-96	-86
Solids, total dissolved	NA	mg/l				--	906	--	--	832	--	--	324	--	--	318	--	--	319	--	--	844	--	--
Solids, total suspended	NA	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm				1629	1606	1528	1163	960	1532	566	291	597	552	646	590	645	633	720	1413	1425	1415	1209
Sulfate, as SO4	NA	mg/l				22.7	24.8	20.3	20.6	22.7	22.5	--	< 5.00 U	--	--	< 5.00 U P1	--	--	< 5.00 U	--	--	25.0	--	23.0
Sulfide, as S^{2-}	NA	mg/l				0.80 >	0.29	0.27	> 0.80	0.18	0.28	--	--	--	--	--	--	--	--	--	--	0.06	--	--
Temperature, field	NA	deg C				9.4	10.1	10.1	9.8	10.3	10.3	8.9	9.5	9.6	8.9	9.9	9.4	8.8	10.3	10.5	8.2	13.3	8.5	7.5
Turbidity, field	NA	NTU				90	50.2	--	167	12.6	6.2	28.4	23.1	17.3	18	36.1	19.0	53.7	87	21.1	4.1	6.6	7.7	8.3
Metals																								
Arsenic	Dissolved	ug/l		2.5		--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--
Boron	Dissolved	ug/l	**500 RAA17**	250.0		--	256	--	--	286	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	291	--	--
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l				--	199	--	--	187	--	--	56.0	--	--	41.3	--	--	49.8	--	--	184	--	--
Chromium	Dissolved	ug/l	100 CR HRL93	25.0		--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--
Copper	Dissolved	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l				--	2880	--	--	2970	--	--	2150	--	--	3940	--	--	7690	--	--	2130	--	--
Lead	Dissolved	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l				--	73.2	--	--	73.1	--	--	52	--	--	49.4	--	--	44.3	--	--	66.4	--	--
Manganese	Dissolved	ug/l	**100 HRL23**			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l				--	3.96	--	--	3.77	--	--	2.78	--	--	2.44	--	--	2.47	--	--	3.01	--	--
Sodium	Dissolved	mg/l				--	35.4	--	--	42	--	--	7.93	--	--	9.89	--	--	8.65	--	--	33.1	--	--
Zinc	Dissolved	ug/l	2000 HRL94	500.0		--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

			Location	P-325L	P-325L	P-325L	P-325L	P-325L	P-326L	P-326L	P-326L	P-326L	P-326L	P-326L	P-326L	P-326L	P-326L	P-327L	P-327L	P-327L	P-327L
			Date	7/14/2022	11/02/2022	4/24/2023	7/20/2023	10/17/2023	5/27/2021	7/13/2021	10/15/2021	4/13/2022	7/14/2022	11/02/2022	4/24/2023	7/20/2023	10/17/2023	7/14/2021	10/18/2021	10/18/2021	7/13/2022
			Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																		
Effective Date			11/13/2023	07/23/2015																		
Exceedance Key			**Bold**	Underline																		
Volatile Organic Compounds																						
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	8.43	7.29	6.17	6.91	4.08	5.55	5.06	5.53	7.94	5.71	5.13	4.46	3.54	5.75	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J4	< 1.00 U J4	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	0.250	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	0.273	0.258	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	1.74	1.57	1.40	1.69	1.61	1.63	2.02	2.29	1.82	2.21	1.99	< 0.100 U	0.675	1.54	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U J4
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C5 J4	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U J4	< 0.500 U J4	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	2.20 C5	1.62 C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.61	1.13 C5	< 1.00 U C3	< 1.00 U	< 1.00 U	1.23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		13.0	8.52	5.91	7.20	5.02	6.05	4.90	6.02	10.4	5.88	4.55	2.40	3.05	8.65	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	34.3	28.2	22.1	29.3	14.6	17.3 C3	17.7	20.4	28.6	18.7	16.8	15.0	13.6	23.9	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	1.21	1.11	< 1.00 U	1.03	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U J3 J4	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U J3 J4	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		11.7 C5	7.45	5.39	5.34	12.5 C3	14.9	< 5.00 U	< 5.00 U	14.7 J3	16.7 C5	11.4	13.4 C5	16.4	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	**1.44**	**0.949**	**0.462**	**0.712**	**0.228**	< 0.0500 U	**0.338**	< 0.0500 U	**0.958**	< 0.0500 U	**0.317**	< 0.0500 U	**0.200**	**0.529**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	**P-325L**	**P-325L**	**P-325L**	**P-325L**	**P-325L**	**P-326L**	**P-326L**	**P-326L**	**P-326L**	**P-326L**	**P-326L**	**P-326L**	**P-326L**	**P-327L**	**P-327L**	**P-327L**	**P-327L**
				Date	**7/14/2022**	**11/02/2022**	**4/24/2023**	**7/20/2023**	**10/17/2023**	**5/27/2021**	**7/13/2021**	**10/15/2021**	**4/13/2022**	**7/14/2022**	**11/02/2022**	**4/24/2023**	**7/20/2023**	**10/17/2023**	**7/14/2021**	**10/18/2021**	**10/18/2021**	**7/13/2022**
				Sample Type	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																	
Effective Date			11/13/2023	07/23/2015																	
Exceedance Key			**Bold**	Underline																	
General Parameters																					
Alkalinity, total, as CaCO3	NA	mg/l			562	596	642	624	621	--	643	--	589	625	613	610	623	645	203	198	206	191
Anions	NA	meq/l			14.5	--	--	16.8	--	--	14.7	--	--	14.7	--	--	14.5	--	4.63	4.91	4.68	4.22
Carbon, total organic	NA	mg/l			7.72	6.88	9.67	9.51	8.44	--	3.25	--	2.37	3.53	2.43	3.21	2.77	2.65	--	--	--	--
Cations	NA	meq/l			15.3	--	--	16.9	--	--	14.8	--	--	15.0	--	--	14.3	--	4.48	4.93	4.63	4.36
Chloride	NA	mg/l			95.6	104	131	138	117	--	53.7	--	47.8	60.9	58.3	56.9	58.1	59.0	14.3	23.1	13.6	10.3
Dissolved oxygen, field test kit					5	2	< 1	--	--	--	--	--	2.5	6	9	1	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l			5.3	1.9	0.2	1.5	0.8	4.8	5.8	3.1	2.5	6.5	3.5	1.3	2.3	3.3	0.9	0.7	0.3	1.3
Ethane	NA	mg/l			0.00088 J	0.00067 J	0.00082 HJ	0.0063 J	--	--	< 0.0010	--	< 0.0010 U	0.00028 J	0.00051 J	0.00038 HJ	< 0.0034 U	--	--	--	--	--
Ethylene	NA	mg/l			< 0.00024 U	< 0.00024 U	< 0.00024 UH	0.0093 J	--	--	< 0.0010	--	< 0.0010 U	< 0.00024 U	< 0.00024 U	< 0.00024 UH	< 0.0048 U	--	--	--	--	--
Iron, ferrous, FE II, field	NA	mg/l			1.25	0.99	1.76	1.51	1.64	--	2.61	--	--	2.72	1.24	2.15	1.80	2.04	--	--	--	--
Manganese II, field	NA	mg/l			--	0.333	0.346	0.300	0.279	--	12.0	--	--	--	0.199	0.327	0.350	0.299	--	--	--	--
Methane	NA	mg/l			1.6	1.1	0.56 H	0.74	--	--	0.73	--	0.32	0.3	0.27	0.19 H	0.16	--	--	--	--	--
Nitrogen, ammonia, as N	NA	mg/l			0.146	--	--	< 0.100 U	--	--	< 0.100 U	--	--	0.108	--	--	< 0.100 U	--	0.202	0.205	0.233	0.505
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--	--	--
pH, field	NA	pH units			7.14	7.19	7.73	6.88	7.5	7.21	6.76	7.48	7.43	7.20	7.19	7.17	6.87	7.45	8.76	7.47	7.55	8.50
Redox (oxidation potential), field	NA	mV			-82	-67	-73	-35	-24	163.4	60	-149	-121	-110	-88	-36	-39	-31	-127.6	-210.6	-212.6	-189
Solids, total dissolved	NA	mg/l			709	--	--	842	--	--	687	--	--	724	--	--	700 J3	--	238	267	237	216
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			1473	1365	1485	1499	1405	1138	1021	924	1172	1345	1251	1245	1283	1275	386	415	453	391
Sulfate, as SO4	NA	mg/l			29.4	28.1	24.6	18.6	25.4	--	15.0	--	< 5.00 U	22.2	27.3	22.1	17.5	25.3	8.24	14.3	8.62	5.13
Sulfide, as S^{2-}	NA	mg/l			0.13	ND	0.02	0.02	BDL	--	0.04	--	--	0.05	ND	0.03	0.02	BDL	--	--	--	--
Temperature, field	NA	deg C			13.5	12.8	7.7	9.6	8.2	10.7	14.2	10.6	4.5	16.0	15.0	6.9	15	8.8	8.8	9.3	9.2	8.9
Turbidity, field	NA	NTU			5.8	5.5	4	3.2	3.3	150	5.5	6.5	8	5.0	4.2	6.3	4.1	7	10.2	7.8	5.4	11.3
Metals																						
Arsenic	Dissolved	ug/l		2.5	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	3.08	2.48	3.40	3.37
Boron	Dissolved	ug/l	**500 RAA17**	250.0	< 200 U	--	--	362	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	< 200 U	< 1000 U	< 1000 U	< 200 U
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l			177	--	--	187	--	--	178	--	--	179 V	--	--	163	--	46.8	57.0	53.8	50.8
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			1360	--	--	1980	--	--	8480	--	--	5670	--	--	9590	--	1570	1890	2340	1510
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l			66.7	--	--	67.7	--	--	63.3	--	--	65.1	--	--	59.5	--	17.8	20.8	18.6	17.1
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l			2.87	--	--	3.26	--	--	2.34	--	--	2.49	--	--	2.79	--	8.68	1.52	1.65	2.32
Sodium	Dissolved	mg/l			18.4	--	--	42.6	--	--	8.61	--	--	9.99	--	--	20.1	--	9.29	6.27	6.49	6.99
Zinc	Dissolved	ug/l	2000 HRL94	500.0	< 10.0 U	--	--	< 10.0 U	--	--	16.0	--	--	13.4	--	--	< 10.0 U	--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-327L	P-327L	P-328L	P-328L	P-328L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L	P-333L	P-333L	P-333L	P-333L	P-333L
					Date	10/31/2022	7/19/2023	7/15/2021	7/13/2022	7/21/2023	4/23/2021	7/14/2021	10/20/2021	4/11/2022	7/13/2022	10/31/2022	4/19/2023	7/21/2023	10/20/2023	4/23/2021	7/15/2021	4/11/2022	7/13/2022	5/15/2023
					Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5		< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U J3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75		< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l				< 1.00 U C4	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U C3
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0		< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C4	< 1.00 U C3
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25		< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5		< 1.00 U	< 0.100 U	< 1.00 U	< 1.00 U	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
1,3-Dichlorobenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5		< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l				< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000		< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U C5 J4	< 10.0 U J3	< 10.0 U	< 10.0 U J4	< 10.0 U C5	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U J3	< 10.0 U	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U C5 J4	< 10.0 U
Allyl chloride	NA	ug/l	30 HRL94	7.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5		< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3
Bromomethane	NA	ug/l	10 HRL93	2.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Butylbenzene, sec	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25		< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Cymene p- (toluene isopropyl p-)	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl benzene	NA	ug/l	40 HRL23	12.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25		< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J3	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U J3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0		< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0		< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3
Propylbenzene	NA	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Styrene	NA	ug/l		25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18			< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J3	< 5.00 U	< 5.00 U J3 J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J3	< 5.00 U C3 J3
Toluene	NA	ug/l	70 HRL23	50.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1		< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05		< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75		< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	P-327L	P-327L	P-328L	P-328L	P-328L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L	P-333L	P-333L	P-333L	P-333L	P-333L
				Date	10/31/2022	7/19/2023	7/15/2021	7/13/2022	7/21/2023	4/23/2021	7/14/2021	10/20/2021	4/11/2022	7/13/2022	10/31/2022	4/19/2023	7/21/2023	10/20/2023	4/23/2021	7/15/2021	4/11/2022	7/13/2022	5/15/2023
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																			
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
General Parameters																							
Alkalinity, total, as CaCO3	NA	mg/l			--	214	211	198	201	--	208	--	--	193	--	--	198	--	--	201	--	187	--
Anions	NA	meq/l			--	4.67	4.68	4.47	4.55	--	4.50	--	--	4.23	--	--	4.32	--	--	4.37	--	4.16	--
Carbon, total organic	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cations	NA	meq/l			--	4.35	4.52	4.56	4.46	--	4.32	--	--	4.25	--	--	4.25	--	--	4.35	--	4.27	--
Chloride	NA	mg/l			--	10.1	5.62	6.67	7.05	--	2.57	--	--	3.08	--	--	2.93	--	--	2.10	--	2.74	--
Dissolved oxygen, field test kit					--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l			0.4	0.9	1.1	1.0	0.9	0.6	0.9	2.8	0.5	0.8	0.6	0.3	0.5	0.4	0.4	0.6	2.5	1.3	1.2
Ethane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylene	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron, ferrous, FE II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methane	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	NA	mg/l			--	0.378	0.230	0.491	0.236	--	< 0.100 U	--	--	0.293	--	--	< 0.100 U	--	--	< 0.100 U	--	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, field	NA	pH units			7.80	6.9	8.06	7.99	7.62	7.86	8.21	7.95	7.93	7.98	7.82	7.87	7.72	7.65	7.73	7.7	7.76	7.80	7.48
Redox (oxidation potential), field	NA	mV			-132	-95	0.7	-23	-65	-43.2	55	-216	-119	-123	-106	-88	-125	-81	-7.3	6.1	-110	-30	-19
Solids, total dissolved	NA	mg/l			--	217	238	233	238	--	223	--	--	222	--	--	223	--	--	226	--	207	--
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			402	350	398	434	384	394	390	390	369	402	386	387	389	393	380	153	413	400	398
Sulfate, as SO4	NA	mg/l			--	5.88	14.2	15.4	16.7	--	12.8	--	--	13.7	--	--	13.9	--	--	13.9	--	16.5	--
Sulfide, as S^{2-}	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	NA	deg C			8.4	9.9	9.5	10.1	8.9	7.6	9.3	8.4	7.4	8.5	9.0	7.8	8.5	8.8	7.5	11.9	9.9	12.5	12
Turbidity, field	NA	NTU			5.5	22.1	16.9	25.2	10.1	78.2	19.6	12.1	7.93	17.1	26.9	21.3	12.9	12.1	1.3	4.8	1.3	5.5	5
Metals																							
Arsenic	Dissolved	ug/l		2.5	--	3.27	< 2.00 U	< 2.00 U	< 2.00 U	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	< 2.00 U	--
Boron	Dissolved	ug/l	**500 RAA17**	250.0	--	< 200 U	< 200 U	< 200 U	< 200 U	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	< 200 U	--
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l			--	50.3	53.8	55.8	53.0	--	51.1	--	--	51.9	--	--	48.8	--	--	52.7	--	53.7	--
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	--	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	< 4.00 U	--
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			--	2120	1190	870	1020	--	980	--	--	470	--	--	603	--	--	2220	--	736	--
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l			--	16.9	17.8	17.7	18.2	--	17.6	--	--	16.4	--	--	18.1	--	--	17.5	--	16.9	--
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l			--	2.75	1.77	1.45	1.41	--	1.73	--	--	1.42	--	--	1.78	--	--	1.57	--	1.31	--
Sodium	Dissolved	mg/l			--	6.98	6.43	5.76	5.59	--	5.45	--	--	5.91	--	--	5.79	--	--	3.78	--	3.21	--
Zinc	Dissolved	ug/l	2000 HRL94	500.0	--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	< 10.0 U	--

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	P-333L 8/10/2023 N	P-334L 4/23/2021 N	P-334L 7/13/2021 N	P-334L 10/20/2021 N	P-334L 4/13/2022 N	P-334L 7/15/2022 N	P-334L 11/02/2022 N	P-334L 4/24/2023 N	P-334L 7/24/2023 N	P-334L 10/18/2023 N	P-335L 4/23/2021 N	P-335L 7/15/2021 N	P-335L 10/20/2021 N	P-335L 4/11/2022 N	P-335L 7/13/2022 N	P-335L 10/31/2022 N	P-335L 4/19/2023 N	P-335L 7/21/2023 N	P-335L 10/20/2023 N
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
Volatile Organic Compounds																							
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U J3	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	< 1.00 U	1.39	1.27	1.45	2.10	2.39	2.48	2.79	3.30	2.68	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U	< 10.0 U	< 10.0 U C5	< 10.0 U C3	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U C5 J4	< 10.0 U C5	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U J3	< 10.0 U
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	6.15	6.54	6.70	7.07	8.95 C5	7.55 C3	7.03	8.14	7.48 C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		< 1.00 U	11.3	11.6	14.0	15.7	18.3	15.2	14.9	16.8	16.9	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	< 1.00 U	7.67	7.54	8.02	9.96	11.9	12.3	12.1	15.1	12.3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U J3	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U J3	5.24 C5	< 5.00 U	6.44	5.24	< 5.00 U J3 J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J3	< 5.00 U	< 5.00 U J3 J4	< 5.00 U	< 5.00 U
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	< 0.0500 U	**0.231**	**0.202**	**0.296**	**0.353**	< 0.0500 U	**0.330**	**0.341**	**0.409**	**0.326 C3**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	P-333L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-335L	P-335L	P-335L	P-335L	P-335L	P-335L	P-335L	P-335L	P-335L
				Date	8/10/2023	4/23/2021	7/13/2021	10/20/2021	4/13/2022	7/15/2022	11/02/2022	4/24/2023	7/24/2023	10/18/2023	4/23/2021	7/15/2021	10/20/2021	4/11/2022	7/13/2022	10/31/2022	4/19/2023	7/21/2023	10/20/2023
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																			
Effective Date			11/13/2023	07/23/2015																			
Exceedance Key			**Bold**	Underline																			
General Parameters																							
Alkalinity, total, as CaCO3	NA	mg/l			201	--	268	--	271	258	269	285	275	281	--	210	--	--	189	--	--	187	--
Anions	NA	meq/l			4.34	--	6.05	--	--	5.94	--	--	6.33	--	--	4.56	--	--	4.22	--	--	4.15	--
Carbon, total organic	NA	mg/l			--	--	1.10	--	1.16	1.50 B	< 1.00 U	1.03 B	1.33 B	1.43	--	--	--	--	--	--	--	--	--
Cations	NA	meq/l			4.91	--	5.82	--	--	6.21	--	--	6.11	--	--	4.37	--	--	4.33	--	--	4.04	--
Chloride	NA	mg/l			2.94	--	11.1	--	14.2	14.0	16.5	16.9	16.7	17.9	--	2.91	--	--	3.81	--	--	3.67	--
Dissolved oxygen, field test kit					--	--	--	--	--	1	< 1	< 1	--	--	--	--	--	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l			0.9	0.5	0.9	2	1	1.5	0.8	0.2	0.7	0.3	1.7	1.6	2.2	0.7	1.7	1.1	0.3	1.7	1.2
Ethane	NA	mg/l			--	--	< 0.0010	--	< 0.0010 U	0.00050 J	0.00021 J	0.00042 HJ	0.00035 J	< 0.0450	--	--	--	--	--	--	--	--	--
Ethylene	NA	mg/l			--	--	< 0.0010	--	< 0.0010 U	0.00033 J	< 0.00024 U	0.00024 HJ	< 0.00024 U	< 0.0396 U	--	--	--	--	--	--	--	--	--
Iron, ferrous, FE II, field	NA	mg/l			--	--	0.90	--	--	0.55	0.15	0.21	0.33	0.39	--	--	--	--	--	--	--	--	--
Manganese II, field	NA	mg/l			--	--	50.0	--	--	--	0.079	0.107	0.189	0.180	--	--	--	--	--	--	--	--	--
Methane	NA	mg/l			--	--	0.5	--	0.85	1.1	0.93	0.73 H	0.92	1.120 1b	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	NA	mg/l			0.115 B	--	< 0.100 U	--	--	0.230	--	--	< 0.100 U	--	--	< 0.100 U	--	--	0.192	--	--	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--	--	--	--	--	--	--	--
pH, field	NA	pH units			7.65	7.79	7.32	7.81	7.9	7.58	7.42	7.7	7.35	7.74	7.18	7	7.25	7.62	7.03	6.93	6.90	6.93	7.03
Redox (oxidation potential), field	NA	mV			-60	-40.3	77	-183	-153	-14	-67	-88	-39	-69	-22.8	77	-101	-111	-68	-33	-67	-66	-62
Solids, total dissolved	NA	mg/l			227	--	306	--	--	340	--	--	334 B	--	--	234	--	--	226	--	--	222	--
Solids, total suspended	NA	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			411	516	488	547	482	605	561	560	454	583	406	386	241	407	382	381	382	385	339
Sulfate, as SO4	NA	mg/l			11.6	--	18.3	--	18.4	18.8	20.1	18.5	17.8	19.5	--	13.9	--	--	16.3	--	--	14.6	--
Sulfide, as S^{2-}	NA	mg/l			--	--	0.10	--	--	0.18	0.45	0.33	0.28	0.23	--	--	--	--	--	--	--	--	--
Temperature, field	NA	deg C			11.8	8.6	9.5	9.6	9	9.8	9.6	8.5	9.1	9	9.5	11.3	10	10.1	10.5	12.0	9.9	10.5	10.6
Turbidity, field	NA	NTU			27.3	28.9	41.1	18.9	30.3	21.1	7.1	5	20.7	4.1	30.6	10.1	13.2	16.1	21.1	10.2	9.9	12.1	8.5
Metals																							
Arsenic	Dissolved	ug/l		2.5	< 2.00 U	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--
Boron	Dissolved	ug/l	**500 RAA17**	250.0	< 200 U	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l			54.7 O1	--	71.2	--	--	76.4	--	--	73.9	--	--	52.6	--	--	53.5	--	--	47.9	--
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	6.77	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--
Copper	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			6570	--	159	--	--	167	--	--	258	--	--	880	--	--	562	--	--	404	--
Lead	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l			21.5	--	25.4	--	--	26.7	--	--	27.1	--	--	18.3	--	--	17.5	--	--	17.3	--
Manganese	Dissolved	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l			1.32	--	1.55	--	--	1.66	--	--	1.58	--	--	1.46	--	--	1.31	--	--	1.3	--
Sodium	Dissolved	mg/l			3.44	--	3.15	--	--	3.49	--	--	3.15	--	--	3.87	--	--	3.86	--	--	3.99	--
Zinc	Dissolved	ug/l	2000 HRL94	500.0	54.3	--	< 10.0 U	--	--	< 10.0 U	--	--	17.7	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	P-337L 4/22/2021 N	P-337L 7/15/2021 N	P-337L 10/20/2021 N	P-337L 7/13/2022 N	P-337L 7/20/2023 N	P-338L 10/22/2021 N	P-338L 4/12/2022 N	P-338L 5/10/2022 N	P-338L 7/15/2022 N	P-338L 11/02/2022 N	P-338L 4/24/2023 N	P-338L 7/24/2023 N	P-338L 10/18/2023 N	P-340L 10/22/2021 N	P-340L 4/12/2022 N	P-340L 5/10/2022 N	P-340L 7/15/2022 N	P-340L 11/02/2022 N
Effective Date			11/13/2023	07/23/2015																		
Exceedance Key			**Bold**	Underline																		
Volatile Organic Compounds																						
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U Q	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U Q	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	1.41	< 1.00 U	< 1.00 U	7.36	7.13	8.00	9.67	7.90	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U J3	< 1.00 U Q	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C4 J4	< 1.00 U C4 J4	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4 J4	< 1.00 U C4 J4	< 1.00 U C4	< 1.00 U C4
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U C4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U C4	< 1.00 U	< 1.00 U C4
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U Q	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U Q	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	0.465	0.706	0.784	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U Q	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U J4	< 10.0 U C5 J4	< 10.0 U C3	< 10.0 U C5 J4	10.9 C5 Q	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U C5 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U Q	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J3
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U Q	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	3.45	3.94	3.53	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	1.05	< 1.00 U	< 1.00 U	4.02 C5	3.76 C3	2.79	4.03	4.07 C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	3.57	< 1.00 U	1.10	15.4	11.3	12.2	14.9	15.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	5.03	1.56	1.79	25.0	23.6	22.3	29.5	23.4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U Q	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U Q	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U Q	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U J3 J4	< 1.00 U Q	< 1.00 U C3	< 1.00 U J4	< 1.00 U C3	< 1.00 U J3 J4	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		< 5.00 U C3	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U Q	< 5.00 U C3	< 5.00 U C3	< 5.00 U	18.5 C5	13.1	10.3	15.6	19.5 C5J3J4	< 5.00 U C3	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	3.38	2.88	2.24	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U Q	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U Q	0.194	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.825**	**0.693**	**1.02**	**0.782 C3**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U Q	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

				Location	P-337L	P-337L	P-337L	P-337L	P-337L	P-338L	P-338L	P-338L	P-338L	P-338L	P-338L	P-338L	P-338L	P-340L	P-340L	P-340L	P-340L	P-340L
				Date	4/22/2021	7/15/2021	10/20/2021	7/13/2022	7/20/2023	10/22/2021	4/12/2022	5/10/2022	7/15/2022	11/02/2022	4/24/2023	7/24/2023	10/18/2023	10/22/2021	4/12/2022	5/10/2022	7/15/2022	11/02/2022
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																		
Effective Date			11/13/2023	07/23/2015																		
Exceedance Key			**Bold**	Underline																		
General Parameters																						
Alkalinity, total, as CaCO3	NA	mg/l			206	456	--	199	198	252	255	--	363	401	436	428	455	112	203	--	188	193
Anions	NA	meq/l			4.86	10.3	--	4.90	4.99	5.72	5.59	--	8.36	--	--	9.97	--	2.70	4.49	--	4.15	--
Carbon, total organic	NA	mg/l			--	--	--	--	--	--	16.6	--	4.36 B	1.42 B	2.32	2.72	2.91	--	< 1.00 U	--	1.15 B	< 1.00 U
Cations	NA	meq/l			4.98	10.7	--	4.84	4.84	6.67	5.30	--	8.92	--	--	9.92	--	2.79	4.02	--	4.65	--
Chloride	NA	mg/l			5.79	15.3	--	8.36	9.16	14.1	11.6	--	29.3	32.6	37.6	37.9	41.2	5.48	4.99	--	3.37	3.53
Dissolved oxygen, field test kit					--	--	--	--	--	--	--	--	1	< 1	< 1	--	--	--	--	--	< 1	< 1
Dissolved oxygen, field YSI	NA	mg/l			0.6	0.9	0.7	0.5	0.5	1.3	0.2	0.2	1.8	0.7	0.2	0.7	0.6	0.9	10.2	0.4	0.5	0.8
Ethane	NA	mg/l			--	--	--	--	--	--	--	--	0.00078 J	0.00089 J	0.00092 HJ	0.00058 J	< 0.0450 U	--	--	--	< 0.00017 U	< 0.00017 U
Ethylene	NA	mg/l			--	--	--	--	--	--	--	--	0.00032 J	< 0.00024 U	< 0.00024 UH	< 0.00024 U	< 0.0396 U	--	--	--	< 0.00024 U	< 0.00024 U
Iron, ferrous, FE II, field	NA	mg/l			--	--	--	--	--	--	--	--	1.54	0.95	1.36	2.13	2.21	--	--	--	1.50	1.04
Manganese II, field	NA	mg/l			--	--	--	--	--	--	--	--	--	0.080	0.147	0.238	0.222	--	--	--	--	0.166
Methane	NA	mg/l			--	--	--	--	--	--	--	--	1.4	1.3	1.3 H	1.4	1.720 1b	--	--	--	0.0059	0.024
Nitrogen, ammonia, as N	NA	mg/l			< 0.100 U	< 0.100 U	--	0.254	< 0.100 U	< 0.100 U	0.151	--	0.205	--	--	< 0.100 U	--	0.139	< 0.100 U	--	0.287	--
Nitrogen, nitrate + nitrite, as N	NA	mg/l			< 0.100 U	--	--	--	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	--	--	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	--	--	--	< 1.00 U	< 1.00 U
pH, field	NA	pH units			7.18	7.32	8.28	8.35	7.55	7.39	7.85	7.73	7.37	7.63	7.56	7.25	7.52	7.31	7.98	7.99	7.98	7.91
Redox (oxidation potential), field	NA	mV			-85	33	-199	-35	-47	-145	-187	-165	-99	-185	-98	-87	-77	-248.4	173	-152	-99	-104
Solids, total dissolved	NA	mg/l			257	563	--	266	278	297	278	--	448	--	--	505 B	--	132	203	--	230	--
Solids, total suspended	NA	mg/l			4.10	--	--	--	--	17.4	18.4	--	10.2 Q	--	--	--	--	24.8	< 4.00 U	--	12.7 Q	--
Specific conductance @ 25 ºC, field	NA	umhos/cm			429	417	370	312	346	513	475	485	785	812	755	808	880	254	398	373	417	430
Sulfate, as SO4	NA	mg/l			28.0	34.4	--	32.9	37.0	13.3	7.99	--	13.8	18.8	16.9	16.9	18.1	14.9	14.0	--	14.7	16.8
Sulfide, as S^{2-}	NA	mg/l			--	--	--	--	--	--	--	--	0.26	> 0.80	0.05	0.04	0.07	--	--	--	0.11	0.09
Temperature, field	NA	deg C			9.7	10.5	9.7	10.3	10.1	12.5	9.5	10.2	10.4	10.5	8.8	10.0	9.7	9.4	6.5	8.9	18.5	12.0
Turbidity, field	NA	NTU			31.7	2	2.1	43.3	67	21	23.1	21.1	22.3	5.8	4.1	7.9	3.3	22.5	0.8	0.7	19.7	23.4
Metals																						
Arsenic	Dissolved	ug/l		2.5	< 2.00 U	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	< 2.00 U	--	--	< 2.00 U	--	< 2.00 U	< 2.00 U	--	< 2.00 U	--
Boron	Dissolved	ug/l	**500 RAA17**	250.0	< 200 U	< 200 U	--	< 200 U	< 200 U	< 200 U	394	--	< 200 U	--	--	< 200 U	--	< 200 U	< 200 U	--	< 200 U	--
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)		< 2.00 U	--	--	--	--	< 2.00 U	< 2.00 U	--	< 2.00 U	--	--	--	--	< 2.00 U	< 2.00 U	--	< 2.00 U	--
Calcium	Dissolved	mg/l			60.6	135	--	57.9	56.7	81.0	61.7	--	110 V	--	--	117	--	24.1	51.5	--	52.0	--
Chromium	Dissolved	ug/l	100 CR HRL93	25.0	< 4.00 U	< 4.00 U	--	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	< 4.00 U	< 4.00 U	--	< 4.00 U	--
Copper	Dissolved	ug/l			< 10.0 U	--	--	--	--	< 10.0 U	< 10.0 U	--	< 10.0 U	--	--	--	--	< 10.0 U	< 10.0 U	--	< 10.0 U	--
Iron	Dissolved	ug/l			1420	< 100 U	--	1140	457	4060	< 100 U	--	4720	--	--	1630	--	2140	< 100 U	--	8580	--
Lead	Dissolved	ug/l			< 10.0 U	--	--	--	--	< 10.0 U	< 10.0 U	--	< 10.0 U	--	--	--	--	< 10.0 U	< 10.0 U	--	< 10.0 U	--
Magnesium	Dissolved	mg/l			21.1	43.8	--	21.1	22.2	26.5	21.8	--	36.5	--	--	46.3	--	14.7	17.4	--	18.1	--
Manganese	Dissolved	ug/l	**100 HRL23**		**460**	--	--	--	--	**411**	**331**	--	**431**	--	--	--	--	**207**	**276**	--	**351**	--
Mercury	Dissolved	ug/l			< 0.200 U	--	--	--	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	--	--	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--
Potassium	Dissolved	mg/l			1.25	1.67	--	1.34	1.36	2.15	4.95	--	1.96	--	--	1.87	--	1.65	1.44	--	1.45	--
Sodium	Dissolved	mg/l			2.78	7.2	--	3.3	3.08	5.36	6.69	--	4.20	--	--	4.15	--	5.86	5.14	--	4.68	--
Zinc	Dissolved	ug/l	2000 HRL94	500.0	< 10.0 U	< 10.0 U	--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	10.3	< 10.0 U	--	14.6	--

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

			Location	P-340L	P-341L	P-341L	P-342L	P-342L	P694477	P694477	P694477	P694477	P694477	P694477	P694477	P694477	P694477
			Date	8/10/2023	8/10/2023	10/17/2023	5/15/2023	8/10/2023	4/23/2021	7/14/2021	10/20/2021	4/12/2022	7/13/2022	11/01/2022	4/21/2023	7/21/2023	10/20/2023
			Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74													
Effective Date			11/13/2023	07/23/2015													
Exceedance Key			**Bold**	Underline													
Volatile Organic Compounds																	
1,1,1,2-Tetrachloroethane	NA	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	NA	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	NA	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U J4	< 0.500 U	< 0.500 U	< 0.500 U J4	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	NA	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	NA	ug/l	80 RAA16 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.73	1.64	1.52	1.88	1.00	2.09	2.44	2.67	1.96
1,1-Dichloroethylene	NA	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2,3-Trichloropropane	NA	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	NA	ug/l	4 HRL13 (1)	1.0	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2,4-Trimethylbenzene	NA	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.05	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	NA	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	NA	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J4	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	NA	ug/l	6 HRL18 (1)	12.5	< 0.100 U	< 0.100 U	< 0.100 U	< 1.00 U	< 0.100 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U
1,2-Dichloroethylene, trans	NA	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	NA	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	NA	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	NA	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	NA	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	NA	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	NA	ug/l	3000 HRL23 (1)	1000	< 10.0 U	< 10.0 U J3 J4	< 10.0 U C3	< 10.0 U	< 10.0 U J3 J4	< 10.0 U	< 10.0 U J4	< 10.0 U C3	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J3	< 10.0 U
Allyl chloride	NA	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	NA	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	NA	ug/l			< 1.00 U J4	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	NA	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	NA	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	NA	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	NA	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	NA	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	NA	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	NA	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3
Chlorotoluene, o	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	NA	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	NA	ug/l	500 RAA17 (1)	175.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	2.57	2.59	2.08	2.04	1.05	2.61 C3	2.47	2.75	2.12
Dichlorofluoromethane (Freon-21)	NA	ug/l	20 RAA17		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	3.84	3.71	4.23	3.89	1.97	4.15	3.74	4.77	4.29
Ethyl benzene	NA	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	NA	ug/l	200 RAA16 (1)	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	7.66	7.11	6.33	8.57	4.43	8.19	9.40	10.4	7.67
Hexachlorobutadiene	NA	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J3	< 0.250 U
Methyl ethyl ketone (2-butanone)	NA	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	NA	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J4	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	NA	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	NA	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	NA	ug/l	70 HRL13	17.5	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Propylbenzene	NA	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	NA	ug/l		25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	NA	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	NA	ug/l	600 HRL18		< 5.00 U	< 5.00 U J3	< 5.00 U C3	< 5.00 U C3 J3	< 5.00 U J3	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Toluene	NA	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	NA	ug/l	**0.4 HRL15 (1)**	0.1	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	NA	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	NA	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	NA	ug/l	**0.2 HRL18 (1)**	0.05	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.207**	**0.275**	**0.281**	0.0990	**0.308**	< 0.0500 U	**0.425**	**0.251**
Xylene, total	NA	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits (2021-2023)
Initial Performance Evaluation Report
Elk River Landfill

					Location	P-340L	P-341L	P-341L	P-342L	P-342L	P694477	P694477	P694477	P694477	P694477	P694477	P694477	P694477	P694477
					Date	8/10/2023	8/10/2023	10/17/2023	5/15/2023	8/10/2023	4/23/2021	7/14/2021	10/20/2021	4/12/2022	7/13/2022	11/01/2022	4/21/2023	7/21/2023	10/20/2023
					Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Total or Dissolved	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74															
Effective Date			11/13/2023	07/23/2015															
Exceedance Key			**Bold**	Underline															
General Parameters																			
Alkalinity, total, as CaCO3	NA	mg/l				193	266	274	188	187	--	348	--	--	316	--	--	372	--
Anions	NA	meq/l				4.21	6.33	6.77	4.02	4.01	--	7.83	--	--	6.99	--	--	8.29	--
Carbon, total organic	NA	mg/l				--	2.15 B	< 1.00 U	--	1.19 B	--	--	--	--	--	--	--	--	--
Cations	NA	meq/l				4.45	7.19	6.53	3.90	4.16	--	7.61	--	--	7.16	--	--	8.14	--
Chloride	NA	mg/l				3.85	22.2	27.6	1.04	1.04	--	14.4	--	--	15.0	--	--	17.6	--
Dissolved oxygen, field test kit						--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved oxygen, field YSI	NA	mg/l				0.7	1.7	0.8	0.7	0.8	0.3	0.8	2.1	0.7	1.2	0.6	0.1	0.3	0.2
Ethane	NA	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylene	NA	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron, ferrous, FE II, field	NA	mg/l				1.00	2.59	2.60	--	0.37	--	--	--	--	--	--	--	--	--
Manganese II, field	NA	mg/l				0.189	0.293	0.290	--	0.293	--	--	--	--	--	--	--	--	--
Methane	NA	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	NA	mg/l				0.143 B	0.102	< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	--	--	0.403 J5	--	--	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	NA	mg/l				--	0.679	< 0.100 U	< 0.100 U	< 0.100 U	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	NA	mg/l	10 HRLMCL			--	0.272	< 1.00 U	--	< 0.100 U	--	--	--	--	--	--	--	--	--
pH, field	NA	pH units				7.80	6.23	7.16	7.52	7.70	7.28	6.75	7.43	7.09	8.01	7.98	7.16	7.17	7.35
Redox (oxidation potential), field	NA	mV				-43	-45	-72	-45	-59	-95	-50	-99	28	-55	-195	-155	-194	-163
Solids, total dissolved	NA	mg/l				229	365	339 B	209	206	--	408	--	--	341	--	--	433	--
Solids, total suspended	NA	mg/l				--	125	22.5	63.3	60.4	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	NA	umhos/cm				400	621	626	413	390	634	652	599	527	641	622	720	743	690
Sulfate, as SO4	NA	mg/l				12.0	18.4	24.7	10.7	11.5 J6	--	22.4	--	--	11.7	--	--	17.3	--
Sulfide, as S^{2-}	NA	mg/l				0.06	0.02	0.14	--	0.07	--	--	--	--	--	--	--	--	--
Temperature, field	NA	deg C				11.9	12.2	11.4	12.0	12.0	10.2	10.4	10.8	9.6	10.9	10.5	9.9	4.0	10.2
Turbidity, field	NA	NTU				12.3	43.1	207	50.0	27.2	3	7.9	11.1	14.2	5.1	1.2	0.8	3.0	1.9
Metals																			
Arsenic	Dissolved	ug/l		2.5		< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--
Boron	Dissolved	ug/l	**500 RAA17**	250.0		< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--
Cadmium	Dissolved	ug/l	0.5 HRL15 (1)			--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	--	--	--	--	--	--	--	--
Calcium	Dissolved	mg/l				51.8	86.1	78.7	45.4 O1	47.0	--	92.6	--	--	87.6	--	--	97.6	--
Chromium	Dissolved	ug/l	100 CR HRL93	25.0		< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	4.84	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--
Copper	Dissolved	ug/l				--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l				395	438	< 100 U	< 100 U	< 100 U	--	774	--	--	4200	--	--	2170	--
Lead	Dissolved	ug/l				--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--	--	--	--	--	--	--	--	--
Magnesium	Dissolved	mg/l				19.5	31.5	29.4	17.8	19.9	--	32.9	--	--	29.3	--	--	35.9	--
Manganese	Dissolved	ug/l	**100 HRL23**			--	**768**	**240**	**193 O1**	**170**	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l				--	< 0.200 U	< 0.200 U	< 0.200 U	0.348	--	--	--	--	--	--	--	--	--
Potassium	Dissolved	mg/l				1.31	3.16	2.60 B	1.56	1.77	--	1.97	--	--	1.56	--	--	1.64	--
Sodium	Dissolved	mg/l				4.69	4.11	3.87	2.87	3.05	--	4.6	--	--	4.3	--	--	4.42	--
Zinc	Dissolved	ug/l	2000 HRL94	500.0		16.9	46.6	< 10.0 U	< 10.0 U	43.8	--	< 10.0 U	--	--	25.2	--	--	< 10.0 U	--

Table D1
Groundwater Data Compared to Groundwater-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

Barr Standard Footnotes and Qualifiers

--	Not analyzed/Not available.
>	Greater than.
[1]	Non-compliance well
BDL	Below detection limit.
J-	The result is an estimated quantity and may be biased low.
U	The analyte was analyzed for, but was not detected.

Laboratory Qualifiers

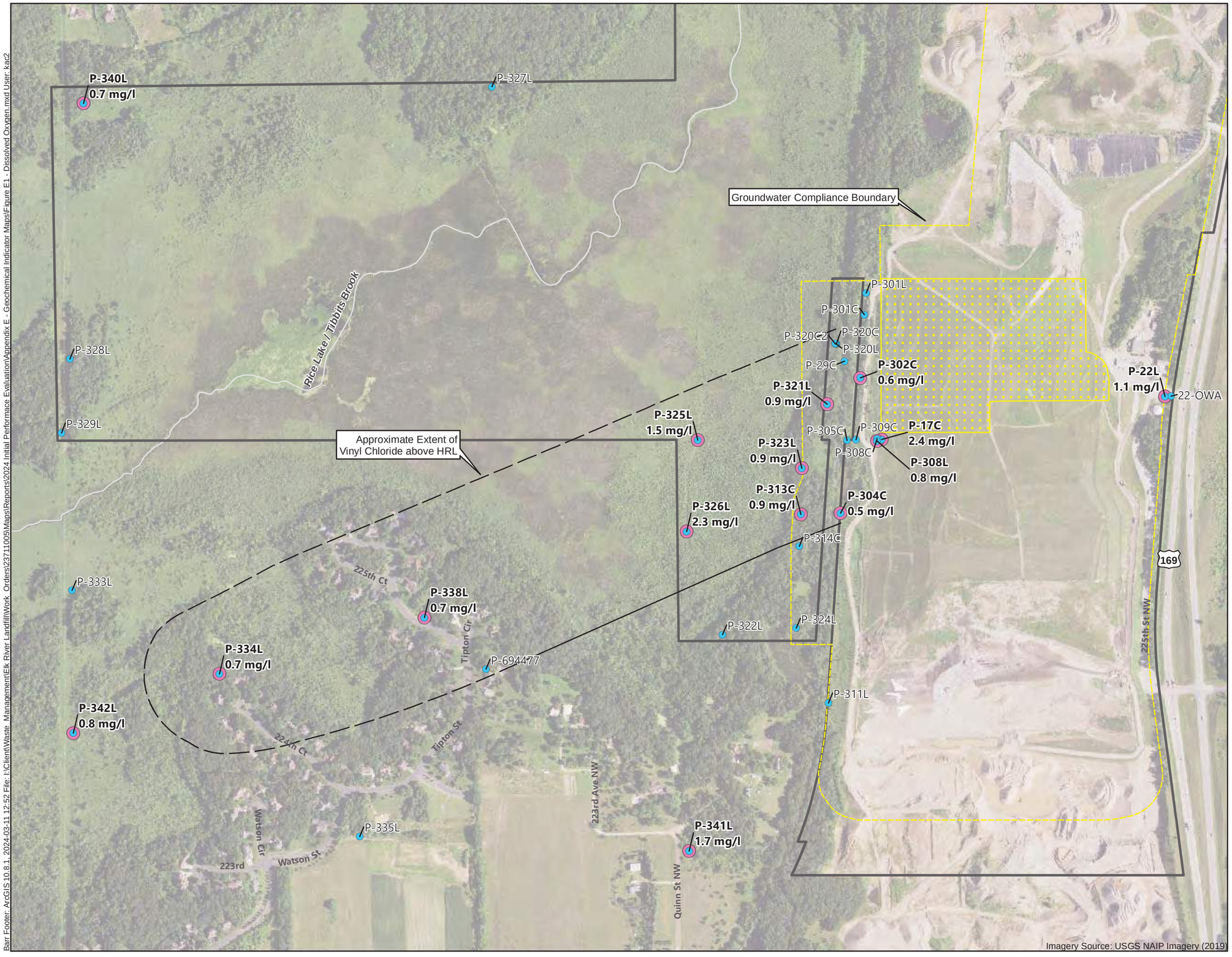
1b	Samples were diluted due to the preservation of the samples which causes instrument issues in headspace analysis.
B	The same analyte is found in the associated blank.
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
C5	The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
H	Recommended sample preservation, extraction or analysis holding time was exceeded.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
O1	The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.
Q	Sample was prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.
V	The sample concentration is too high to evaluate accurate spike recoveries.

MDH Human Health-Based Water Guidance Table

(1)	Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.
CR	Value represents the criteria for Chromium, hexavalent.
DCP	Value shown is 1,3-dichloropropene in the MDH criterion, however, the laboratory reports cis and trans isomers individually.
HBV20	Health Based Value 2020.
HBV22	Health Based Value 2022.
HRL09	Health Risk Limit 2009.
HRL13	Health Risk Limit 2013.
HRL15	Health Risk Limit 2015.
HRL18	Health Risk Limit 2018.
HRL23	Health Risk Limit 2023.
HRL93	Health Risk Limit 1993.
HRL94	Health Risk Limit 1994.
HRLMCL	Health Risk Limit; Maximum Contaminant Level.
ND	Not derived due to insufficient information.
RAA13	Risk Assessment Advice 2013.
RAA16	Risk Assessment Advice 2016.
RAA17	Risk Assessment Advice 2017.
XYL	Value shown is for the sum of the mixed o,m and p Xylene isomers.

Appendix E

Geochemical Parameter Maps



Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

Note:
- Displayed data from July-August 2023 monitoring event. Measured using field YSI probe.
- Data shown only at MNA network monitoring wells.

N

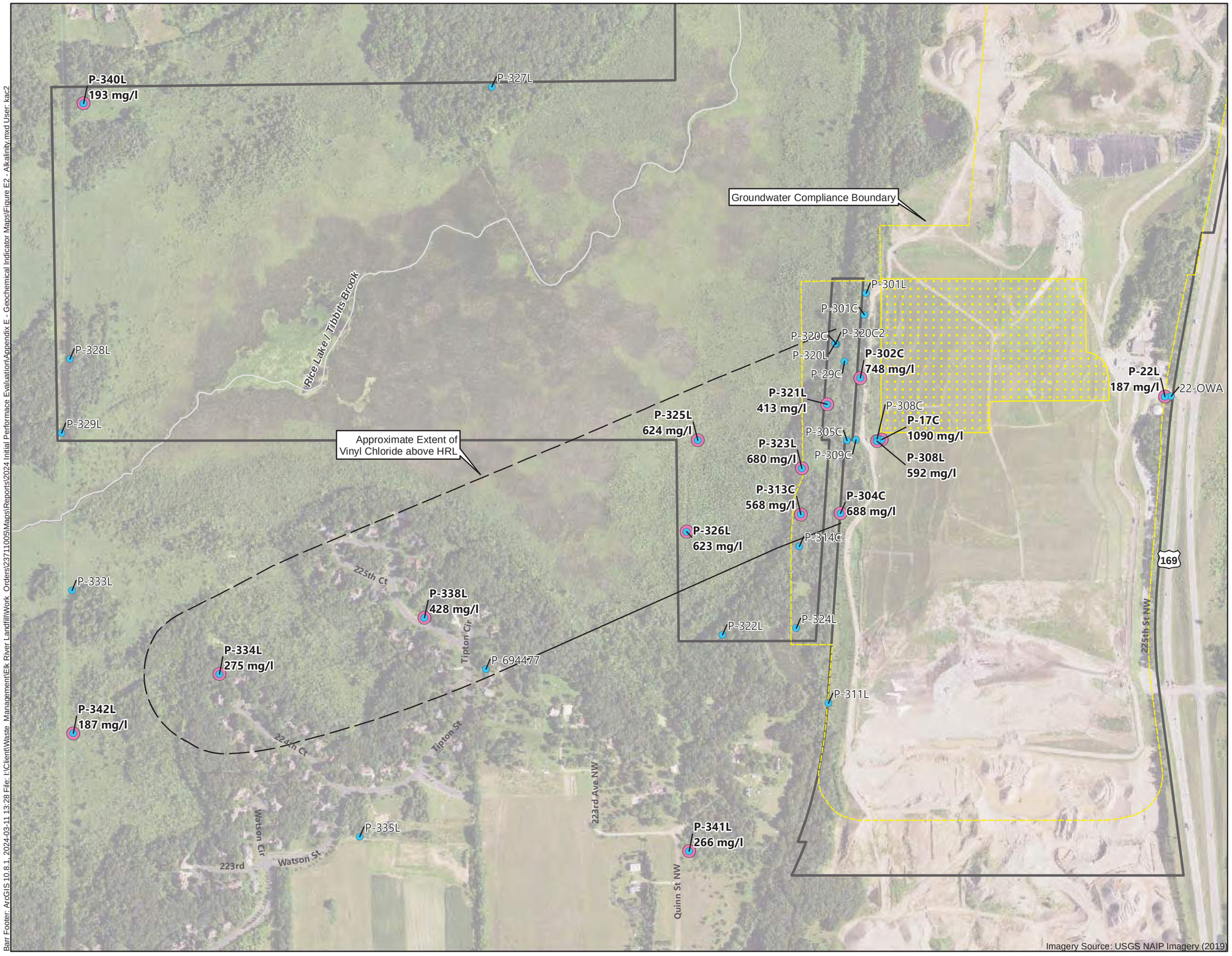
Feet
0 600 1,200

Figure E1

DISSOLVED OXYGEN
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-11 12:52 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711005\Maps\Reports\2024 Initial Performance Evaluation\Appendix E - Geochemical Indicator Maps\Figure E1 - Dissolved Oxygen.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

Note:
- Displayed data from July-August 2023 monitoring event.

N

Feet
0 600 1,200

Figure E2

ALKALINITY
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-11 13:28 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711005\Maps\Reports\2024 Initial Performance Evaluation\Appendix E - Geochemical Indicator Maps\Figure E2 - Alkalinity.mxd User: kac2

Barr Footer: ArcGIS 10.8.1, 2024-03-11 13:30 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711005\Maps\Reports\2024 Initial Performace Evaluation\Appendix E - Geochemical Indicator Maps\Figure E3 - Redox Potential.mxd User: kac2

P-340L
-43 mV

P-327L

P-328L

P-329L

P-333L

P-338L
-87 mV

P-334L
-39 mV

P-342L
-59 mV

P-335L

P-341L
-45 mV

P-326L
-39 mV

P-325L
-35 mV

P-313C
-12 mV

P-323L
-58 mV

P-304C
-55 mV

P-308L
-117 mV

P-17C
-82 mV

P-308C

P-309C

P-305C

P-321L
-78 mV

P-302C
-111 mV

P-29C

P-320C2

P-320L

P-301C

P-301L

P-314C

P-322L

P-324L

P-311L

P-694477

P-22L
-123 mV

22-OWA

Groundwater Compliance Boundary

Approximate Extent of
Vinyl Chloride above HRL

Rice Lake / Tibbits Brook

225th Ct

224th Ct

Tipton Cir

Tipton St

Watson Cir

Watson St

223rd

223rd Ave NW

Quinn St NW

225th St NW

169

Imagery Source: USGS NAIP Imagery (2019)

Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

Note:
- Displayed data from July-August 2023 monitoring event.
- Data shown only at MNA network monitoring wells.

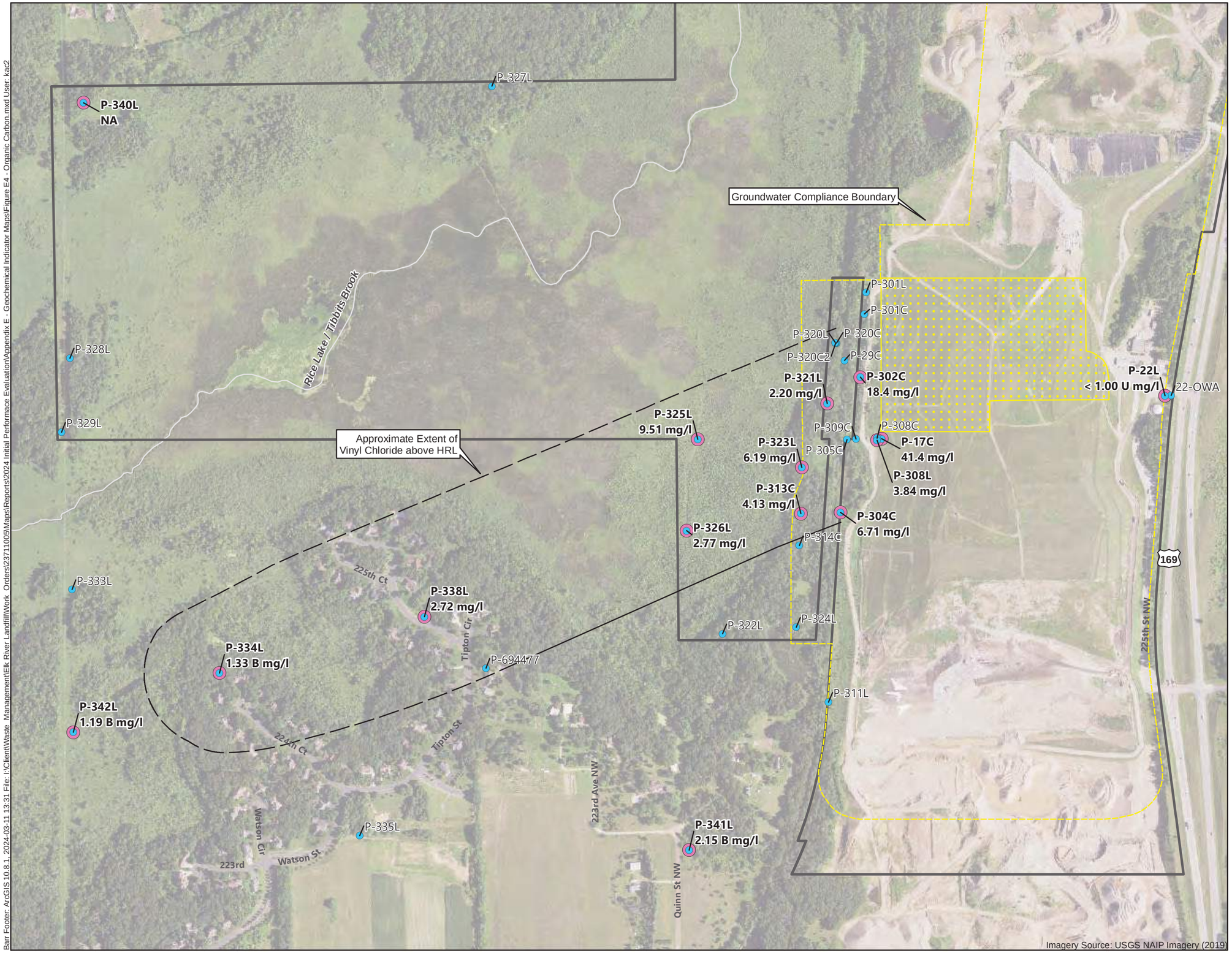
N

Feet
0 600 1,200

Figure E3

REDOX POTENTIAL
Elk River Landfill
Elk River, Minnesota

BARR



Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

Note:
- Displayed data from July-August 2023 monitoring event.

NA - Not Analyzed

U The analyte was analyzed for, but was not detected.
B The same analyte is found in the associated blank.

N

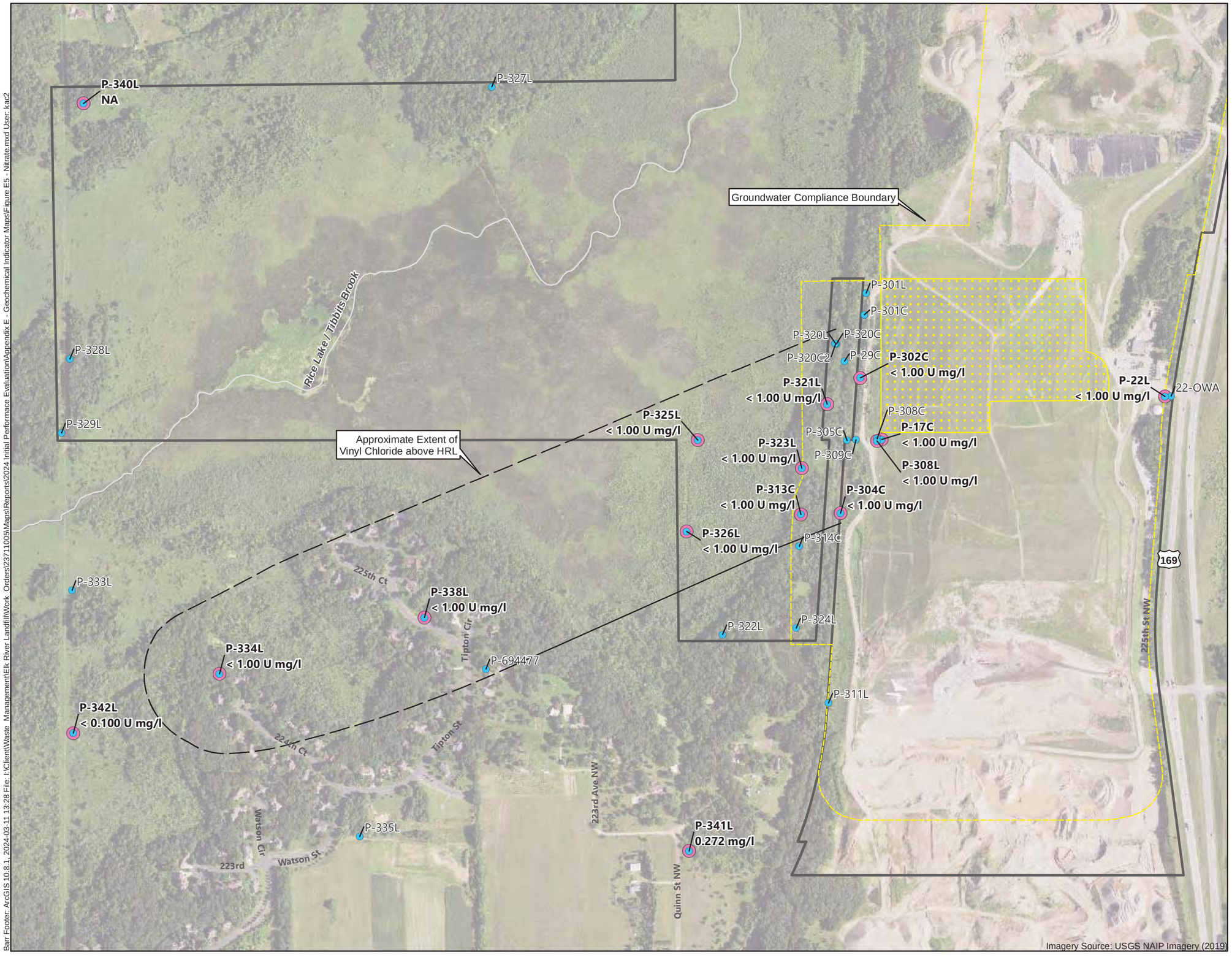
Feet
0 600 1,200

Figure E4

ORGANIC CARBON
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-11 13:31 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711005\Maps\Reports\2024 Initial Performance Evaluation\Appendix E - Geochemical Indicator Maps\Figure E4 - Organic Carbon.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

Note:
- Displayed data from July-August 2023 monitoring event.

NA - Not Analyzed

U The analyte was analyzed for, but was not detected.

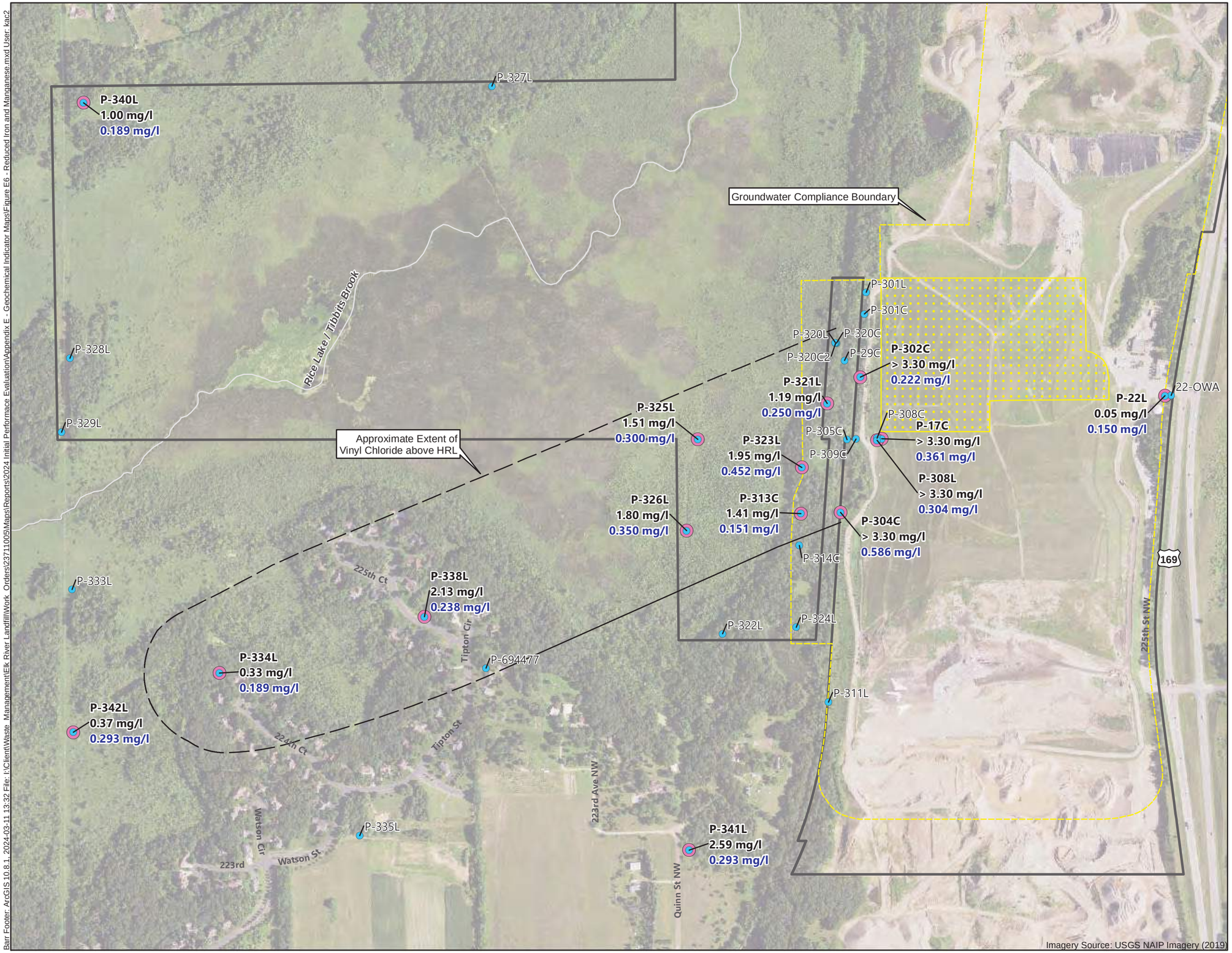
N

Feet
0 600 1,200

Figure E5

NITRATE
Elk River Landfill
Elk River, Minnesota

Barr Footer: ArcGIS 10.8.1, 2024-03-11 13:28 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711005\Maps\Reports\2024 Initial Performance Evaluation\Appendix E - Geochemical Indicator Maps\Figure E5 - Nitrate.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

6.5 mg/l Reduced Iron Concentration

200 mg/l Manganese Concentration

Note:
- Displayed data from July-August 2023 monitoring event.

N

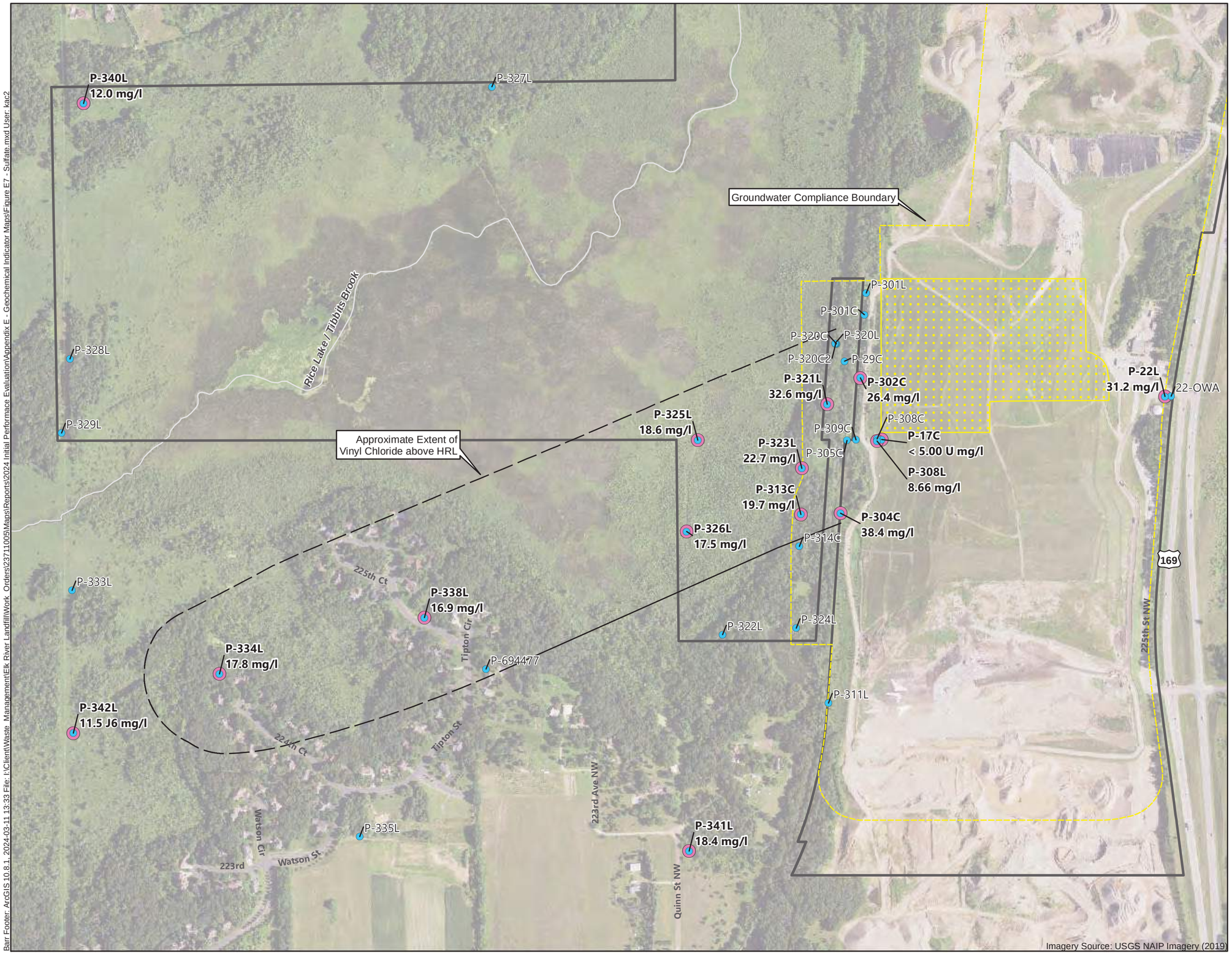
Feet
0 600 1,200

Figure E6

REDUCED IRON AND MANGANESE
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-11 13:32 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711005\Maps\Reports\2024 Initial Performace Evaluation\Appendix E - Geochemical Indicator Maps\Figure E6 - Reduced Iron and Manganese.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

Note:
- Displayed data from July-August 2023 monitoring event.

U The analyte was analyzed for, but was not detected.

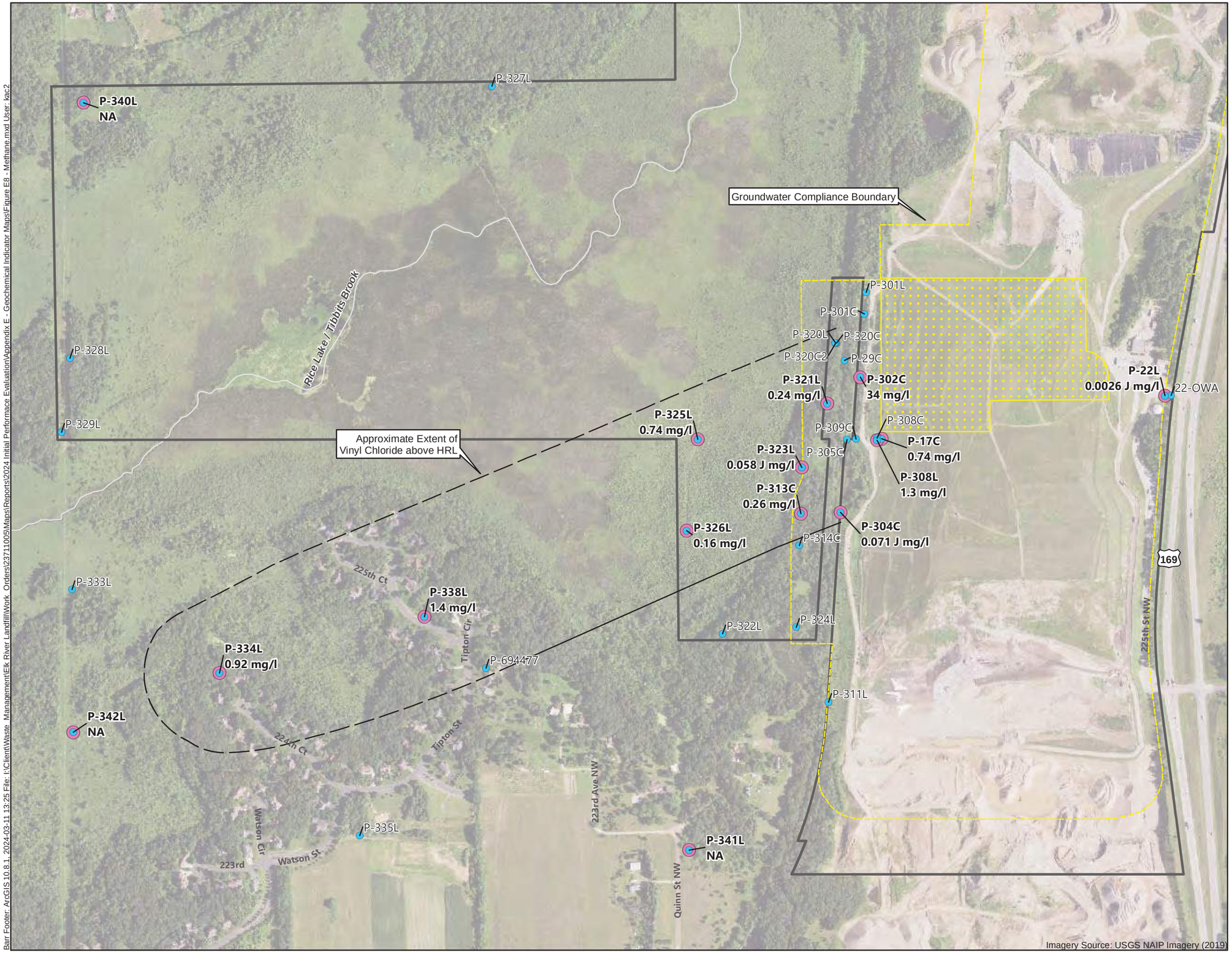
N

Feet
0 600 1,200

Figure E7

SULFATE
Elk River Landfill
Elk River, Minnesota

Barr Footer: ArcGIS 10.8.1, 2024-03-11 13:33 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711005\Maps\Reports\2024 Initial Performance Evaluation\Appendix E - Geochemical Indicator Maps\Figure E7 - Sulfate.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

Note:
- Displayed data from July-August 2023 monitoring event.

NA - Not Analyzed

J The identification of the analyte is acceptable; the reported value is an estimate.

N

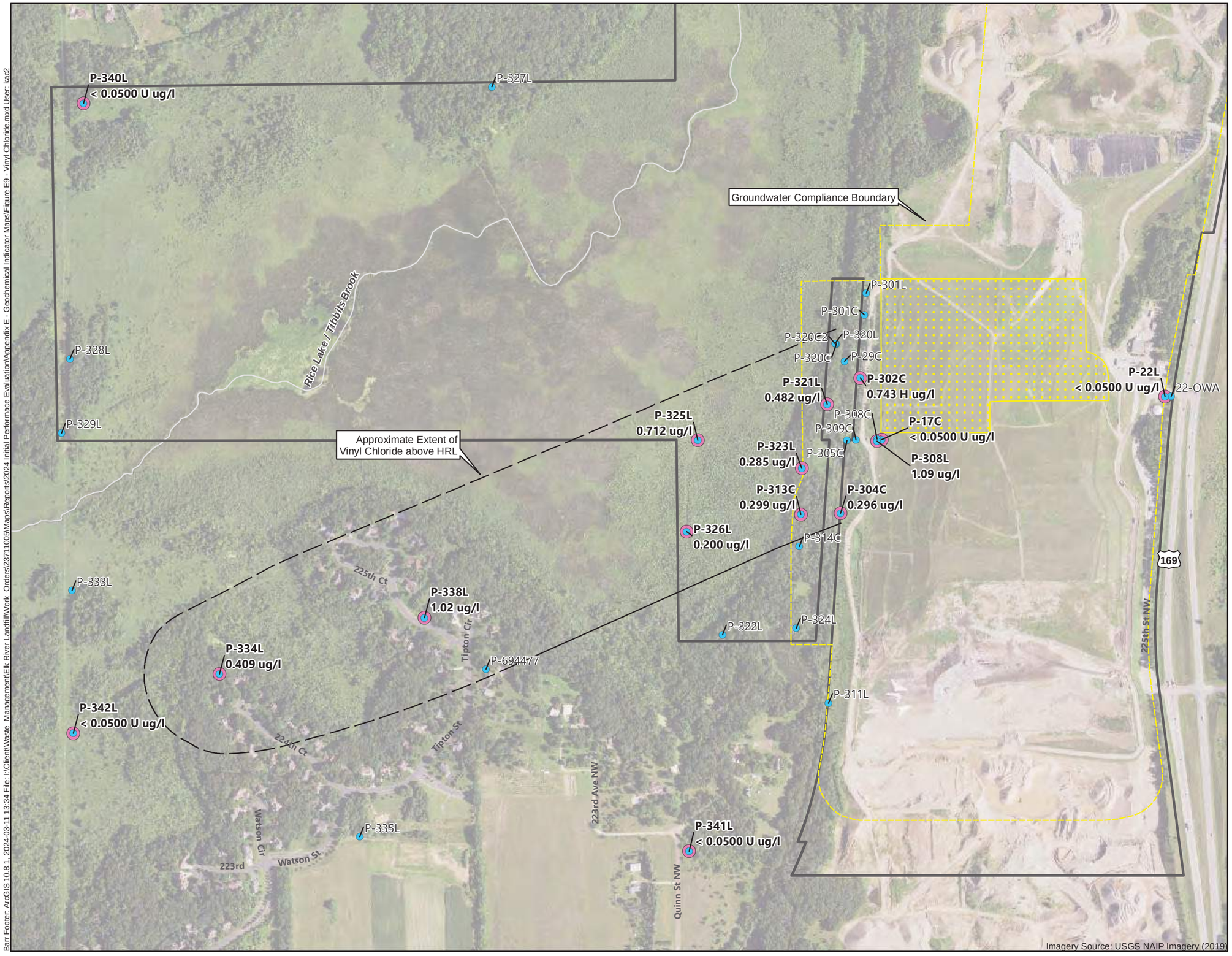
Feet
0 600 1,200

Figure E8

METHANE
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-11 13:25 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711005\Maps\Reports\2024 Initial Performance Evaluation\Appendix E - Geochemical Indicator Maps\Figure E8 - Methane.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

Note:
- Displayed data from July-August 2023 monitoring event.
- Data shown only at MNA network monitoring wells.

U The analyte was analyzed for, but was not detected.
H Recommended sample preservation, extraction or analysis holding time was exceeded.

N

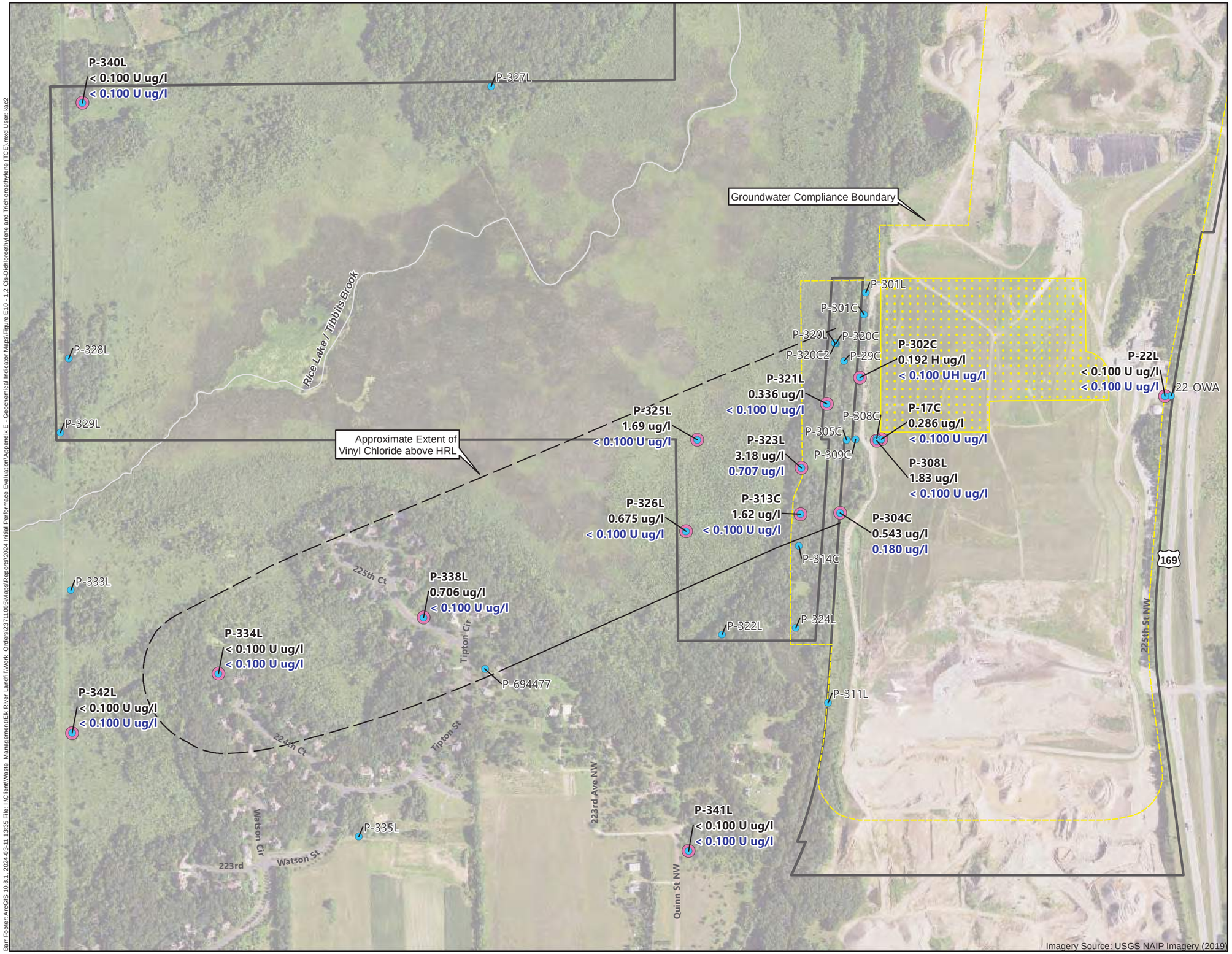
Feet
0 600 1,200

Figure E9

VINYL CHLORIDE
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-11 13:34 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711005\Maps\Reports\2024 Initial Performace Evaluation\Appendix E - Geochemical Indicator Maps\Figure E9 - Vinyl Chloride.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

6.5 ug/l 1,2-Dichloroethylene, cis Concentration

0.001 ug/l Trichloroethylene (TCE) Concentration

Note:
- Displayed data from July-August 2023 monitoring event.
- Data shown only at MNA network monitoring wells.

U The analyte was analyzed for, but was not detected.
H Recommended sample preservation, extraction or analysis holding time was exceeded.

N

Feet
0 600 1,200

Figure E10

1,2 CIS-DICHLOROETHYLENE AND TRICHLOROETHYLENE (TCE)
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-03-11 13:35 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711005\Maps\Reports\2024 Initial Performance Evaluation\Appendix E - Geochemical Indicator Maps\Figure E10 - 1,2 Cis-Dichloroethylene and Trichloroethylene (TCE).mxd User: kaz2

Appendix F

Magnetic Susceptibility Results

Table F1
Magnetic Susceptibility Results
Elk River Landfill

Sample ID	Geologic Unit	Top of Sample (feet)	Bottom of Sample (feet)	Magnetic Susceptibility	
				m^3/kg	+ / - m^3/kg
P-410L 97-97'	Till	97	97	2.3E-06	1.4E-07
P-410L 102-103'	Outwash	102	103	2.2E-06	3.4E-07
P-410L 129-130'	Outwash	129	130	1.0E-06	1.8E-07
P-410L 147-148'	Outwash	147	148	9.6E-07	1.0E-07
P-410L 167-168'	Outwash	167	168	8.7E-07	1.3E-07
P-342L 42-42'	Till	42	42	7.3E-07	2.0E-08
P-342L 50-51'	Outwash	50	51	1.3E-06	9.0E-08
P-342L 75-76'	Outwash	75	76	9.1E-07	7.0E-08
P-342L 97-98'	Outwash	97	98	1.8E-06	5.0E-08
Average				**1.3E-06**	**1.2E-07**

Note:
- Well P-410L installed approximately 1,400 feet north of well P-301L as part of a separate hydrogeologic evaluation

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SITE LOGIC Report

Abiotic Potential

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MI Identifier: 115UC

Report Date: 4-4-2023

Project Name: ERL-CA

Comments:

Overview

Although not always fully considered, abiotic degradation can be a substantial or even the primary process for chlorinated hydrocarbon destruction at sites undergoing or transitioning to monitored natural attenuation (MNA). A variety of iron-bearing minerals including iron sulfides (mackinawite and pyrite), iron oxides (magnetite), green rust, and iron-bearing clays are capable of complete or nearly complete degradation of PCE, TCE, and carbon tetrachloride (He et al. 2009). Some iron-bearing minerals also catalyze the degradation of chlorinated ethanes and the lesser chlorinated ethenes cis-dichloroethene (DCE) and vinyl chloride. While the quantities and types will vary, these reactive iron minerals are frequently identified in subsurface environments under iron reducing and sulfate reducing conditions.

Brown et al. (2007) recommend four avenues for evaluating the role of abiotic processes in contaminant attenuation. First, examining contaminant concentrations along the flow path - decreasing parent compound concentrations with no evidence of accumulation of chlorinated transformation products like cis-DCE and vinyl chloride suggest abiotic degradation. Performing compound specific isotope analysis (CSIA) or monitoring for products unique to abiotic reactions such as acetylene can also provide a strong line of evidence. Microcosm studies with native sediment and killed controls can also be performed. Finally, Brown et al. (2007) suggest performing mineralogical analyses on aquifer sediment to characterize reactive minerals such as magnetite or iron monosulfides

Magnetic Susceptibility - Magnetite

Magnetite (Fe_3O_4) is a mixed valence iron mineral shown to react with PCE, TCE, and carbon tetrachloride. Furthermore, Ferrey et al. (2004) conclusively linked the observed degradation of cis-DCE at a former ammunition plant to magnetite in the subsurface. No direct chemical test is available for quantification of magnetite. However, magnetite is the most abundant mineral in natural sediments that exhibits magnetic behavior. Therefore, magnetic susceptibility provides an inexpensive and valuable estimate of the quantity of magnetite in environmental samples.

X-ray Diffraction (XRD) - Mackinawite, Pyrite, Magnetite and Green Rust

XRD is one of the primary techniques used to identify unknown crystalline materials. Most minerals are crystalline and will scatter X-rays in a regular, characteristic manner dependent on their crystal structure.

- Mackinawite is the most reactive of the iron-bearing minerals and a crystalline form (tetragonal FeS) can be detected by XRD. Mackinawite will transform PCE and TCE primarily by elimination to acetylene. Carbon tetrachloride is transformed mainly to chloroform but carbon dioxide, formate, and carbon disulfide have also been detected. Finally, the more heavily chlorinated ethanes including hexachloroethane, pentachloroethane, and tetrachloroethanes react to form chlorinated ethenes which can be further degraded.
- Pyrite (FeS_2) catalyzes beta elimination transforming PCE, TCE, and cis-DCE to acetylene and ethene. Vinyl chloride is transformed to ethene and ethane. Pyrite is also capable of degradation of carbon tetrachloride potentially forming a number of products including chloroform, carbon dioxide, carbon disulfide, and formate depending on reaction conditions.
- While not quantitative like the magnetic susceptibility test, XRD can also detect magnetite when present at between 2% and 5% on a weight basis.
- Green rusts have been reported to transform a number of common chlorinated contaminants including cis-DCE, vinyl chloride, trichloroethanes, and tetrachloroethanes. While special sample care to prevent oxidation would be needed, XRD can be used to detect green rust.

Percent Clay

Clays have large surface areas, balanced by exchangeable cations, which can bind a large number of both organic and inorganic molecules impacting their availability and reactivity in the subsurface. While less well studied than the other iron-bearing minerals, various phyllosilicate clays have been shown to be capable of degradation of PCE, TCE, cis-DCE, vinyl chloride, and carbon tetrachloride

Sample Location	P-410L 97-97	P-410L 102-103	P-410L 129-130
Date Sampled	02/21/2023	02/21/2023	02/21/2023
Magnetic Susceptibility Analysis			
Magnetic Susceptibility (m3/kg)	2.3E-6 ± 1.4E-7	2.2E-6 ± 3.4E-7	1.0E-6 ± 1.8E-7

Sample Location	P-410L 147-148	P-410L 167-168	P-342L 42-42
Date Sampled	02/28/2023	02/28/2023	03/03/2023
Magnetic Susceptibility Analysis			
Magnetic Susceptibility (m3/kg)	9.6E-7 ± 1.0E-7	8.7E-7 ± 1.3E-7	7.3E-7 ± 2.0E-8

Sample Location	P-342L 50-51	P-342L 75-76	P-342L 97-98
Date Sampled	03/03/2023	03/03/2023	03/03/2023
Magnetic Susceptibility Analysis			
Magnetic Susceptibility (m3/kg)	1.3E-6 ± 9.0E-8	9.1E-7 ± 7.0E-8	1.8E-6 ± 5.0E-8

* Analysis performed in triplicate and results reported as the mean followed by +/- standard deviation.

References

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Ferrey, M. L., R. T. Wilkin, R. G. Ford and J. T. Wilson (2004). "Nonbiological Removal of cis-Dichloroethylene and 1,1-Dichloroethylene in Aquifer Sediment Containing Magnetite." Environmental Science & Technology **38**(6): 1746-1752.

He, Y., C. Su, J. T. Wilson, R. T. Wilkin, C. Adair, T. Lee, P. Bradley and M. Ferrey (2009). Identification and characterization of methods for reactive minerals respnsible for natural attenuation of chlorinated organic compounds in ground water, US EPA.

Liu, Y., S. A. Majetich, R. D. Tilton, D. S. Sholl and G. V. Lowry (2005). "TCE Dechlorination Rates, Pathways, and Efficiency of Nanoscale Iron Particles with Different Properties." Environmental Science & Technology **39**(5): 1338-1345.

Song, H. and E. R. Carraway (2005). "Reduction of Chlorinated Ethanes by Nanosized Zero-Valent Iron: Kinetics, Pathways, and Effects of Reaction Conditions." Environmental Science & Technology **39**(16): 6237-6245.

Abiotic Reactions of Chlorinated Compounds with Iron Bearing Minerals and Zero Valent Iron (ZVI). Summaries for iron bearing minerals are based on He et al. (2009) and references therein. He et al. available at http://nepis.epa.gov/. Summary of ZVI based on Liu et al. (2005) and Song et al. (2005).

Contaminant	Mineral	Degradation	Reported Degradation Intermediates and Products[1]
PCE	FeS	Yes	Acetylene, TCE, cis-DCE, 1,1-DCE, ethene
	Pyrite	Yes	TCE, acetylene, ethene
	Magnetite	Yes	Unknown[2]
	[3]GR(SO_4)	Reports Differ	
	phyllosilicate clays	Yes	TCE, 1,1-DCE, vinyl chloride, 1,1,2-TCA, 1,1-DCA, chloroacetylene, acetylene, ethene, ethane
	ZVI	Yes	Ethene and ethane
TCE	FeS	Yes	Acetylene, cis-DCE, vinyl chloride, 1,1-DCE
	Pyrite	Yes	Acetylene, ethene, cis-DCE, (organic acids with DO present)
	Magnetite	Yes	Unknown[1]
	GR(SO_4), GR(CO_3)	No	Only observed degradation when Cu(II) added
	phyllosilicate clays	Yes	cDCE, vinyl chloride, acetylene, ethene, ethane
	ZVI	Yes	Ethane, ethene, acetylene with minor amounts of DCE, VC depending on conditions
cis-DCE	FeS	No	None detected
	Pyrite	Yes	Acetylene, ethene
	Magnetite	Yes	Unknown[2]
	GR(SO_4)	Yes	
	phyllosilicate clays	Yes	
	ZVI	Yes	Primarily acetylene and ethene but also much lesser amounts of ethane and VC and traces of methane, propane, propene, butane and butene
Vinyl chloride	FeS	Unknown	
	Pyrite	Yes	Ethene, ethane
	Magnetite	Yes	Unknown[2]
	GR(SO_4)	Yes	
	phyllosilicate clays	Yes	
	ZVI	Yes	Ethene, ethane, (no evidence of acetylene)

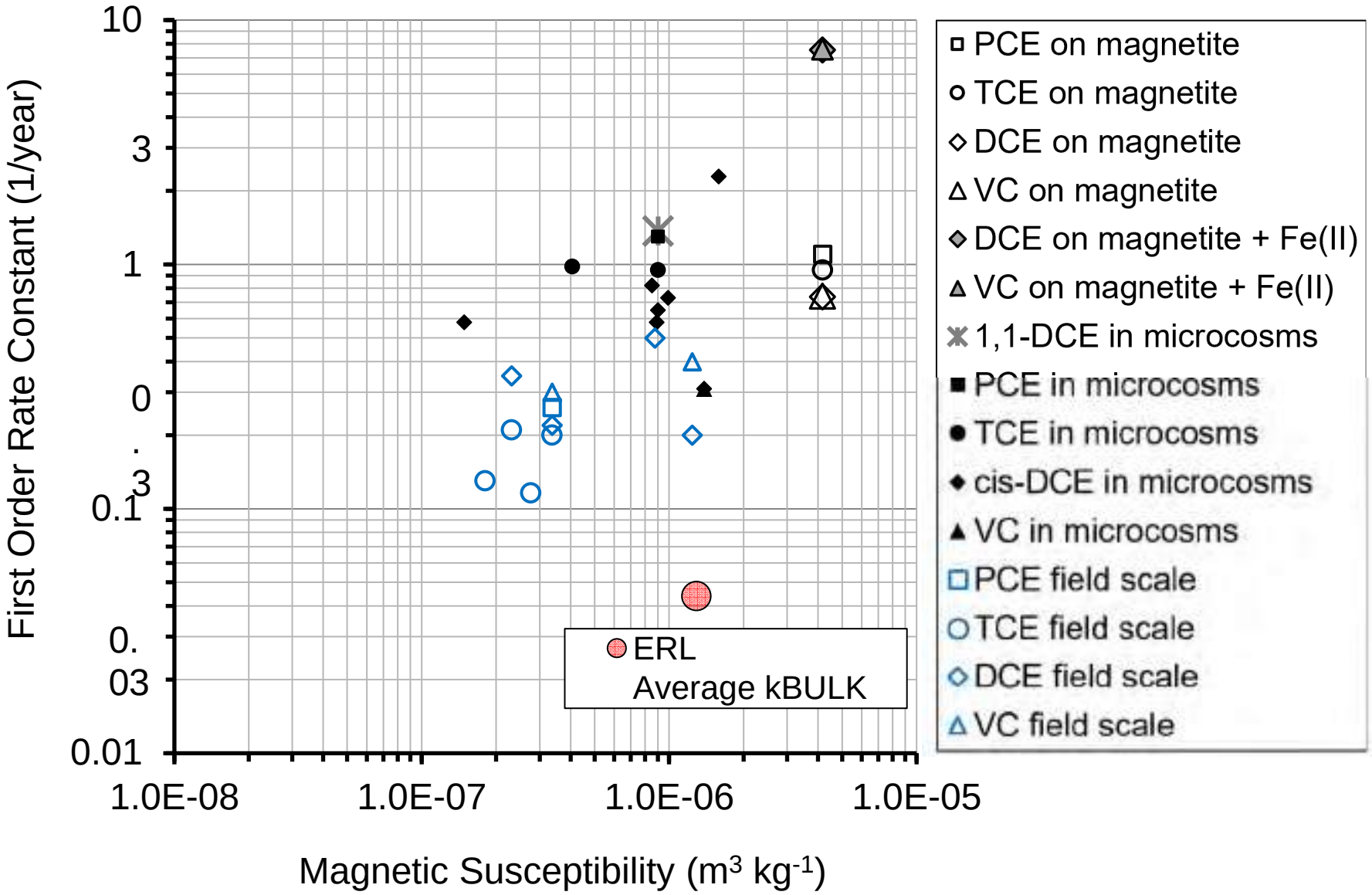
Contaminant	Mineral	Degradation	Reported Degradation Intermediates and Products[1]
1,1-DCA	FeS	Not Significant	None detected
1,1-DCA	GR(SO_4)	Low conversion	Ethene and ethane (w/ Cu or Ag)
1,1-DCA	ZVI	Yes (low)	Ethane
1,2-DCA	FeS	Not Significant	None detected
1,2-DCA	FeS (Biogenic)	Yes	Not monitored
1,2-DCA	GR(SO_4)	No	
1,2-DCA	ZVI	No	
1,1,1-TCA	FeS	Yes	1,1-DCA, ethene, 2-butyne
1,1,1-TCA	GR(SO_4)	Yes	1,1-DCA, CA, ethene ethane
1,1,1-TCA	ZVI	Yes	1,1-DCA, ethane
1,1,2-TCA	FeS	Rate not significant	Small amounts of 1,1-DCE and vinyl chloride but rate not significant
1,1,2-TCA	GR(SO_4)	Yes	Vinyl chloride, 1,1-DCE, ethene, ethane
1,1,2-TCA	ZVI	Yes	Ethane
1,1,1,2-TeCA	FeS	Yes	1,1-DCE
1,1,1,2-TeCA	GR(SO_4)	Yes	1,1-DCE and minor (<1%) vinyl chloride, ethene, ethane
1,1,1,2-TeCA	phyllosilicate clays	Yes	1,1-DCE
1,1,1,2-TeCA	ZVI	Yes	TCE, 1,1-DCE
1,1,2,2-TeCA	FeS	Yes	TCE, cis-DCE, trans-DCE, acetylene
1,1,2,2-TeCA	GR(SO_4)	Yes	TCE (major), cis-DCE, trans-DCE
1,1,2,2-TeCA	phyllosilicate clays	Yes	TCE
1,1,2,2-TeCA	ZVI	Yes	TCE, trans-DCE, cis-DCE
Carbon Tetrachloride	FeS	Yes	Chloroform, carbon disulfide, possibly methane, ethene, ethane
CT	Pyrite	Yes	Chloroform , CO_2, carbon disulfide, formate (highly dependent on conditions)
CT	Magnetite	Yes	Chloroform , carbon monoxide, methane, formate (highly dependent on conditions)
CT	GR(SO_4)	Yes	Chloroform and hexachloroethane; Chloroform, DCM, methane, ethene
CT	phyllosilicate clays	Yes	Chloroform
CT	ZVI	Yes	Chloroform, dichloromethane, methane (depending on conditions)

Notes: GR(SO_4) sulfate green rust. GR(CO_3) carbonate green rust. ZVI zero valent iron

[1]Compilation of reported degradation products. Mass recovery of products typically low --- additional undetected and unreported products are likely. Reported reaction products or proportions of reaction products were often a function of environmental conditions.

[2]No published studies that identify the transformation products of PCE, TCE, cis-DCE or vinyl chloride with magnetite. Ferrey et al (2004) analyzed for products of cis-DCE dechlorination including vinyl chloride, ethene, and ethane and did not find them. If Fe^{2+} sorbed to magnetite stabilizes carbene ions, the ultimate degradation product of cis-DCE on magnetite would be CO_2.

Figure F1 - Magnetic Susceptibility vs Rate Constant, Comparison to Other Sites



*Rate constants from other sites are based on field scale and microcosm data as presented in the BIOPIC tool (ER-201730, 2021)

Appendix G

Trend Analysis

Table G1
Mann-Kendall Trend Analysis Summary

Location	total sample count	total count NDs	count used for trend[1]	NDs used in trend	Mean (ppb)[2]	Std Deviation (ppb)[2]	CV	MK Test Value (S)[3]	p-value[4]	Trend Statement	Note
P-17C	18	9								Not enough data above reporting limits to complete trend analysis	
P-22L	8	8								Not enough data above reporting limits to complete trend analysis	
P-29C	39	14	27	2	0.506	0.226	45%	-18	0.361	No statistical evidence according to the MK test of an upward or downward trend at 95% confidence level	Trend period 2015-2023
P-29D	39	39								Not enough data above reporting limits to complete trend analysis	
P-301C	40	24	25	9	0.119	0.178	150%	32	0.224	No statistical evidence according to the MK test of an upward or downward trend at 95% confidence level	Trend period 2016-2023
P-301L	39	34								Not enough data above reporting limits to complete trend analysis	
P-302C	39	12	27	0	0.469	0.228	49%	102	0.0176	Statistically significant upward trend at 95% confidence level	Trend period 2015-2023
P-303C	29	29								Not enough data above reporting limits to complete trend analysis	
P-304C	39	23	24	9	0.169	0.121	72%	-108	0.00314	Statistically significant downward trend at 95% confidence level	Trend period 2016-2023
P-305C	39	30								Not enough data above reporting limits to complete trend analysis	
P-308C	13	9								Not enough data above reporting limits to complete trend analysis	
P-308L	11	1	11	1	0.963	0.563	58%	-13	0.175	No statistical evidence according to the MK test of an upward or downward trend at 95% confidence level	Trend period 2019-2023
P-309C	13	4	9	0	0.362	0.0709	20%	-3	0.417	No statistical evidence according to the MK test of an upward or downward trend at 95% confidence level	Trend period 2015-2023
P-310C	29	29								Not enough data above reporting limits to complete trend analysis	
P-311C	29	29								Not enough data above reporting limits to complete trend analysis	
P-311D	39	39								Not enough data above reporting limits to complete trend analysis	
P-311L	34	34								Not enough data above reporting limits to complete trend analysis	
P-313C	39	13	27	5	0.364	0.234	64%	-206	0.000009	Statistically significant downward trend at 95% confidence level	Trend period 2015-2023
P-314C	26	7	26	7	0.326	0.277	85%	-148	0.00053	Statistically significant downward trend at 95% confidence level	Trend period 2015-2023
P-315L	9	9								Not enough data above reporting limits to complete trend analysis	
P-320C	39	18	26	5	0.218	0.139	64%	-35	0.226	No statistical evidence according to the MK test of an upward or downward trend at 95% confidence level	Trend period 2015-2023
P-320C2	38	16	25	3	0.14	0.107	76%	-21	0.329	No statistical evidence according to the MK test of an upward or downward trend at 95% confidence level	Trend period 2015-2023
P-320L	39	14	26	1	0.302	0.149	49%	-5	0.465	No statistical evidence according to the MK test of an upward or downward trend at 95% confidence level	Trend period 2015-2023
P-321L	39	3	36	1	1.108	0.63	57%	-331	0.0000032	Statistically significant downward trend at 95% confidence level	Trend period 2012-2023
P-322L	39	39								Not enough data above reporting limits to complete trend analysis	
P-323L	37	13	28	6	0.397	0.271	68%	-220	0.000007	Statistically significant downward trend at 95% confidence level	Trend period 2014-2023
P-324L	37	36								Not enough data above reporting limits to complete trend analysis	
P-325L	29	3	27	1	0.52	0.313	60%	37	0.226	No statistical evidence according to the MK test of an upward or downward trend at 95% confidence level	Trend period 2015-2023
P-326L	29	6	27	4	0.493	0.313	63%	-142	0.001610	Statistically significant downward trend at 95% confidence level	Trend period 2015-2023
P-327L	10	10								Not enough data above reporting limits to complete trend analysis	
P-328L	7	7								Not enough data above reporting limits to complete trend analysis	
P-329L	23	23								Not enough data above reporting limits to complete trend analysis	
P-333L	13	13								Not enough data above reporting limits to complete trend analysis	
P-334L	20	9	17	6	0.176	0.135	77%	76	0.00053	Statistically significant upward trend at 95% confidence level	Trend period 2019-2023
P-335L	18	18								Not enough data above reporting limits to complete trend analysis	
P-337L	7	7								Not enough data above reporting limits to complete trend analysis	
P-338L	8	5								Not enough data above reporting limits to complete trend analysis	
P-340L	6	6								Not enough data above reporting limits to complete trend analysis	
P-341L	2	2								Not enough data above reporting limits to complete trend analysis	
P-342L	2	2								Not enough data above reporting limits to complete trend analysis	
P694477	26	16	13	3	0.176	0.117	66%	29	0.0427	Statistically significant upward trend at 95% confidence level	Trend period 2019-2023

Table G1
Mann-Kendall Trend Analysis Summary

General Notes:

(1) For purposes of this trend analysis, all samples reported as non-detections were given the value of the reporting limit or detection limit unless otherwise noted. Mann-Kendall (MK) trend analyses were only considered if datasets had at least eight data points greater than or equal to the associated reporting or detection limit. To the extent possible, all data were used for trend analyses. Prior to completing the analyses, data were screened on a case-by-case basis to identify usable data within the time series and to remove ambiguities within the dataset (primarily as it relates to datasets with multiple detection limits). The following rules were used to screen data in a consistent manner:

(a) Time series with samples that have multiple detection limits were replaced with the highest detection limit value. Detections below the highest detection limit were replaced with the detection limit value. As long as the number of detections remains above eight, a trend analysis was run.

(b) To handle cases when analytical techniques improved over time and detection limits became lower, the period with the high detection limit(s) was excluded from the trend analysis, including both detections and non-detections. This removed ambiguity in the dataset caused by the prior non-detections.

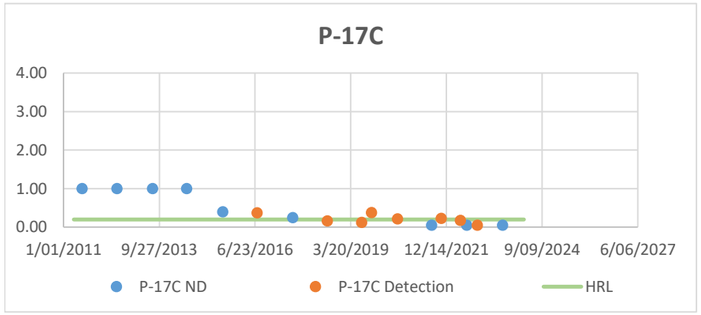
(c) Under most circumstances, non-detections were not selectively exlcuded within a data series. However, there are instances where this is an appropriate practice in order to maintain the maximum amount of information. For example, singular non-detections at relatively high limits were excluded if there were at least 5 usable data points before and after a non-detection in question. This avoided the situation where the majority of a dataset would have been replaced by the highest non-detection value (as with P-320L).

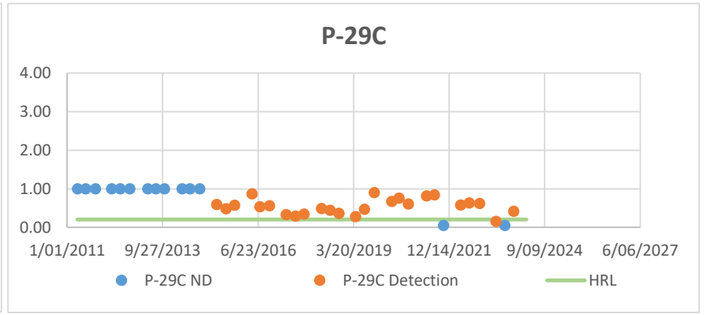
(2) Mean and standard deviations are reported for the data included in the trend analysis, not for the complete dataset. For data sets that included non-detects, mean and standard deviation were calculated using the Kaplan-Meier method.

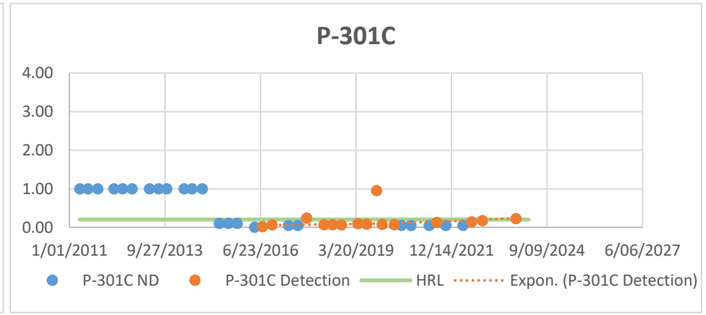
(3) The direction of the trend (upward or downward) is inferred based on the value of the Mann-Kendall (MK) test value, S. An S value that is greater than zero suggests an upward trend and an S value less than zero suggests a downward trend. Values that are close to zero suggest no net upward or downward trend. Statements concerning the statistical signifance of the trend are inferred based on the associated p-value.

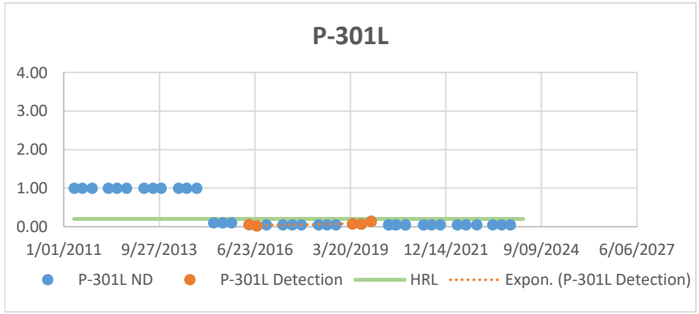
(4) Trends with p-values that are less than or equal to 0.05 are considered statistically significant trends at the 95% confidence level. Trends with P-values greater than 0.05 and less than or equal to 0.1 are considered possible trends, but are not statistically significant. Trends with p-values greater than 0.1 do not have enough evidence to indicate an upward or downward trend.

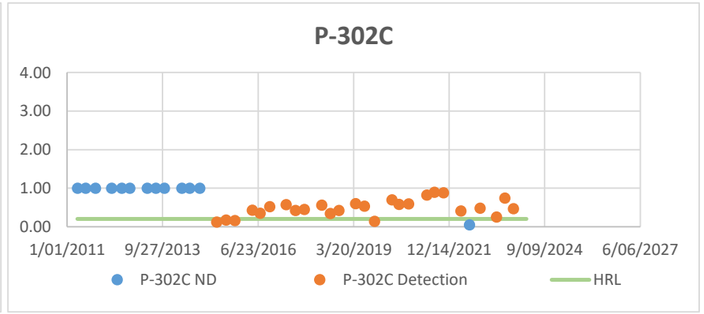
Figure G1
Vinyl Chloride Trends (2011-2023)

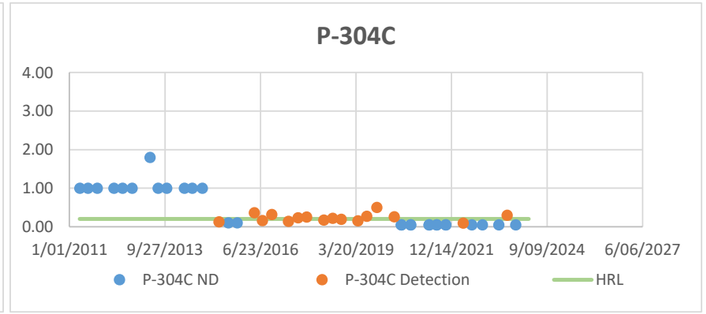


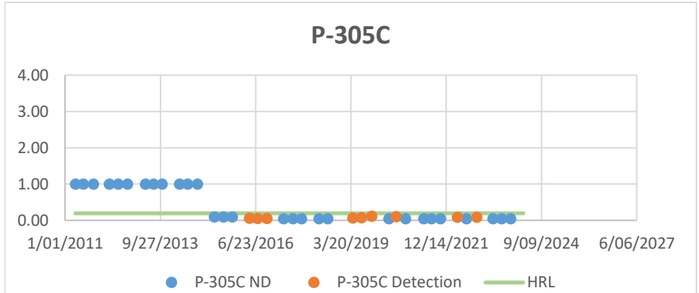


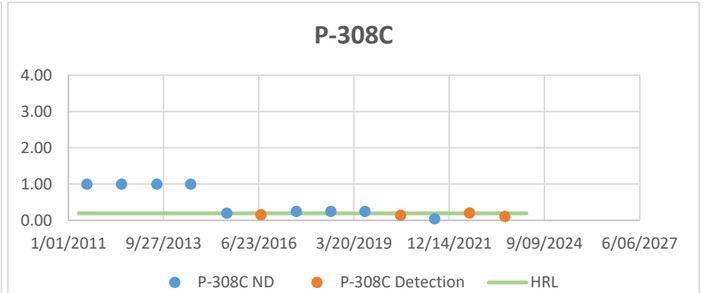


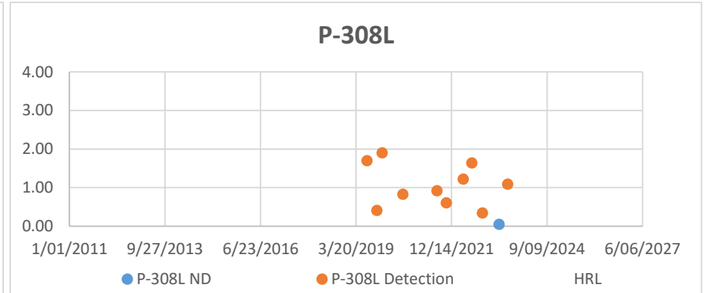


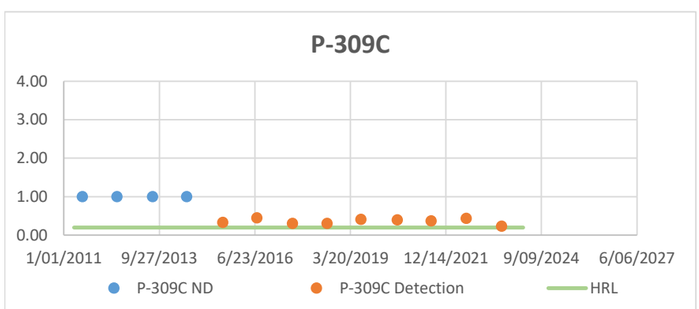


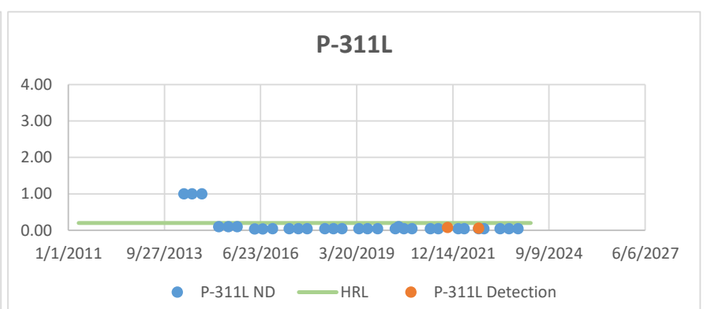












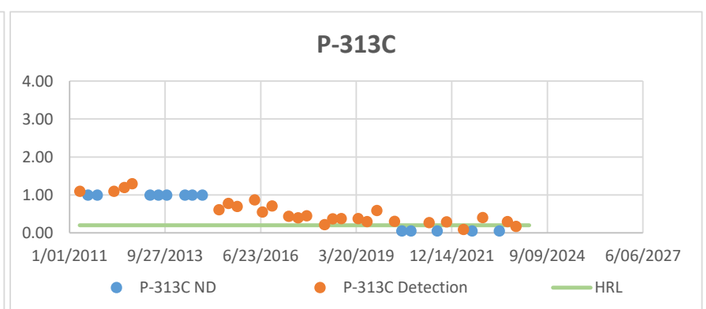
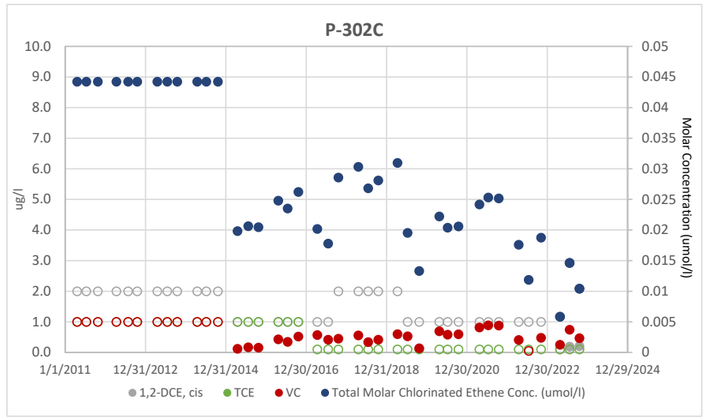


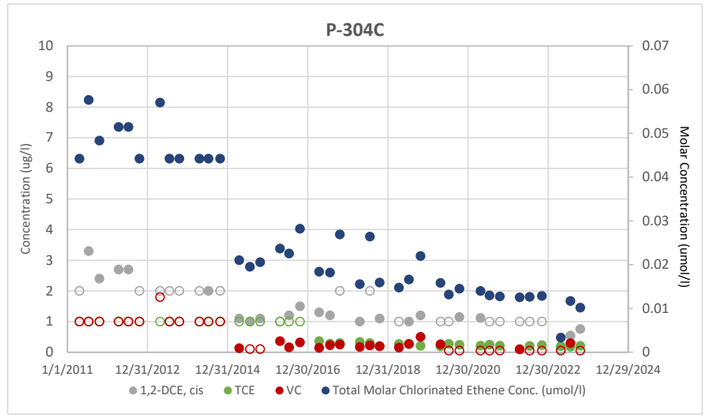
Figure G1
Vinyl Chloride Trends (2011-2023)

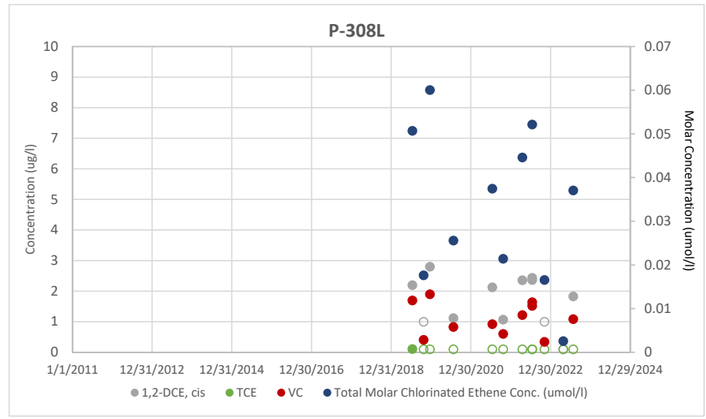


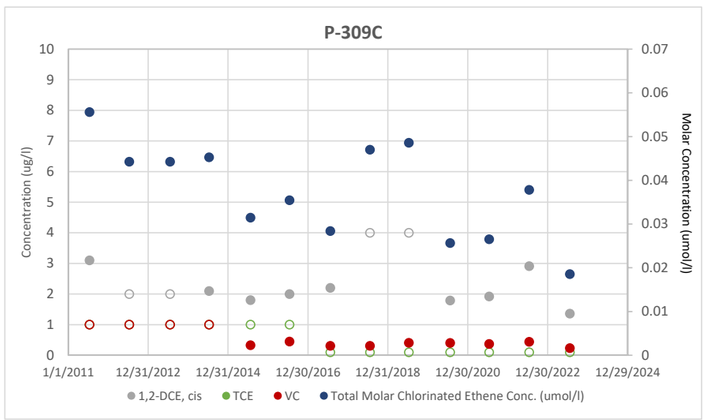
Note: Only locations where vinyl chloride has been detected in recent are displayed.
Trend lines shown for locations with 8 or more detections. Where trend line is shown, the dispalyed trends are based on detected concentrations only.

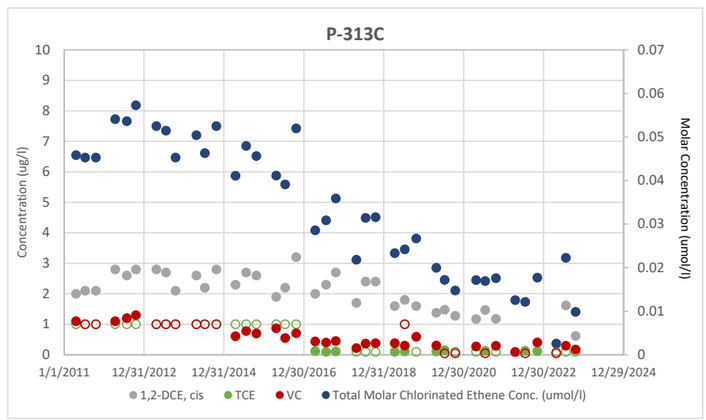
Figure G2
Vinyl Chloride, Potential Precursor Compound (TCE, DCE), and Total Molar Chlorinated Ethene Trends (2011-2023)

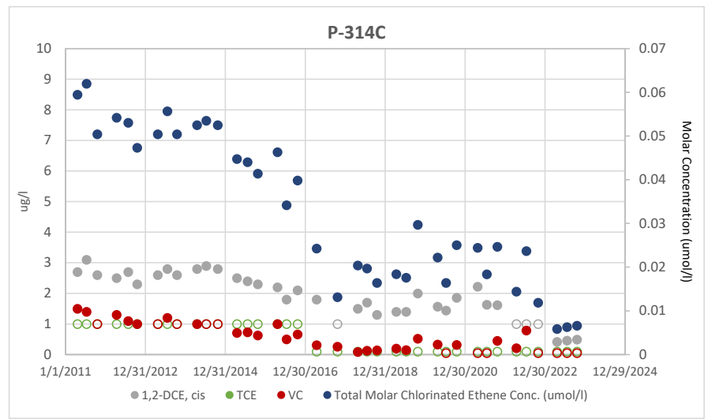


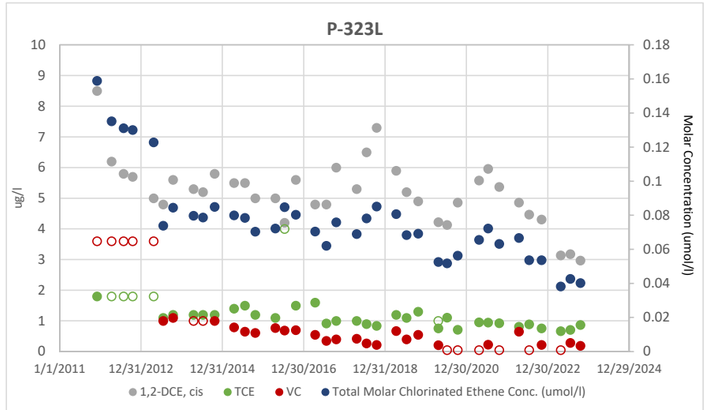


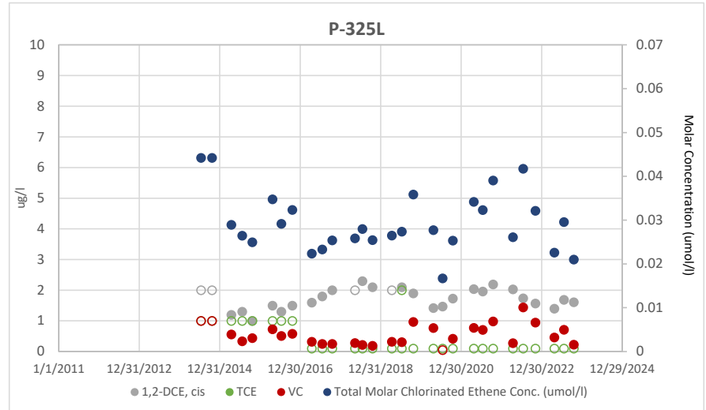


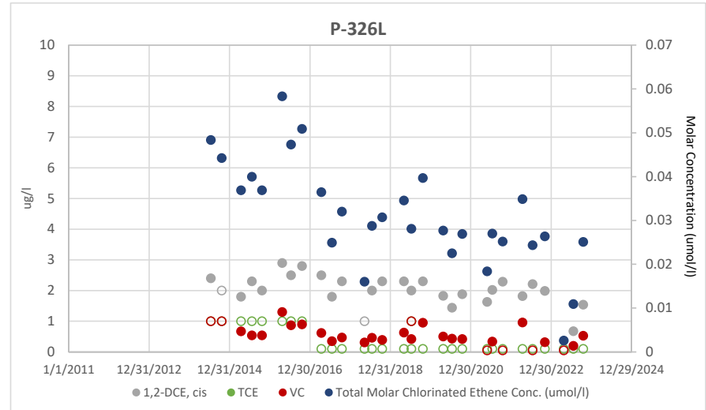












Notes: Only wells where TCE or cis-DCE have routinely been detected are displayed (PCE not detected).
Open symbol indicates sample was non-detect.

Appendix H

Attenuation Rate and Mass Estimates

Appendix H
Summary of Estimated Attenuation Rates and Related Projections

This appendix documents the inputs, assumptions, and methodology for developing A) estimated groundwater flow velocity, B) attenuation rates and resulting projections of vinyl chloride concentrations (and travel distance) downgradient of ERL, and C) vinyl chloride mass and input (flux) from the western edge of ERL into the groundwater system. Referenced equations and inputs are provided in Attachment H1.

A) Vinyl Chloride Transport Velocity and Approximated Arrival Times at Downgradient Monitoring Wells

The vinyl chloride transport velocity (V_{VC}) in groundwater in the lower outwash aquifer (where organics mass transport is predominantly occurring west of ERL) is estimated to be approximately 112 feet/year (Equation 1). The estimate is based on the observed extent of vinyl chloride downgradient of the facility at P-334L (assumed to be midway between P-334L and P-342L) and the beginning of landfill operations (estimated to be 1972).

Applying a retardation factor (R) of 1.052 for vinyl chloride (Equation 2), the groundwater flow velocity (V_{GW}) is calculated to be approximately 117 feet/year (ft/yr) (Equation 3). This calculated V_{GW} is approximately twice the calculated velocity from an aquifer test at P-308L performed in 2019 (Equation 4). This discrepancy is attributed to the heterogeneity of the lower outwash (e.g., coarse gravel was more abundant at wells P-325L and P-326L than at the wells along the west side of the landfill [Barr, 2015]).

Note that the vinyl chloride transport velocity would be higher if the release did not occur for years after landfill operations began. In the estimates provided in this Appendix, a +25% multiplier is applied to represent an alternative higher end estimate for vinyl chloride transport velocity ($V_{VC,HI}$ = 139 ft/yr) and groundwater flow velocity ($V_{GW,HI}$ = 147 ft/yr) to account for this uncertainty.

Using these velocity values, the estimated arrival times for the slug of elevated organics concentrations (observed at P-17C in 1992) to arrive at downgradient monitoring points was calculated (See Table H1). Based on this estimation, the slug of elevated organics concentrations has moved past P-325L / P-326L. The slug is estimated to be around well P-338L and is projected to reach well P-334L between 2024 and 2033.

B) Attenuation Rates

Location-specific (k_{POINT}) and bulk attenuation rates (k_{BULK}) and were calculated to further assess attenuation and develop projections based on existing data. Location-specific attenuation rates provide a gauge of the degree of attenuation is occurring at the evaluated location. For example, a value of 0.07/year represents a concentration half-life of approximately 10 years. Bulk attenuation rates provide an overall assessment of attenuation across the entire length of a plume (with some limitations as described below).

Location-Specific Attenuation Rates (k_{POINT})

Location-specific vinyl chloride attenuation rates are useful in assessing trends and projecting time until concentrations reach a certain level (i.e. Intervention Limits) at well locations[1]. This evaluation was only applied to vinyl chloride in the central and southern portions of the plume (where decreasing vinyl chloride trends are occurring near the Compliance Boundary and Property Boundary) and not the

[1] Location-specific attenuation rates should not be used to make projections across an entire plume (Newell & Rifai et. al, 2002).

northern third of the plume (i.e., north of well P-321L) due to the mix of stable and increasing concentration trends (Appendix G). Attenuation rates were also not calculated for downgradient locations due to too few detections (P-342L), insufficient data (P-338L), no statistically significant trend (P-325L) or increasing trends (P-334L and P-694477).

Vinyl chloride concentration data from 2011 to 2023 was reviewed to calculate k_{POINT} values (Newell & Rifai et. al, 2002) for six wells located near (P-313C, P-314C, P-321L, P-323L) and beyond (P-325L, P-326L) the Compliance Boundary (see Equation 6).

Calculated k_{POINT} values ranged from 0.125 (P-321L) to 0.254 (P-314C) (Table H2). The k_{POINT} values indicate the following. Using first order kinetics and k_{POINT} values, projections for when each of these wells may approach Intervention Limits (ILs) were calculated. These projections range from approximately 1 (i.e., 2025 at P-314C and P-323L) to 12 years (i.e., 2036 at P-321L) and are shown in Table H2[2].

Bulk Attenuation Rates (k_{BULK})

Bulk attenuation rates represent an overall measure (or value) that quantifies the rate of attenuation over a defined length of a groundwater plume at one point in time. Bulk attenuation rates and can be used to project the distance a plume will expand while being subjected to attenuation processes (Newell & Rifai et. al, 2002).

Bulk attenuation rates (k_{BULK}) were estimated using trend line analysis methods outlined in MPCA guidance (MPCA, 2006). A primary assumption in applying this method is that the plume (i.e., vinyl chloride and other organics) have achieved steady state (i.e., is stable / not expanding). The steady state assumption is valid at ERL (based on current data), given the long operational history of the facility and non-detect concentrations at distal well P-342L; however this assumption is subject to change based on results of the proposed investigation referenced in Section 6.0 of the report and continued monitoring of organics in groundwater downgradient of the ERL.

Two approaches were applied to develop a range of potential bulk attenuation rates along the plume centerline (P-308L, P-323L, P-326L, P-334L, P-338L, and P-342L) using the trend line analysis method. July 2019, July 2021, and July-August 2023 datasets were applied with the objective of including wells P-308L (installed in 2019), P-338L (installed in 2021) and P-342L (installed in 2023).

1) July 2019, July 2021, and July-August 2023 datasets (vinyl chloride only).
2) July 2019, July 2021 and July-August 2023 datasets (total molar concentration of vinyl chloride and precursor compounds PCE, TCE, DCE).

Using these two approaches (Equation 5), the resulting estimated bulk attenuation rates are:

	Bulk Att. Rate at V_{GW} = 115 ft/yr			**Bulk Att. Rate at V_{GW} = 137 ft/yr**		
Method	**$K_{BULK,2019}$ (/yr)**	**$K_{BULK,2021}$ (/yr)**	**$K_{BULK,2023}$ (/yr)**	**$K_{BULK,2019,HI}$ (/yr)**	**$K_{BULK,2021,HI}$ (/yr)**	**$K_{BULK,2023,HI}$ (/yr)**
1. Vinyl chloride*	0.082	0.023	0.035	0.103	0.029	0.044
2. Molar total chlorinated ethenes**	0.047	0.035	0.047	0.059	0.044	0.059
Overall average	**0.045**			**0.056**		

[2] Note that the location-specific attenuation rates may be biased low as they do not account for conversion of precursor compounds (PCE, TCE, and DCE) to vinyl chloride.

Appendix H
Summary of Estimated Attenuation Rates and Related Projections

Notes: * - This approach likely represents a low estimate of attenuation rates as conversion from precursor compounds (PCE, TCE, DCE) to vinyl chloride are not considered.
** - This approach includes precursor compounds to capture transformation to vinyl chloride and may represent a high estimate of vinyl chloride attenuation rates as precursor compounds are present at several locations and generally attenuate more rapidly than vinyl chloride.

The estimated vinyl chloride travel velocities and k_{BULK} are applied to evaluate the following scenarios. See Table H3 for details.

A) Scenario A: What is the estimated highest vinyl concentration at the Compliance Boundary that would naturally attenuate below the IL or detection limit (0.05 micrograms per liter [µg/l]) before reaching nearest residential water supply user in the direct downgradient flowpath of the mapped vinyl chloride extent if the groundwater flow path is complete[3].
    a. Range: 0.23 to 11 µg/l
    b. Average: 1.0 µg/l

    This scenario suggests that, on average, vinyl chloride concentrations at or below 1.0 µg/l at the Compliance Boundary will attenuate before reaching the nearest residential well downgradient of P-342L.

B) Scenario B: What is the estimated highest vinyl chloride concentration at monitoring well P-342L that would naturally attenuate below the IL or detection limit (0.05 µg/l) before reaching nearest residential water supply user in the direct downgradient flow path of the mapped vinyl chloride extent if the groundwater flow path is complete[3].
    a. Range: 0.08 to 0.32 µg/l
    b. Average: 0.14 µg/l

    This scenario suggests that, on average, vinyl chloride concentrations at or below 0.14 µg/l in groundwater at well P-342L will attenuate before reaching the nearest downgradient residential well.

C) Scenario C: How far is vinyl chloride projected to travel downgradient of the Compliance Boundary considering peak 2023 concentrations reported near Compliance Boundary (*0.48 µg/l at P-321L*) if the groundwater flow path is complete[3]?
    a. Range: 3,200 to 11,300 feet
    b. Average: 5,900 feet

    This scenario suggests that, based on average bulk attenuation rates, the vinyl chloride detected in groundwater at well P-321L will travel a distance of 5,900 feet before decreasing below the IL or detection limit (0.05 µg/l). For context the nearest residential water supply user in the direct downgradient flow path of the mapped vinyl chloride extent is approximately 7,700 feet downgradient of the Compliance Boundary.

Bulk attenuation rates were cross-referenced against observed vinyl chloride concentration data where wells with sufficient historical data exists. The highest bulk attenuation rate calculated (0.082/yr) was found to be in good agreement with measured concentration data in wells beneath RL/TB along the southern extent of the vinyl chloride plume downgradient of the compliance boundary. For example, the

[3] The groundwater flow path may not be complete based on the observed lower outwash thickness and 2023 monitoring results from well P-342L.

estimated groundwater travel time between P-313C and P-326L is approximately 6 years assuming a vinyl chloride transport velocity of approximately 112 feet/year. The average concentration at P-313C in 2012 was 0.43 µg/l. Seven years later, the average 2023 concentration at P-326L was 0.26 µg/l. Using first order kinetics and the calculated attenuation rate of 0.082/yr, the anticipated concentration at P-326L in 2023 would also be 0.26 µg/l; therefore, the highest calculated bulk attenuation rate appears to be in line with vinyl chloride concentrations observed over time in this example.

Along the northern portion of the plume downgradient of the compliance boundary, bulk attenuation rates underestimate the observed decrease in vinyl chloride. For example, the estimated groundwater travel time between P-321L and P-325L is approximately 8 years assuming a vinyl chloride transport velocity of approximately 112 feet/year. The average concentration at P-321L in 2012 was 1.4 µg/l. Seven years later, the average 2023 concentration at P-325L was 0.47 µg/l. Using first order kinetics and the highest calculated attenuation rate of 0.082/yr, the anticipated concentration at P-326L in 2023 would be 0.73 µg/l; therefore, the highest calculated bulk average attenuation rate appears to underestimate the observed vinyl chloride concentration decrease in this example.

C) Mass Estimates of Vinyl Chloride

The change in vinyl chloride mass flux in groundwater flowing from western edge of the landfill was estimated using a mass flux approach that applies principles of Darcy's Law for the purpose of comparing current and past conditions. The Approximate Extent of Vinyl Chloride Above Intervention Limits shown on Cross Section A-A' (Figure 8 of the 2021 Groundwater Corrective Action Work Plan; Barr, 2021) represents the evaluated cross-sectional area through which groundwater if flowing. The mass flux through this cross sectional area was evaluated using groundwater quality and hydraulic head datasets from 2010, 2019, and 2023. Data inputs, assumptions, and calculated values are included in Table H4.

Using this method, the mass flux of vinyl chloride flowing from the western edge of ERL is estimated to be 0.017 lb/yr in 2023. Th2023 mass flux rate is 82% lower than the estimated mass flux rates from 2010 (0.098 lb/yr) and 70% lower than 2019 (0.057 lb/yr). Similar to the k_{POINT} attenuation values, the zones showing the greatest decrease in mass flux over that time period were in the central and southern areas while the northern area remained similar over that time period.

Summary

The projections described above suggest the following:

- The slug of elevated organics in groundwater previously observed in 1992-1994 at well P-17C is estimated to currently be located near well P-338L and is projected to reach well P-334L between 2024 and 2033.
- Vinyl chloride concentrations are projected to meet ILs along the Compliance Boundary and Property boundary along the southern two-thirds (P-313C, P-314C, P-321, P-323L, P-326) within the next 12 years . The timing of vinyl chloride to meet ILs along the Compliance Boundary / Property boundary in the northern one-third of the plume has not been predicted due to mixed trends in this area (e.g. P-320C and P-325L).
- Assuming the plume is stable and groundwater flow paths are complete[3], the 2023 vinyl chloride concentrations observed along the Compliance Boundary are anticipated to attenuate under

natural conditions before reaching the nearest residential well downgradient of well P-342L (using average k_{BULK} value).

- Mass flux calculations show the estimated mass of vinyl chloride migrating downgradient of the ERL has declined by 82 % since 2010. This decline is expected to result in lower downgradient vinyl chloride concentrations and reduce the plume extents in the future.
- Vinyl chloride has not been detected to date at P-342L; however, concentrations at or below 0.14 µg/l in groundwater at well P-342L are projected to attenuate before reaching the nearest downgradient residential well (using average k_{BULK} value) if the groundwater flow path is complete[3].

Consideration on Estimate Rates and Projections Presented Above

The attenuation rates and the resulting projections are estimates that are based on existing data (at this time) and that are subject to method limitations and stated assumptions described above (i.e., not definitive values). Further monitoring at current reporting limits and at recently installed wells (i.e., in the last decade) is needed to improve confidence in and refine these estimates as appropriate. Furthermore, downgradient effects of the previously referenced slug of organics observed from 1992-1994 at monitoring well P-17C may be influencing groundwater conditions in the monitoring network which may result in over estimation of attenuation rates.

References

Barr Engineering Co., 2021. Groundwater Corrective Action Work Plan, Elk River Landfill, March 2021.

Barr, 2015. Supplemental Site-Wide Hydrogeologic Evaluation Report, Elk River Landfill, June, 2015.

MPCA, 2006. Guidelines, Natural Attenuation of Chlorinated Solvents in Groundwater. Minnesota Pollution Control Agency, Site Remediation Section, Revised June 2006.

Newell & Rifai et. al, 2002. Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation Studies. United States Environmental Protection Agency Groundwater Issue. EPA/540/S-02/500. November 2002.

Attachments

Attachment H1 – Equations and Inputs

Table H1 – Organics Plug Travel Projections

Table H2 – Projecting Time to Achieve ILs at Wells

Table H3 – Bulk Attenuation Projections

Table H4 – Mass Flux of Vinyl Chloride Downgradient of ERL

Attachments

Attachment H1
Equations and Inputs
Elk River Landfill

Equation 1) Vinyl Chloride Velocity Estimate → $V_{VC}=x/t_{LF}$

Variable	Value	Units	Source/Comment			
x	5800	ft	Estimated distance vinyl chloride has traveled from source (assumed center of Pre-Subtitle D Area)			
t_{LF}	52	years	Years from beginning of landfill operations (est. 1972) to detection of vinyl chloride at P-334L in 2019.			
V_{VC}	112	ft/yr	Vinyl chloride velocity	$V_{VC,HI}$	139 ft/yr	+25% higher end estimate

Equation 2) Retardation Factor → $R=1+r_b k_d/n$

Variable	Value	Units	Source/Comment
r_s	2.65	kg/L	Quartz solids density
r_b	1.9875	kg/L	Bulk Density → $r_b=r_s(1-n)$
f_{oc}	0.00035		Fractional organic carbon - https://www.itrcweb.org/DNAPL-ISC_tools-selection/Content/Appendix%20I.%20Foc%20Tables.htm
k_{oc}	18.6	L/kg	MPCA Risk-Based Guidance for Soil Leaching Pathway, Working Draft Guidelines (1998)
k_d	0.00651	L/kg	Soil Distribution Coefficient → $k_d=f_{oc}k_{oc}$
n	0.25		2015 Hydro Report (Barr)
R	1.052		Retardation Factor - Vinyl chloride 5.2% retarded

Equation 3) Groundwater Velocity → $V_{GW}=V_{VC}R$

Variable	Value	Units	Source/Comment			
V_{GW}	117	ft/yr	Velocity of Groundwater at Base of Lower Outwash Unit	$V_{GW,HI}$	147	+25% higher end estimate

Equation 4) ALTERATE Groundwater Velocity → $V_{GW}=Ki/n$

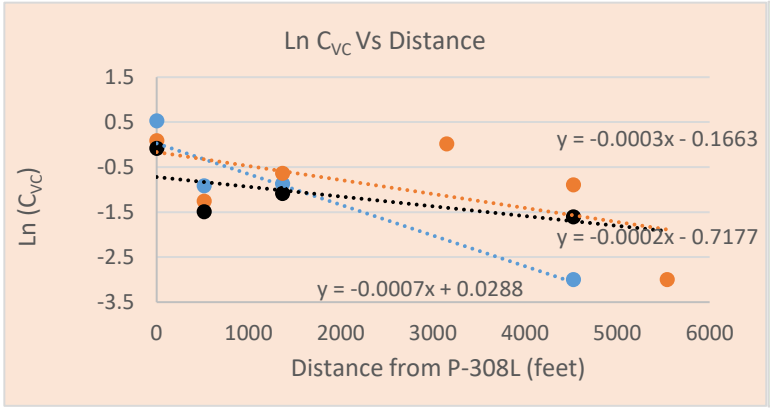
Variable	Value	Units	Source/Comment
K	41.99	ft/day	P-308L Step Test (2019) ALTERNATE IS 5.67 ft/d (0.002 cm/s from 2015 Hydro Report)
n	0.25		2015 Hydro Report
$x_{P323L-P334L}$	3990	ft	Distance from P-323L to P-334L
i	0.00097	ft/ft	Avg water Levels 2018-2019 (P-323L, P-334L), Distance between the locations (3990 ft)
V_{GW}	59.7	ft/yr	Not utilized for attenuation rate calculations as it does not align with vinyl chloride presence at well P-334L

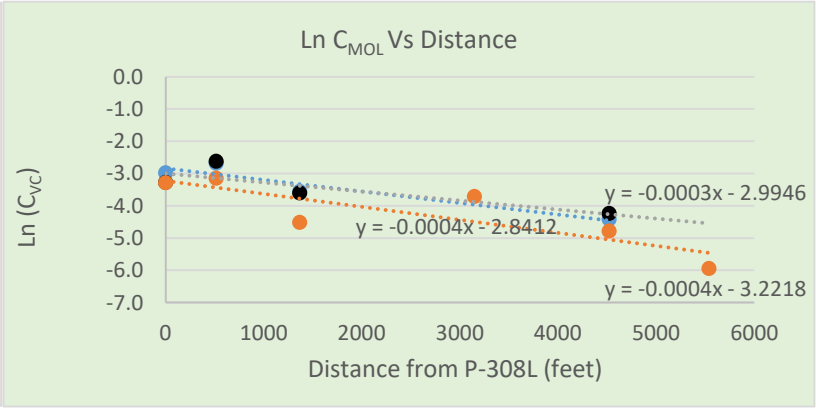
Attachment H1
Equations and Inputs
Elk River Landfill

Equation 5) Overall Bulk Attenuation Rate (Solve for k_{BULK}) → $-k/V_{GW}$=Regression Slope (see MPCA, 2006 - Appendix A for methodology)

		July 2019		July 2021		July-Aug 2023		Molar July 2019		Molar July 2021		Molar July-Aug 2023		total chlorin
	Distance (ft)	C_{VC} (ug/l)	Ln C_{VC}	C_{VC} (ug/l)	Ln C_{VC}	C_{VC} (ug/l)	Ln C_{VC}	C_{MOL} (umol/l)	Ln C_{MOL}	C_{MOL} (umol/l)	Ln C_{MOL}	C_{MOL} (umol/l)	Ln C_{MOL}	
P-308L	0	1.7	0.53	0.92	-0.08	1.09	0.09	0.051	-2.981	0.037	-3.284	0.0371	-3.294	
P-323L	516	0.4	-0.92	0.23	-1.49	0.29	-1.26	0.068	-2.682	0.072	-2.627	0.0427	-3.154	
P-326L	1365	0.42	-0.87	0.34	-1.08	0.53	-0.64	0.028	-3.563	0.027	-3.612	0.0109	-4.519	
P-338L	3147	not yet installed		not yet installed		1.02	0.02	not yet installed		not yet installed		0.0244	-3.713	
P-334L	4521	0.05	-3.00	0.20	-1.60	0.41	-0.89	0.012	-4.423	0.014	-4.247	0.0083	-4.791	
P-342L	5539	not yet installed		not yet installed		0.05	-3.00	not yet installed		not yet installed		0.0026	-5.952	
Reg. Slope		-0.0007	Plot Slope	-0.0002	Plot Slope	-0.0003	Plot Slope	-0.0004	Plot Slope	-0.0003	Plot Slope	-0.0004	Plot Slope	**AVG.**
k_{BULK}		**0.082**	**/yr**	**0.023**	**/yr**	**0.035**	**/yr**	**0.047**	**/yr**	**0.035**	**/yr**	**0.047**	**/yr**	**0.045 /yr**
$k_{BULK,HI-VELO}$		**0.103**	**/yr**	**0.029**	**/yr**	**0.044**	**/yr**	**0.059**	**/yr**	**0.044**	**/yr**	**0.059**	**/yr**	**0.056 /yr**

Note: Red values are non-detect and displayed at reporting limit.





Bulk attenuation rates indicate attenuation is occuring over the length of the plume, but there is high variability in rates based on calculation methods.

C_{VC} = vinyl chloride concentration

Attachment H1
Equations and Inputs
Elk River Landfill

Equation 6) Location-specific Attenuation Rates (k_{POINT})(see Newell & Rifai et al., 2002 for calculation methods)

Note: Red values are non-detect and displayed at reporting limit.

P-313C	VC (ug/l)	ln VC	Yrs	P-314C	VC (ug/l)	ln VC	Yrs	P-321L	VC (ug/l)	ln VC	Yrs
4/19/2011	1.1	0.095	0.0	4/19/2011	1.5	0.405	0.0	4/19/2011	1.0	0.000	0.0
7/11/2011	1.0	0.000	0.2	7/11/2011	1.4	0.336	0.2	7/12/2011	1.0	0.000	0.2
10/17/2011	1.0	0.000	0.5	10/17/2011	1.0	0.000	0.5	10/24/2011	1.0	0.000	0.5
4/10/2012	1.1	0.095	1.0	4/10/2012	1.3	0.262	1.0	4/10/2012	1.3	0.262	1.0
7/26/2012	1.2	0.182	1.3	7/26/2012	1.1	0.095	1.3	7/26/2012	1.0	0.000	1.3
10/16/2012	1.3	0.262	1.5	10/16/2012	1.0	0.000	1.5	10/17/2012	1.3	0.262	1.5
4/22/2013	1.0	0.000	2.0	4/22/2013	1.0	0.000	2.0	4/22/2013	1.4	0.336	2.0
7/18/2013	1.0	0.000	2.2	7/18/2013	1.2	0.182	2.2	7/17/2013	1.3	0.262	2.2
10/14/2013	1.0	0.000	2.5	10/14/2013	1.0	0.000	2.5	10/15/2013	1.5	0.405	2.5
4/22/2014	1.0	0.000	3.0	4/15/2014	1.0	0.000	3.0	4/15/2014	1.3	0.262	3.0
7/9/2014	1.0	0.000	3.2	7/9/2014	1.0	0.000	3.2	7/9/2014	1.1	0.095	3.2
10/22/2014	1.0	0.000	3.5	10/22/2014	1.0	0.000	3.5	10/22/2014	1.3	0.262	3.5
4/15/2015	0.61	-0.494	4.0	4/15/2015	0.71	-0.342	4.0	4/14/2015	1.5	0.405	4.0
7/21/2015	0.78	-0.248	4.3	7/21/2015	0.73	-0.315	4.3	7/21/2015	1.3	0.262	4.3
10/22/2015	0.7	-0.357	4.5	10/22/2015	0.63	-0.462	4.5	10/21/2015	1.4	0.336	4.5
4/20/2016	0.87	-0.139	5.0	4/20/2016	1.0	0.000	5.0	4/19/2016	3.0	1.099	5.0
7/12/2016	0.55	-0.598	5.2	7/12/2016	0.5	-0.693	5.2	7/11/2016	2.6	0.956	5.2
10/20/2016	0.71	-0.342	5.5	10/20/2016	0.66	-0.416	5.5	10/19/2016	2.1	0.742	5.5
4/12/2017	0.44	-0.821	6.0	4/12/2017	0.31	-1.171	6.0	4/11/2017	1.8	0.588	6.0
7/20/2017	0.4	-0.916	6.3	10/19/2017	0.26	-1.347	6.5	7/21/2017	1.0	0.000	6.3
10/17/2017	0.45	-0.799	6.5	4/23/2018	0.088	-2.430	7.0	10/17/2017	1.0	0.000	6.5
4/23/2018	0.22	-1.514	7.0	7/17/2018	0.13	-2.040	7.2	4/17/2018	1.1	0.095	7.0
7/16/2018	0.37	-0.994	7.2	10/16/2018	0.14	-1.966	7.5	7/16/2018	1.1	0.095	7.2
10/15/2018	0.38	-0.968	7.5	4/10/2019	0.2	-1.609	8.0	10/15/2018	1.0	0.000	7.5
4/9/2019	0.38	-0.968	8.0	7/9/2019	0.15	-1.897	8.2	4/8/2019	1.4	0.336	8.0
7/9/2019	0.3	-1.204	8.2	10/23/2019	0.52	-0.654	8.5	7/10/2019	0.98	-0.020	8.2
10/22/2019	0.59	-0.528	8.5	4/22/2020	0.329	-1.112	9.0	10/23/2019	1.8	0.588	8.5
4/23/2020	0.31	-1.184	9.0	7/8/2020	0.05	-2.996	9.2	4/21/2020	0.53	-0.637	9.0
7/8/2020	0.05	-2.996	9.2	10/13/2020	0.32	-1.139	9.5	7/8/2020	0.79	-0.234	9.2
10/13/2020	0.05	-2.996	9.5	4/22/2021	0.05	-2.996	10.0	10/12/2020	0.62	-0.481	9.5
4/21/2021	0.27	-1.306	10.0	7/15/2021	0.05	-2.996	10.2	4/21/2021	0.57	-0.571	10.0
7/13/2021	0.05	-2.996	10.2	10/19/2021	0.451	-0.796	10.5	7/12/2021	0.42	-0.860	10.2
10/19/2021	0.29	-1.231	10.5	4/11/2022	0.21	-1.561	11.0	10/19/2021	0.42	-0.879	10.5
4/14/2022	0.09	-2.386	11.0	7/12/2022	0.789	-0.237	11.2	4/14/2022	0.43	-0.835	11.0
7/14/2022	0.05	-2.996	11.2	10/27/2022	0.05	-2.996	11.5	7/15/2022	0.05	-2.996	11.2
11/2/2022	0.41	-0.904	11.5	4/18/2023	0.05	-2.996	12.0	11/3/2022	0.45	-0.807	11.6
4/24/2023	0.05	-2.996	12.0	7/18/2023	0.05	-2.996	12.3	4/24/2023	0.33	-1.097	12.0
7/20/2023	0.30	-1.207	12.3	10/17/2023	0.05	-2.996	12.5	7/20/2023	0.48	-0.730	12.3
10/17/2023	0.17	-1.760	12.5					10/18/2023	0.22	-1.519	12.5
	k_{P313C}	**0.2172**			**k_{P314C}**	**0.2536**			**k_{P321L}**	**0.1245**	

NOTE: k_{POINT}=slope of plotted LN VC vs Time Plot using this methodology

Attachment H1
Equations and Inputs
Elk River Landfill

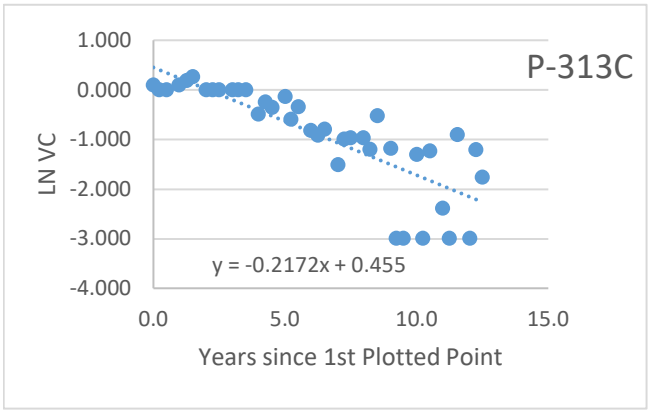
Equation 6) continued

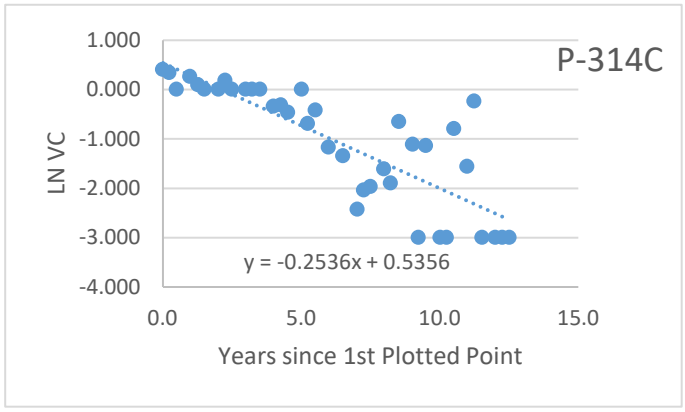
P-323L	VC (ug/l)	ln VC	Yrs
12/1/2011	3.6		
4/10/2012	3.6		
7/26/2012	3.6		
10/16/2012	3.6		
4/22/2013	3.6		
7/17/2013	1.0	0.000	0
10/14/2013	1.1	0.095	0.2
4/15/2014	1.0	0.000	0.7
7/10/2014	1.0	0.000	1.0
10/22/2014	1.0	0.000	1.3
4/14/2015	0.79	-0.236	1.7
7/21/2015	0.65	-0.431	2.0
10/21/2015	0.61	-0.494	2.3
4/19/2016	0.77	-0.261	2.8
7/11/2016	0.69	-0.371	3.0
10/20/2016	0.7	-0.357	3.3
4/11/2017	0.55	-0.598	3.7
7/21/2017	0.35	-1.050	4.0
10/17/2017	0.4	-0.916	4.3
4/19/2018	0.42	-0.868	4.8
7/16/2018	0.27	-1.309	5.0
10/15/2018	0.22	-1.514	5.2
4/8/2019	0.67	-0.400	5.7
7/10/2019	0.4	-0.916	6.0
10/23/2019	0.55	-0.598	6.3
4/21/2020	0.21	-1.565	6.8
7/8/2020	0.05	-2.996	7.0
10/12/2020	0.05	-2.996	7.2
4/21/2021	0.05	-2.996	7.8
7/12/2021	0.23	-1.492	8.0
10/19/2021	0.05	-2.996	8.3
4/14/2022	0.65	-0.431	8.7
7/15/2022	0.05	-2.996	9.0
11/3/2022	0.22	-1.523	9.3
4/24/2023	0.05	-2.996	9.8
7/20/2023	0.29	-1.255	10.0
10/18/2023	0.19	-1.666	10.3
	k_{P323L}	**0.2505**	

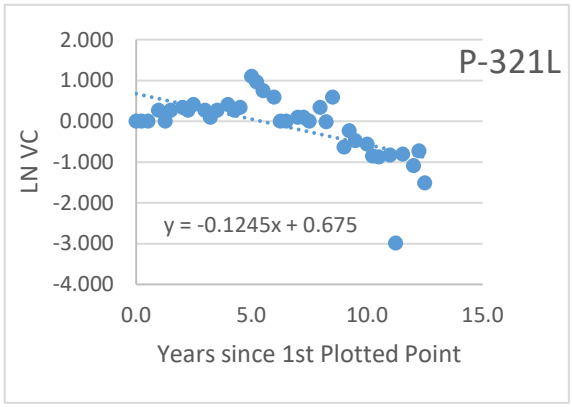
P-326L	VC (ug/l)	ln VC	Yrs
7/14/2014	1.0		
10/21/2014	1.0		
4/14/2015	0.67	-0.400	0
7/22/2015	0.54	-0.616	0.3
10/22/2015	0.54	-0.616	0.5
4/22/2016	1.3	0.262	1.0
7/11/2016	0.87	-0.139	1.2
10/19/2016	0.9	-0.105	1.5
4/13/2017	0.62	-0.478	2.0
7/18/2017	0.35	-1.050	2.3
10/16/2017	0.47	-0.755	2.5
5/10/2018	0.31	-1.171	3.1
7/17/2018	0.46	-0.777	3.3
10/17/2018	0.39	-0.942	3.5
5/2/2019	0.63	-0.462	4.1
7/9/2019	0.42	-0.868	4.2
10/22/2019	0.95	-0.051	4.5
4/23/2020	0.50	-0.687	5.0
7/13/2020	0.43	-0.842	5.3
10/14/2020	0.42	-0.863	5.5
5/27/2021	0.05	-2.996	6.1
7/13/2021	0.34	-1.085	6.3
10/15/2021	0.05	-2.996	6.5
4/13/2022	0.96	-0.043	7.0
7/14/2022	0.05	-2.996	7.3
11/2/2022	0.32	-1.149	7.6
4/24/2023	0.05	-2.996	8.0
7/20/2023	0.20	-1.609	8.3
10/17/2023	0.53	-0.637	8.5
	k_{P326L}	**0.1985**	

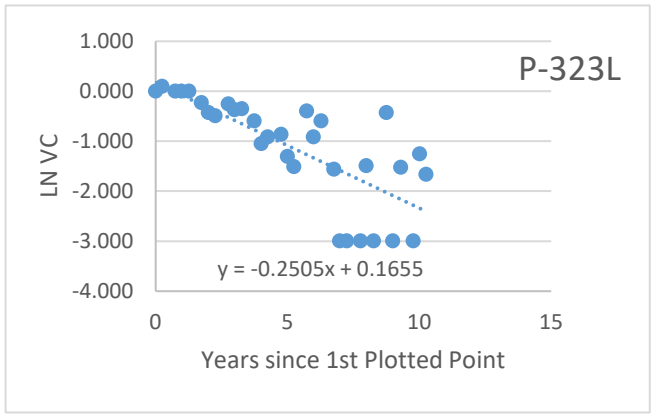
NOTE: k_{POINT}=slope of plotted LN VC vs Time Plot using this methodology

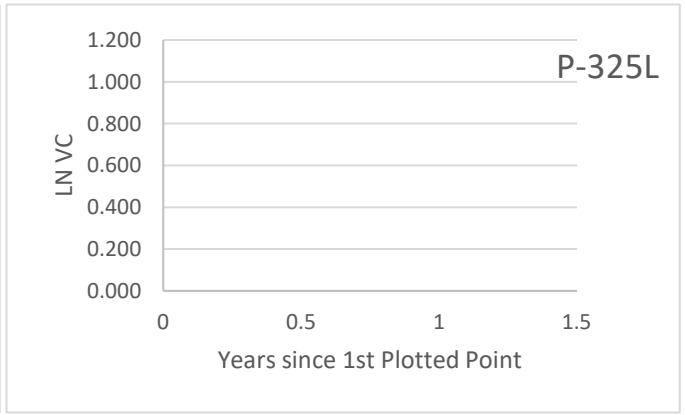
Attachment H1
Equations and Inputs
Elk River Landfill











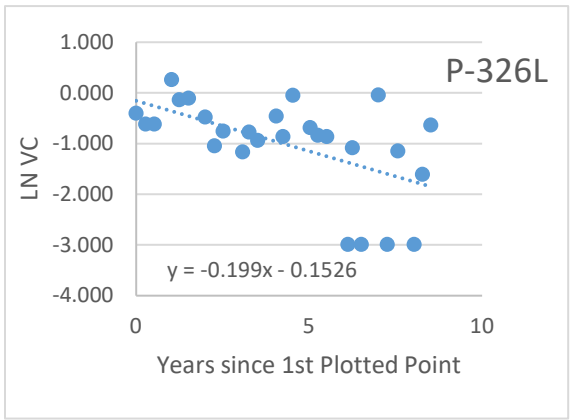


Table H1
Organics Plug Travel Projections

Projections/Estimated timing of when the 1992 organics slug arrived/will arrive downgradient of ERL (if not attenuated before arriving)

Location	Distance from P-17C/P-308L (feet)	Estimated Arrival Year (using V_{VC})	Estimated Arrival Year (using $V_{VC,HI}$)	Observed Maximum Vinyl Chloride Concentration to Date (ug/l)	Observed Maximum Vinyl Chloride Concentration Occurrence (Date)	Notes
P-325L	1158	**2002**	**2000**	0.97	7/14/2022	P-325L was installed in 2014.
P-326L	1365	**2004**	**2002**	1.3	4/22/2016	P-326L was installed in 2014.
P-338L	3147	**2020**	**2015**	1.0	7/24/2023	P-338L was installed in 2021.
P-334L	4521	**2033**	**2024**	0.41	7/24/2023	P-334L was installed in 2018.
P-342L	5539	**2042**	**2032**	<0.05	none detected	P-342L was installed in 2023

Inputs

V_{VC}	112	ft/yr	Vinyl Chloride Travel Velocity (estimated)
$V_{VC,HI}$	139	ft/yr	Vinyl Chloride Travel Velocity (high estimate)
Year	1992		Starting Year of Organics Concentration Spike at P-17C (1992-1994)

Table H2
Projecting Time to Achieve ILs at Wells

Well	k_{POINT}	C_0	C_0 Date	C_{IL}	Projected Year C_{IL} Achieved
P-313C	0.217	1.1	4/19/2011	0.05	2026
P-314C	0.254	1.5	4/19/2011	0.05	2025
P-321L	0.125	1	4/19/2011	0.05	2036
P-323L	0.251	1.0	7/17/2013	0.05	2025
P-326L	0.199	0.67	4/14/2015	0.05	2029

Notes: -Projected Year C_{IL} Achieved is based on application of first order kinetics using the calculated overall attenuation rate and dataset shown in Equation 6.
-Locations nearest to the Compliance Boundary and Property Boundary are shown.

Equation / Variables

$C_{IL} = C_0 e^{-kt}$

t = time (years)

k_{POINT} = Calculated overall attenuation rate at well (/year)

x = distance

C_{IL} = Vinyl chloride intevention limit (0.05 ug/l)

C_0 = Vinyl chloride concentration at date listed. Listed date based on first detections at well since 2011 (or installation date)

Table H3
Bulk Attenuation Projections

Scenario	Description	Guiding Equation	Overall Attenuation Rate		Vinyl Chloride Travel Distance, Velocity, and Time					Vinyl Chloride Concentration	
			Variable	Overall Attenuation Rate (/yr)	Start Point	End Point	Distance (feet)	V_{GW} (ft / year)	Travel Time (years)	C_{IL} (ug/l)	C_{CB} (ug/l)
A	Calculate the estimated maximum vinyl chloride concentration at the Compliance Boundary that would naturally attenuate below ILs before reaching nearest residential water supply user downgradient of mapped extent assuming the flow path is complete[1]?	$C_{CB} = \frac{C_{IL}}{e^{-k\frac{x}{V_{GW}}}}$	$k_{2019, VC}$	0.082	Compliance Boundary	Nearest Directly Downgardient Residential Water Supply User	7724	117	66	0.05	**11**
			$k_{2021, VC}$	0.023							**0.23**
			$k_{2023, VC}$	0.035							**0.51**
			$k_{2019, MOL}$	0.047							**1**
			$k_{2021, MOL}$	0.035							**0.51**
			$k_{2023, MOL}$	0.047							**1.1**
			k_{AVG}	0.045							**<u>1.0</u>**
B	Calculate the estimated maximum vinyl chloride concentration at P-342L that would naturally attenuate below ILs before reaching nearest residential water supply user downgradient of mapped extent (C. Thompson) assuming the flow path is complete[1]?	$C_{P-342L} = \frac{C_{IL}}{e^{-k\frac{x}{V_{GW}}}}$	$k_{2019, VC}$	0.082	P-342L	Nearest Directly Downgardient Residential Water Supply User	2638	117	24	0.05	**0.32**
			$k_{2021, VC}$	0.023							**0.08**
			$k_{2023, VC}$	0.035							**0.11**
			$k_{2019, MOL}$	0.047							**0.14**
			$k_{2021, MOL}$	0.035							**0.11**
			$k_{2023, MOL}$	0.047							**0.14**
			k_{AVG}	0.045							**<u>0.14</u>**
C	How far is vinyl chloride projected to travel downgradient of the Compliance Boundary before attenuating below ILs considering the peak 2023 concentrations reported near Compliance Boundary *(0.48 ug/l at P-321L)* assuming the flow path is complete[1]?	$x = \left(\frac{ln\frac{C_{IL}}{C_{CB}}}{-k}\right)V_{GW}$	$k_{2019, VC}$	0.082	Compliance Boundary	NA	**3231**	117	NA	0.05	0.48
			$k_{2021, VC}$	0.023			**11309**				
			$k_{2023, VC}$	0.035			**7539**				
			$k_{2019, MOL}$	0.047			**5654**				
			$k_{2021, MOL}$	0.035			**7539**				
			$k_{2023, MOL}$	0.047			**5654**				
			k_{AVG}	0.045			**<u>5900</u>**				

<u>Assumptions/Notes:</u>

-Bulk k_{VC} values may be conservatively biased low due to observed presence of parent compounds to vinyl chloride upgradient of P-334L.

-The extent of vinyl chloride is stable and no longer expanding.

-First order kinetics applied, i.e. $C_x = C_0 e^{-kt}$

-The higher end groundwater velocities (+25%) do not yield different results than what is shown above. A change in groundwater velocities yields a proportional change in attenuation rates. This results in no change to results in bolded text above.

NA = Not applicable or not analyzed

Inputs in Standard Text, **Results in Bolded Text**

<u>Value calculated using average attenuation rate, or estimated groundwater velocity, is underlined</u>.

[1] The groundwater flow path may not be complete based on the observed lower outwash thickness and 2023 monitoring results from well P-342L.

<u>Variables</u>

C_{CB} = Vinyl chloride concentration at Compliance Boundary.

t = time

k = overall attenuation rate

x = distance

C_{IL} = Vinyl chloride intevention limit (0.05 ug/l)

V_{VC} = Vinyl chloride velocity

C_{P334L} = Vinyl chloride concentration at P-334L

k_{MOL} = Bulk attenuation rate of chlorinated ethenes (PCE, TCE, 1,2-DCE, and VC)

k_{VC} = Bulk attenuation rate of vinyl chloride

Table H4
Mass Flux of Vinyl Chloride Downgradient of ERL (April 2010 / 2019 / 2023)

Mass Flux of Vinyl Chloride Downgradient of ERL - April 2010

Box ID	Wells Included in "Box"	"Box" Depth (feet)	"Box" Width (feet)	"Box" Area (sq feet)	K (ft/day)	GW Elev u/g (ft MSL)	GW Elev d/g (ft MSL)	i (ft/ft)	VC Conc (µg/L)	VC Flux (g/day)	VC Flux (lb/yr)
A - south	P-314C	27	500	13500	41.99	952	951	0.0011	2.00	0.04	0.03
B	P-313C	27	250	6750	41.99	952	951	0.0011	1.40	0.01	0.01
C	P-323L	25	400	10000	41.99	952	951	0.0011	*1.00*	0.01	0.01
D	P-321L	50	400	20000	41.99	952	951	0.0011	1.20	0.03	0.03
E	4 Wells	55	400	22000	41.99	952	951	0.0011	*0.85*	0.03	0.02
F - north	2 Wells	55	500	27500	41.99	952	951	0.0011	*0.03*	0.001	0.001
									Total	**0.12**	**0.098**
				Distance u/g to d/g contour (feet)		875					

Mass Flux of Vinyl Chloride Downgradient of ERL - 2019

Box ID	Wells Included in "Box"	"Box" Depth (feet)	"Box" Width (feet)	"Box" Area (sq feet)	K (ft/day)	GW Elev u/g (ft MSL)	GW Elev d/g (ft MSL)	i (ft/ft)	VC Conc (µg/L)	VC Flux (g/day)	VC Flux (lb/yr)
A - south	P-314C	27	500	13500	41.99	952	951	0.0011	0.29	0.01	0.004
B	P-313C	27	250	6750	41.99	952	951	0.0011	0.42	0.004	0.003
C	P-323L	25	400	10000	41.99	952	951	0.0011	0.54	0.01	0.01
D	P-321L	50	400	20000	41.99	952	951	0.0011	1.4	0.04	0.03
E	4 Wells	55	400	22000	41.99	952	951	0.0011	0.29	0.01	0.01
F - north	2 Wells	55	500	27500	41.99	952	951	0.0011	0.20	0.01	0.01
									Total	**0.07**	**0.057**
				Distance u/g to d/g contour (feet)		875					
									Decrease in VC flux in 2019 compared to April 2010:		**42%**

Mass Flux of Vinyl Chloride Downgradient of ERL - 2023

Box ID	Wells Included in "Box"	"Box" Depth (feet)	"Box" Width (feet)	"Box" Area (sq feet)	K (ft/day)	GW Elev u/g (ft MSL)	GW Elev d/g (ft MSL)	i (ft/ft)	VC Conc (µg/L)	VC Flux (g/day)	VC Flux (lb/yr)
A - south	P-314C	27	500	13500	41.99	949	948	0.0011	0.05	0.001	0.001
B	P-313C	27	250	6750	41.99	949	948	0.0011	0.17	0.002	0.001
C	P-323L	25	400	10000	41.99	949	948	0.0011	0.17	0.002	0.002
D	P-321L	50	400	20000	41.99	949	948	0.0011	0.35	0.009	0.007
E	4 Wells	55	400	22000	41.99	949	948	0.0011	0.17	0.005	0.004
F - north	2 Wells	55	500	27500	41.99	949	948	0.0011	0.07	0.003	0.002
									Total	**0.02**	**0.017**
				Distance u/g to d/g contour (feet)		900					
									Decrease in VC flux in 2023 compared to April 2010:		**82%**

Table H4
Mass Flux of Vinyl Chloride Downgradient of ERL (April 2010 / 2019 / 2023)

Notes:

-Mass flux estimated using transect/box model method by application of Darcy's Law.

-Estimated "Box Width" based on Approximate Extent of Vinyl Chloride above IL and Maximum Estimated Northern Extent of VC above ILs on Figure 2 of this GWCA Initial Performance Evaluation. Estimated "Box Depth" based on Figure 4 of the Work Plan (Barr, 2021)

-Hydraulic conductivity (K) data based on P-308L step test (2019)

-Wells P-29C, P-320C, P-320C2, and P-321L included in Box E. Wells P-301C and P-301L included in Box F.

-2019 groundwater elevations/horizontal gradient (i) are based on 952 ft MSL (u/g) and 951 ft MSL (d/g) contours on Figure 3 of CAER. For consistency, the 2010 groundwater elevations/horizontal gradient (i) were kept consistent with 2019. The current downgradient well network was not yet established.

-2023 groundwater elevations/horizontal gradient (i) are based on 949 ft MSL (u/g) and 948 ft MSL (d/g) contours on Figure 6 of this GWCA Initial Performance Evaluation.

-2010 Average Vinyl Chloride concentrations are from the April 2010 monitoring event from wells located in each "box". For locations with no data or where non-detect values were reported due to higher reporting limits, data from the nearest date where a detection was reported is applied. These data points are *italicized* .

-2019 and 2023 Average Vinyl Chloride concentrations are average values from wells located in each "box".

EXHIBIT 7

MINNESOTA POLLUTION CONTROL AGENCY

Protecting wild rice waters

SECTION MENU

Contact

Wastewater.Permitting.MPCA@state.mn.us



Wild rice is an important part of the biological community in many Minnesota lakes, streams, and wetlands. Wild rice is also a cultural resource to many, particularly members of the Dakota and Ojibwe Tribal Nations in Minnesota, and it is an important economic resource to those who harvest and market it. Minnesota recognizes wild rice as its official state grain.

Wild rice is found primarily in low-sulfate waters. Sulfate is a naturally occurring chemical and can also be found in discharges from mining operations, wastewater treatment plants, and industrial facilities.

The MPCA is currently working to fully implement a water quality standard to protect wild rice from excess sulfate. The standard, 10 mg/L sulfate, which was adopted in 1973, applies to "waters used for production of wild rice." The agency is also working with permittees, researchers, Tribal partners, other levels of government, as well as the public to investigate ways to protect wild rice.

History

The MPCA has sponsored studies on how sulfate affects wild rice. Research projects in 2012-2013, including a field survey, laboratory experiments, and mesocosm (outdoor growth tank) experiments, helped to inform a 2017 proposal to amend the existing sulfate water quality standard. This rulemaking attempt was ultimately unsuccessful. Consequently, the 1973 sulfate water quality standard remains in effect. MPCA is committed to implementing this standard.

Implementation

The 10 mg/L sulfate water quality standard is designed to protect wild rice and applies in specific waters called "waters used for production of wild rice" (Minn. R. 7050.0224).

Where the standard applies. The MPCA has developed a list of approximately 2,400 waters used for production of wild rice. This list was developed from multiple sources of information — biological monitoring data, survey databases, and various inventories — to determine where the wild rice beneficial use has been, or could be, attained.



Wild rice producing waters

This online search tool will assist in identifying waters used for production of wild rice, as well as in identifying facilities that require a permit review because they are located in a watershed upstream or partially upstream of such waters.

Open tool

NPDES/SDS permitting

The MPCA is continuing to work with permittees, the public, and state, local, federal partners, and tribal nations to develop ways to protect this important Minnesota resource through implementation of the long-standing 10 mg/L sulfate standard via monitoring, assessment, and permitting.

- The MPCA held an informational meeting (May 24, 2023) for representatives of NPDES/SDS permitted facilities, to discuss where the standard applies and how the standard would be considered in NPDES/SDS permits.
- In a follow-up meeting (June 28, 2023) we discussed options if a facility can't meet a permit limit and the framework for developing site-specific sulfate standards to protect waters used for production of wild rice.
- In the final meeting in the series (Sept. 27, 2023), MPCA staff responded to NPDES/SDS permit-related questions received during the feedback periods, and leaders from the University of Minnesota Duluth Natural Resources Research Institute provided information about their sulfate treatment technology research.
- Minnesota Wild Rice Sulfate Water Quality Standard NPDES/SDS wastewater permit implementation (wq-wwprm1-42)
- Procedures for implementing the Class 4A Wild Rice Sulfate Standards in NPDES wastewater permits in Minnesota (wq-wwprm2-109)

Impaired waters

In the 2024 Impaired Waters List, MPCA identified a total of 43 waterbodies (56 assessment units) as impaired due to measured sulfate levels in excess of 10 mg/L.

Site-specific standards

- Framework for developing and evaluating site-specific sulfate standards for the protection of wild rice (wq-s6-66a) (December 2023)

More information

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EXHIBIT 8

Information

MINNESOTA POLLUTION CONTROL AGENCY

Wild rice is an important part of the ecosystem in many Minnesota lakes and streams. Wild rice is also a cultural resource to many, particularly members of Minnesota's Dakota and Ojibwe tribal communities, and is an important economic resource to those who harvest and market it.

The MPCA has preliminarily determined that a list of approximately 2400 waters can reasonably be considered as constituting "waters used for production of wild rice". This list was developed based on reviewing multiple sources of information - including various inventories, biological monitoring, and survey databases – to determine where the wild rice beneficial use has been or could be attained.

This list includes many waters that are wholly or partially within tribal boundaries and therefore have shared state and tribal jurisdiction. Appearance on this list does not supersede any applicable tribal water quality standards or regulations on wild rice harvest. The waters are included to show where MPCA will be reviewing water program activities to ensure the 10 mg/L sulfate standard is met.

EXHIBIT 9

United States
Environmental Protection
Agency

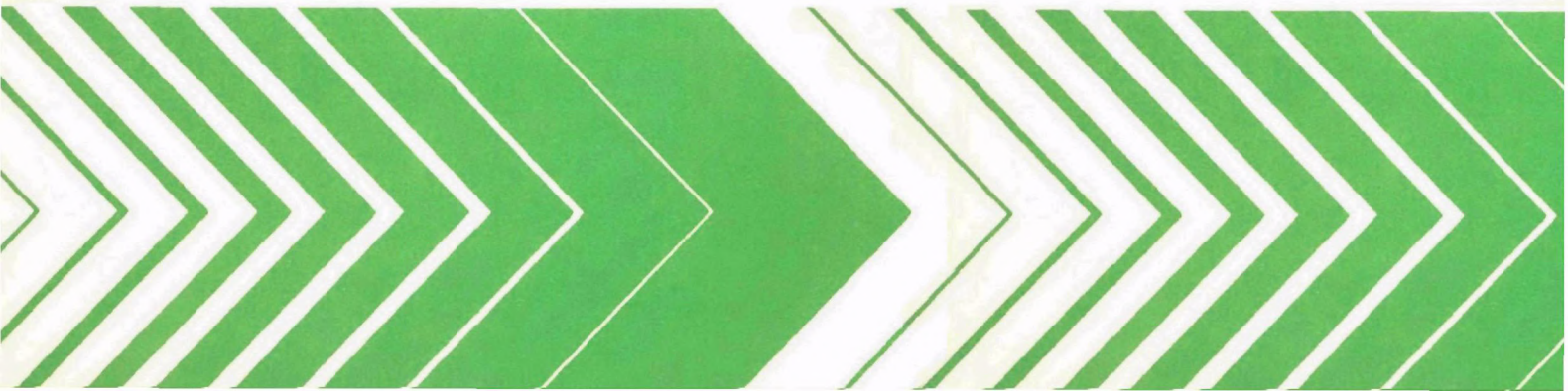
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Chemical and Physical Effects of Municipal Landfills on Underlying Soils and Groundwater



RESEARCH REPORTING SERIES

Research reports of the Office of Research and Development, U.S. Environmental Protection Agency, have been grouped into nine series. These nine broad categories were established to facilitate further development and application of environmental technology. Elimination of traditional grouping was consciously planned to foster technology transfer and a maximum interface in related fields. The nine series are:

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May 1978

CHEMICAL AND PHYSICAL EFFECTS OF MUNICIPAL LANDFILLS ON UNDERLYING SOILS AND GROUNDWATER

by

Environmental Effects Laboratory
U.S. Army Engineer Waterways Experiment Station
Vicksburg, Mississippi 39180

Interagency Agreement No. EPA-IAG-D4-0569

Project Officer

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FOREWORD

The Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimony to the deterioration of our natural environment. The complexity of that environment and the interplay between its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution and it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems for the prevention, treatment, and management of wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, for the preservation and treatment of public drinking water supplies, and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research; a most vital communications link between the researcher and the user community.

This report presents results from the field investigation of three municipal solid waste landfill sites to determine their effects on surrounding soils and groundwater. It provides basic data on the potential pollution from land disposal of municipal solid waste and will add to the knowledge required to determine the environmental consequences of the land as a rector of waste materials.

Francis T. Mayo, Director
Municipal Environmental Research
Laboratory

ABSTRACT

Three municipal landfill sites in the eastern and central United States were studied to determine the effects of the disposal facilities on surrounding soils and groundwater. Borings were made up the groundwater gradient, down the groundwater gradient and through the landfill. Soil and groundwater samples from the test borings were examined. Groundwater samples were analyzed chemically. Soil samples were tested physically and distilled water extracts and nitric acid digests of the soils were analyzed chemically.

Groundwater samples from under and downgradient from the landfill showed elevated levels of sulfate in every case. At some sites increased levels of nitrate, total organic carbon and cyanide could be related to the presence of the landfill.

No changes in physical characteristics could be related to the presence of the landfill at any site. No evidence was found in this study to indicate that sub-landfill soils seal themselves.

Distilled water extracts prepared from soil samples showed consistently low levels for all soluble constituents. Generally, there was more sulfate, chloride, organic carbon, nitrate and higher levels of trace metals in extracts of soils from under the landfill than from soils collected at similar depths outside the landfill.

Nitric acid digests of soil samples showed great variability in chemical composition. At two of the three sites; iron, manganese, boron, beryllium and zinc were found in higher concentrations in nitric acid digests immediately under the landfill.

The results of this investigation indicate that chemical characteristics; but, not physical characteristics were altered in sub-landfill soils. Removal of pollutants from leachate through the action of soil was observed for only a very limited number of pollutants.

This report was submitted in partial fulfillment of Interagency Agreement Number EPA-IAG-D4-0569 by the U. S. Army Engineer Waterways Experiment Station under the sponsorship of the U. S. Environmental Protection Agency. This report covers the period from June 1975 to December 1977.

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SECTION 1

INTRODUCTION

Disposal on land is the oldest method of municipal solid waste disposal and is still the most widely used system. Over 90% of all municipal wastes are currently disposed of on land in open dumps or sanitary landfills. The sanitary landfill with systematic deposition, compaction and burial of refuse emerged in the 1930's as the safest, least objectionable system of land-based disposal. Some 1,400 cities are currently using landfills to dispose of some 318 thousand metric tons per day of solid wastes. The expenditure of money on solid waste disposal is surpassed only by that spent on schools and roads in most municipal budgets(1).

The disposition of solid wastes in landfills carries the inherent potential for degrading the quality of groundwater in the area of the landfill. There are numerous examples of municipal landfills producing groundwater pollution. Garland and Mosher(2) have cited several examples where the pollution from landfills could be detected; including one case where effects could be observed at a distance of 3 kilometers due to high selenium values in groundwater samples. Exler(3) reported that a landfill in Germany had a groundwater pollution plume that was also detectable for a distance of 3 kilometers down the flow gradient from the fill. The polluted groundwater in this case showed high levels of chloride and dissolved organic material.

The pollution of groundwater by landfills has in some cases caused severe degradation of drinking water supplies to the extent that such water is no longer potable. Incidences of pollution of this sort cause grave economic hardship on local governments that must attempt to relieve the pollution problem or provide a new water supply.

Some landfills are designed to contain all contaminants, but many allow the slow downward leakage of water that has come in contact with the buried refuse. This latter design anticipates the removal of undesirable materials in this leachate either by filtration through or adsorption onto the earth materials between the bottom of the landfill and the water table. This purification process is referred to as attenuation. The attenuated leachate that does reach the water table is then diluted by the much larger quantity of groundwater into which it flows. Groundwater pollution occurs when this filtration, adsorption and dilution process does not operate successfully.

Although some prediction of attenuation properties can be made from soil characteristics, such as clay content, particle size distribution, cation exchange capacity, etc., there is no conclusive method for verifying that attenuation is not effective until groundwater pollution is observed. The

soil beneath a landfill should show an increase in contaminants if attenuation is occurring. Therefore, the examination of earth materials beneath sanitary landfills should be a useful technique for gauging the extent of pollutant attenuation.

The objectives of the present investigation are to examine three landfills that are situated in widely different geological circumstances in order to:

a) discover if changes have occurred in the chemical characteristics of local groundwater because of landfill operation,

b) determine the influence of the landfilled refuse on the chemical characteristics and physical properties of the geologic materials directly below the landfill,

c) determine if chemical constituents that are present in the soil below the landfill can be released into contacting water,

d) establish if a relationship exists between the depth below the refuse and the chemical and physical properties of the earth materials, and

e) discover if any physical or chemical characteristics of the material beneath a landfill can be used to predict the extent of contaminant attenuation.

To meet these objectives, an idealized concept or model (Figure 1) for leachate movement and attenuation was developed to provide a rationale for the sampling program. In this model the rainwater falling on the landfill saturates the refuse and then percolates through the soil directly below. A variable portion of the filterable and exchangeable material in the leachate is deposited in the soil below the landfill. This attenuated leachate continues downward into the water table. Groundwater flowing under the landfill dilutes the leachate and carries the pollutants in a plume down the groundwater gradient. Based on this idealized model, borings were located in such a way as to produce:

a) groundwater from wells beneath the landfill and from wells located both up and down the groundwater flow gradient in the area of the landfill,

b) samples of soil from beneath the landfill and from comparable depths outside the landfill,

c) soil samples collected at different levels down the boreholes both outside and beneath the landfill, and

d) samples collected near the top of the saturated zone (water table) around and inside the landfill.

Physical testing of soil samples collected below the landfill and at comparable depths outside the landfill was undertaken to evaluate changes related to the buried refuse. The physical characterization included percent

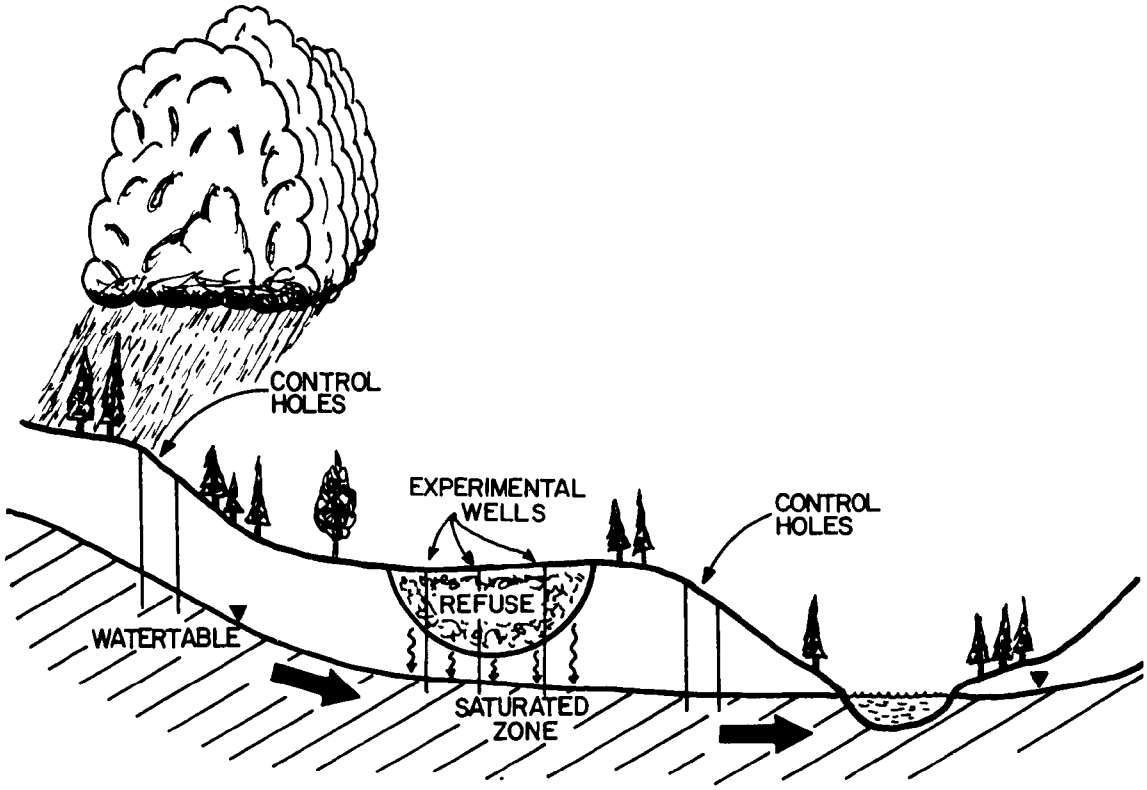


Figure 1. Sketch of typical landfill showing sampling plan. The updip control holes show background levels. The experimental wells and downdip control holes show contaminant movement from the landfill. Bold arrows indicate direction of groundwater movement.

moisture, dry density, grain size distribution, permeability and soil classification. Randomization was used to test for significant differences in physical properties. Vertical variability in selected bore holes was also evaluated. The small sample sizes did not allow the use of statistical tests.

The samples of groundwater collected in this study were used to indicate loss of contaminants from the landfill or the soil beneath the landfill into the local groundwater. If contaminants are moving to the water table, their concentrations should be higher beneath and downdip from the landfill. A list of analyses run is given in Table 1. A one-way analysis of variance technique was employed to assess the significance of changes in water quality.

Soil samples from beneath the landfill and from comparable depths outside the landfill were treated in two ways: One aliquot of soil was extracted with distilled water to remove all ions that could be dislodged by water alone. A list of analyses run is given in Table 1. The distilled water extract gives a rate of release of material from the soil into the surrounding water. The water extract is assumed to represent the maximum concentration available in water contacting the soil, not the maximum, total amount capable of being leached from the soil. The distilled water leach then indicates the mobility of various ions being held in the soil. The most effective attenuation is occurring when the soil beneath the landfill shows an ability to accumulate a contaminant and to release the contaminant at a very slow rate. A randomization technique was used to test the significance of differences observed in the composition of the distilled water extracts of soil samples collected directly beneath the landfill and samples collected at comparable depth outside the landfill. The significant results of the randomization test point out those elements at each site whose mobility in aqueous solution is effected by material from the landfill. A second aliquot of fresh soil was digested with hot, 8N nitric acid to bring all ions not bound into silicate lattices into solution. A list of analyses run is also given in Table 1. This digest represents the total of all materials that could potentially be leached from the soil under the most severe conditions. Since it is assumed that there is no lateral movement of leachate above the water table, differences in composition between digests of these samples can be interpreted as the loss or gain of material in the soil due to the presence of the landfill.

A randomization technique was used to test for significant differences in composition between acid digests of soil samples collected directly below the landfill and samples collected at comparable depths (and above the water table) outside the landfill. The significant results from the randomization tests point out those elements at each site that are being added to the soil or removed from the soil by the movement of leachate from the landfill.

If the soil beneath the landfill is being altered by leachate from the landfill, any change should be most pronounced directly beneath the refuse and the magnitude of this change should decrease with depth. Samples of soil were taken at intervals down the boreholes to determine if any correlation between the concentration of materials in the soil and depth (or sample elevation) could be observed. Correlation with sample elevation was only attempted with those elements that had shown a significant contrast in concentrations available under and away from the landfill at each site. A

TABLE 1. CHEMICAL CONSTITUENTS ANALYTICALLY DETERMINED IN GROUNDWATER FILTRATES, DISTILLED WATER EXTRACTS, AND NITRIC ACID DIGESTS

Constituent	Groundwater filtrate	Water extract of soil samples	Nitric acid digests of soil samples
SO_4	X	X	--
SO_3	X	X	--
Cl	X	X	--
NO_3-N	X	X	--
NO_2-N	X	X	--
CN	X	X	--
TOC	X	X	--
Ca	X	X	--
Fe	X	X	X
Mg	X	X	--
Mn	X	X	X
Na	X	X	--
As	X	X	X
B	X	X	X
Be	X	X	X
Cd	X	X	X
Cr	X	X	X
Cu	X	X	X
Hg	X	X	X
Ni	X	X	X
Pb	X	X	X
Se	X	X	X
Zn	X	X	X

-- = Not determined.

Spearman rank correlation technique was employed. The correlation technique made it possible to see if consistent relationships could be observed between sample elevation and sample composition in borings made inside and outside the landfill.

Samples of soil collected near the top of the saturated zone both outside and inside the landfill were examined to see if any effects of lateral movement of leachate could be observed. Distilled water leaches and nitric acid digests of these soil samples were analyzed. Plots of analyses were prepared to assess any changes in constituents that could be related to the presence of the landfill. No attempt was made to evaluate these analyses statistically because of the small sample sizes involved.

SECTION 2

CONCLUSIONS

At all three municipal landfill sites, changes in the chemical composition of the groundwater could be related to the position of the borings with respect to the landfill. Water quality below and down the groundwater flow gradients from the landfills showed increased sulfate levels in every case. At several sites increased nitrate, total organic carbon, and cyanide levels could be related to the presence of the landfill.

No changes in physical parameters measured in soil samples in this study could be related to the effect of the landfill. No consistent alterations in dry density, water content, permeability, or percent fines could be related to the position of soil samples with respect to the landfill. Physical characteristics of sub-landfill soil samples as measured by standard engineering techniques were not significantly different from samples collected at comparable depth outside the landfill. No consistent vertical changes in soil physical characteristics in borings through the landfill could be detected. The percolation of leachate did not alter the permeability of the soil beneath the refuse. No evidence was found in this study to substantiate the idea that sub-landfill soils seal themselves.

Distilled water extracts prepared from soil samples showed all soluble constituents were present in very small quantities. Many variations observed were not consistent from one site to another. In general, there was more leachable sulfate, chloride, organic carbon, nitrate and more available trace metals in soil from under the landfills than in soils from similar depths outside the landfill. Calcium, iron and zinc were the only metals that showed decreased availability under any of the landfills. The lack of water-extractable iron under the landfill at the one actively operating site was probably due to its precipitation as an insoluble compound such as sulfide. In another series of distilled water extracts, many constituents showed decreasing availability with increasing sample depth in borings below the landfill, suggesting their source was the refuse in the landfill. Calcium and zinc were exceptions to this trend and showed increasing levels in distilled water extracts with increasing depth. This trend may be due to removal by leaching by organic acids from the refuse (especially in the case of calcium) or the formation of insoluble compounds under the landfill.

Analyses of distilled water extracts of soil samples taken from near the water table shows that the maximum concentration of many constituents as measured in the water extract can be displaced down the groundwater gradient from the landfill. Displacement of the concentration maxima was noted with nitrate, organic carbon, calcium, iron, magnesium, manganese, sodium and boron.

Nitric acid digests of soil show great variability in chemical composition. At two sites iron, manganese, boron, beryllium and zinc were found in higher concentrations in nitric acid digests from immediately under the landfill than at comparable depths outside the landfill. This suggests that these metals are being added to the soil under the landfill (i.e. attenuated). Only arsenic showed a decreased level under the landfills suggesting it was being mobilized or leached from the sub-landfill soil.

Analyses of nitric acid digests from soil samples collected at increasing depth below the landfill indicate that iron, manganese, arsenic, boron, beryllium, lead, selenium and zinc (at site B) are accumulating in soil immediately beneath the landfill. Only two metals, nickel and zinc (at site C), showed an increasing abundance with increasing depth indicating these metals are leaching out of the upper layers of sub-landfill soil.

Analyses of nitric acid digests of soil samples taken from near the water table also show that the maximum concentration of some of the landfill constituents can be displaced down the groundwater gradient from the landfill. This trend was noted for the maximum concentrations of arsenic, manganese, copper and lead.

The results of this investigation indicate that chemical characteristics, but not physical characteristics, were altered in soil under the landfill, and chemical changes in the sub-landfill soil can be related to the capacity of the soil to filter, absorb or precipitate the contaminants from the refuse. Instances were noted where the leachate added material to the soil and also mobilized normal soil constituents to effect changes in soil composition.

SECTION 3

RECOMMENDATIONS

The interaction between leachate from municipal refuse and soil is complex varying with the character of the soil and the composition of the leachate. The chemical character of the soil is itself changed as material is added or leached out. The landfill leachate varies with the nature of the refuse disposed and the type of decomposition occurring. The results of this survey indicate that significant chemical changes occur in the soil that can be related to the attenuation process.

Future investigations should include characterization of the landfill leachate before and after contact with the soil as well as analysis of acid digests of the soil. Any future study of sub-landfill soils should include soil variables such as mineralogy, cation exchange capacity, and slurry pH. Any continued work on leachate-soil interaction could include following soil changes through several annual cycles until stabilization of the refuse occurs. Further physical testing should be undertaken on a very fine scale, carefully including the soil-refuse interface.

Field investigations of this nature while involving many variables, represent the best approach to the understanding of how attenuation processes operate and their effect on groundwater quality. Continued work of this type may allow us to predict and overcome the hazard to groundwater resources involved in landfill disposal.

SECTION 4

METHODS AND MATERIALS

SITE SELECTION

Three municipal landfills were selected from widely different geographic areas in the Eastern United States. All sites were selected from areas where rainfall and infiltration rates were sufficient to produce an abundance of leachate. A summary of the important engineering and geologic characteristics of each of the sites selected for this survey is given in Table 2. The sites are designated only by letter.

Two principal factors effecting the character of the contaminants leaving a landfill are the nature of waste buried, and the age of material in the site. Other factors that impinge on the problem of the character of leachate from a landfill are oxidation-reduction conditions in the landfill, temperature in the landfill, and dilution of the leachate by local groundwater flow. The exact type and amount of waste material deposited in each site is difficult to determine, especially if the landfill has been completed and closed. Only in the case of site A is there a reasonably complete listing of wastes available from the local Department of Public Works (Table 3). Note that several types of industrial wastes have gone into this site including wastes from local rubber manufacturing, meat packing and paper mill operations. The information regarding the nature of waste placed at site B is not available. The waste is thought to be largely municipal (household and commercial) with only minor industrial input since there are no large manufacturing operations in the area served by the landfill. No waste survey is available for site C; but, engineering reports associated with the project state that the site received 900 tons per day of commercial and household refuse and 200 tons per day of incinerator ash. This site also received a great deal of sewage sludge and has been top-dressed with this material.

Sanitary landfill leachate typically changes in composition as the material in the landfill degrades (4,5) therefore the age of the landfill is an important consideration. Site A had been officially closed for fifteen years when the samples for this study were collected. However, there was some evidence of recent, unauthorized use of the site as an open dump for household refuse. The refuse was originally placed in trenches and was not compacted. Differential settling produced a series of shallow gullies where the trenches had been dug. The municipality later filled in the depressions with sewage sludge. At site B, the landfill was completed in 1972, and then regraded to produce a recreation area. The regrading included exposing and reburying part

TABLE 2. SUMMARY OF THE CHARACTERISTICS OF THE THREE SITES SELECTED FOR STUDY

Characteristic	Site A	Site B	Site C
Geographic area within the U.S.	North Central	South Central	East Central
General geologic setting	Glacial outwash (valley train deposits)	Wind-blown silt and clay (loess)	Deeply weathered residual soil (metamorphic terrane)
Mean annual rainfall	74 cm	124 cm	104 cm
Mean annual air temperature	8°C	19°C	13°C
Nature of waste	Municipal and industrial	Municipal and industrial(?)	Municipal and industrial(?)
Liner used below refuse	None	None	None
Thickness of refuse observed	4.82-6.52 m (avg. 5.40 m)	1.92-4.88 m (avg. 3.08 m)	14.02-24.70 m (avg. 19.45 m)
Thickness of unsaturated zone	18.23-20.24 m (avg. 19.33 m)	0.91-3.51 m (avg. 2.47 m)	0.91-10.88 m (avg. 4.79 m)
Nature of material in unsaturated zone	Sand	Clayey silt	Silty sand
Average hydraulic conductivity below refuse	$1x10^{-1}$ cm/sec	$7.3x10^{-7}$ cm/sec	$2.9x10^{-5}$ cm/sec
Average thickness of covering material	1.65 m	0.09 m	0.82 m
Character of covering material	Sand and gravel	Clay	Clay
Dates of operation of site	1947 - 1961	1959 - 1972	1964 - present
Type of operation	Trench and fill	Surface fill	Surface fill

TABLE 3. CHARACTER OF WASTE DEPOSITED IN LANDFILL AT SITE A AS LISTED BY THE MUNICIPALITY

Mixed demolition refuse
Sand
Dirt
Gravel
Rock
Broken pavement
Construction materials
Household refuse
Domestic garbage and kitchen wastes
Domestic incinerator residue
Cans and glass bottles
Furniture and carpets
Major appliances
Yard refuse
Logs
Grass and garden clippings
Brush
Chipped limbs and leaves
Commercial refuse
Used tires
Mixed commercial trash
Kitchen wastes
Commercial incinerator residue
Scrap metal
Wood crates
Industrial wastes
Rubber manufacturing wastes
Rubber scrap
Liquid and wet chemical waste
Paper mill sludge
Oil, tar and asphalt
Meat packing waste
Paunch
Manure
Sewage grit
Sewage sludge

of the refuse and compacting the landfill prior to partial paving with asphalt. The regrading took place only a year before this investigation. Site C was still receiving wastes; but, the portion where two of the borings (1 and 2) were placed had been closed from one to three years at the time of sampling.

All of the sites selected had been in place long enough to have possibly effected the groundwater and soil beneath and around the landfill (see Table 2). All of the sites contain domestic and commercial wastes; but only site A has received a major amount of industrial waste. These landfills were chosen because they have many factors in common with other landfills in the Eastern United States. All contain mixed residential and commercial refuse buried using prevailing landfilling methods.

SAMPLING PROCEDURES

A general sampling plan for all sites was generated using the theoretical model as described above (Figure 1) and then modified to fit the requirements at the individual sites. The general sampling scheme called for six or more holes to be bored at each landfill: a minimum of two holes to be bored through the buried refuse and five to six holes to be bored outside the landfill. This sampling pattern allowed comparison between typical, uneffected groundwater and soil, and groundwater and soil which was in contact with leachate draining from the buried refuse.

All sampling was done with a truck-mounted, rotary drill using 16.8 cm OD hollow-stem auger. The auger with a central plug in place was drilled in to the desired depth. The central plug was removed and a Hvorslev fixed-piston sampler (Figure 2) or a split spoon sampler (Figure 3) was pressed into the sediment or soil directly below the end of the auger using the hydraulic cylinders on the drill rig. In this way an undisturbed soil or sediment sample was obtained. The split spoon sampler was only used in cases where objects were encountered in the subsurface that could not be penetrated by the thin-walled tube (Shelby tube) on the Hvorslev sampler.

The vertical distribution of soil/sediment samples collected down the hole was arranged in a way to maximize the probability of collecting samples at two critical points in the boring: the refuse-soil interface, and the top of the saturated zone. Since the strongest effects of leachate on the subfill material should occur directly below the refuse, a sample was always taken at the depth predicted by the landfill design as being the combined thickness of the refuse and cover. Sampling then continued at closely spaced intervals down the hole. The top of the water-saturated zone was predicted from water table measurements that had been recorded for other wells in the area. A series of closely spaced samples was taken in this interval. The holes were allowed to remain open for two to three days with the auger flights in place. These auger flights served as a temporary well casing to prevent seepage from the surface from entering the well. Groundwater samples were obtained from the temporary wells by lowering a bailer into the top of the hollow stem auger. After a groundwater sample was obtained the auger was removed and the holes were backfilled with cement and/or bentonite to a point well above the water table. The filling was then completed with well cuttings. This

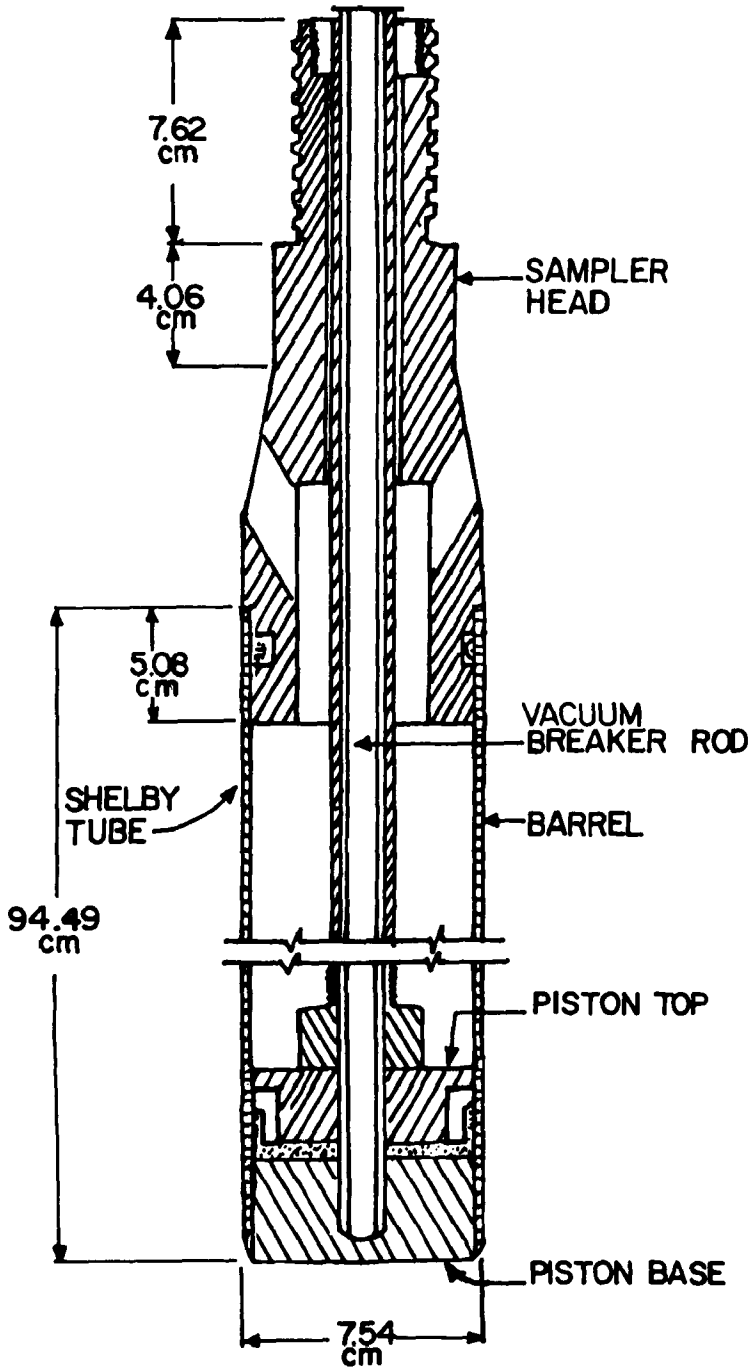


Figure 2. Sketch of Hvorslev Sampler

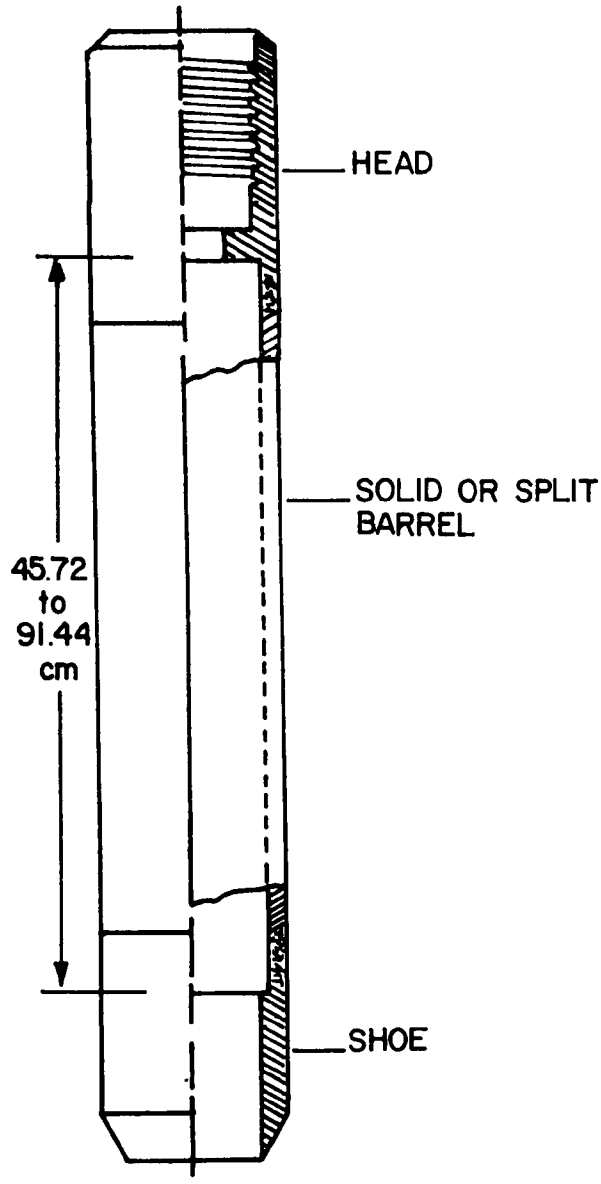


Figure 3. Sketch of split spoon sampler.

was done to assure that a well would not provide a conduit for flow of polluted water to the water table.

The locations of all borings at each landfill site are given in Figures 4-6. Arrows in these figures indicate the most probable direction of groundwater flow deduced from water level maps (Figures A-1, B-1, C-1 in appendices) and chemical data. The descriptive well logs are presented in the appendices (Tables A-1--A-8, B-1--B-8, C-1--C-9). Tables A-9, B-9, and C-10 list all soil/sediment samples examined from each boring giving their elevation and other relevant data.

SAMPLE HANDLING AND PREPARATION TECHNIQUES

Two different types of soil samples were collected in the boring program: samples for physical testing and samples for chemical analysis. Groundwater samples were also taken from each well for chemical analysis. The set of samples obtained for physical testing was used to determine soil class under the unified soil classification system (6), dry density, grain-size distribution, water content and permeability. These physical parameters were determined using standard engineering test procedures. This sample set was collected without disturbing the soil more than necessary. All physical testing samples were carefully packaged and sealed in coring tubes to retain the original moisture content and sample texture during transportation.

Depth to groundwater was measured with a chalked, steel tape at each boring. All of the groundwater samples were collected from the borings by bailing the water from the center of the hollow stem auger using a bailer made from small diameter tubing. The groundwater was transferred to polyethylene bottles which were labelled and packed in an insulated chest filled with crushed ice. The samples were stored under refrigeration and kept tightly capped until they were prepared for chemical analysis. The preparation consisted of centrifuging each sample at 2200 rpm for 30 minutes. The resulting supernatant was membrane-filtered through a 0.45 nm filter and split into five subsamples which were preserved as shown in Table 4.

Samples of soil for chemical analysis were collected simultaneously with the samples for physical testing; but, no attempt was made to maintain the soil in an undisturbed condition. Each sample was removed from the sampler, placed in a wide-mouthed polyethylene bottle, labelled, and packed in an ice-filled chest. These soil samples were refrigerated during all subsequent transportation and/or storage. Two extracts were made from each soil sample: one with distilled water and one with 8N nitric acid. The material that could be easily leached out with distilled water was considered transient and would readily be leached from the soil by dissolution in rainwater. The nitric acid leach would contain the transient materials and also all of the material that could be solubilized by a strong, oxidizing acid. Those elements present as carbonates or sulfides, or adsorbed to clay minerals, to iron oxide or to insoluble organic materials would be freed (7,8). Elements in non-clay silicate lattices would be leached only to a minor degree (9).

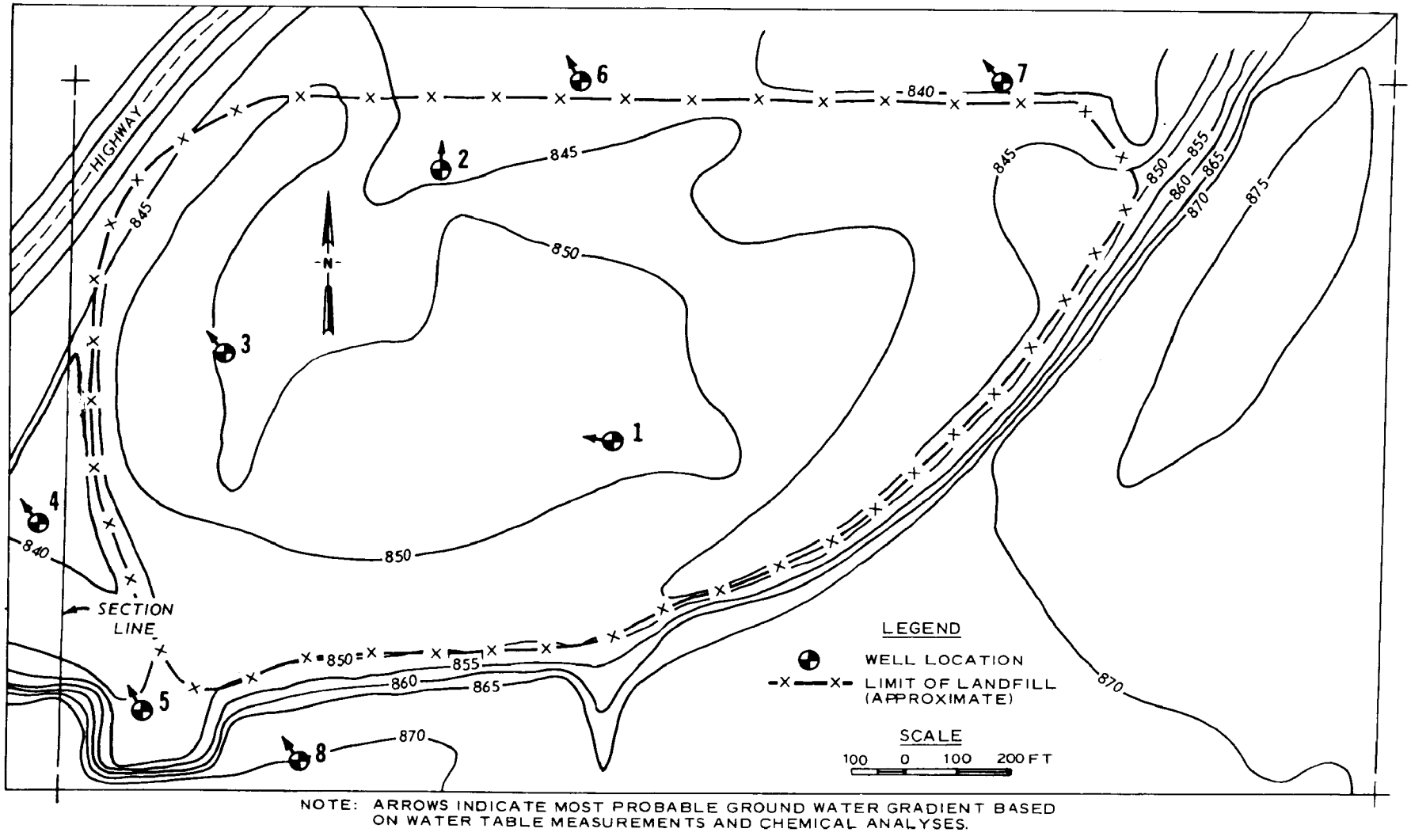


Figure 4. Topographic map of site A (contour lines are in feet above mean sea level). 0.305 m = 1 ft.

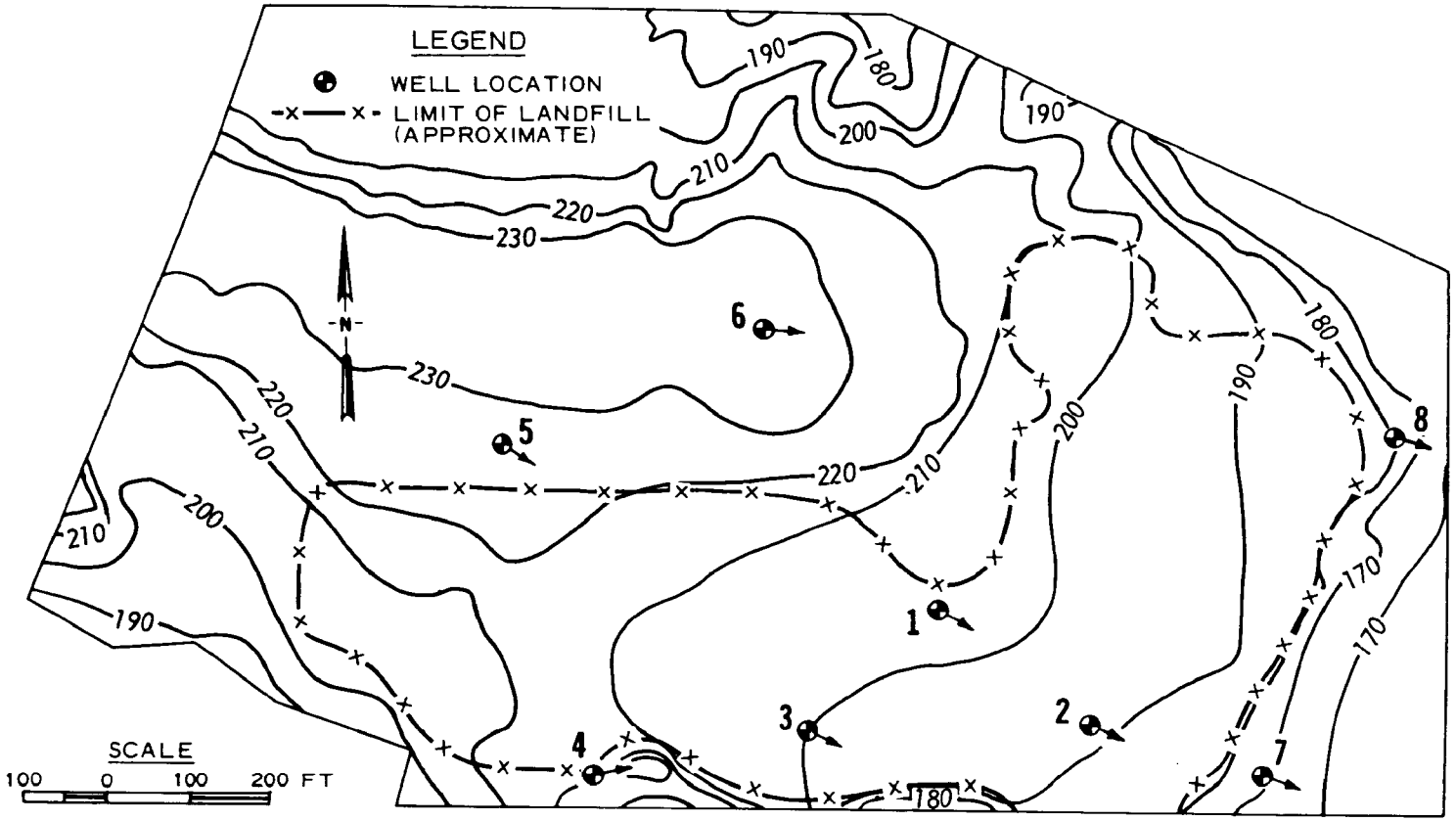


Figure 5. Topographic map of site B (contour lines are in feet above mean sea level). 0.305 m = 1 ft.

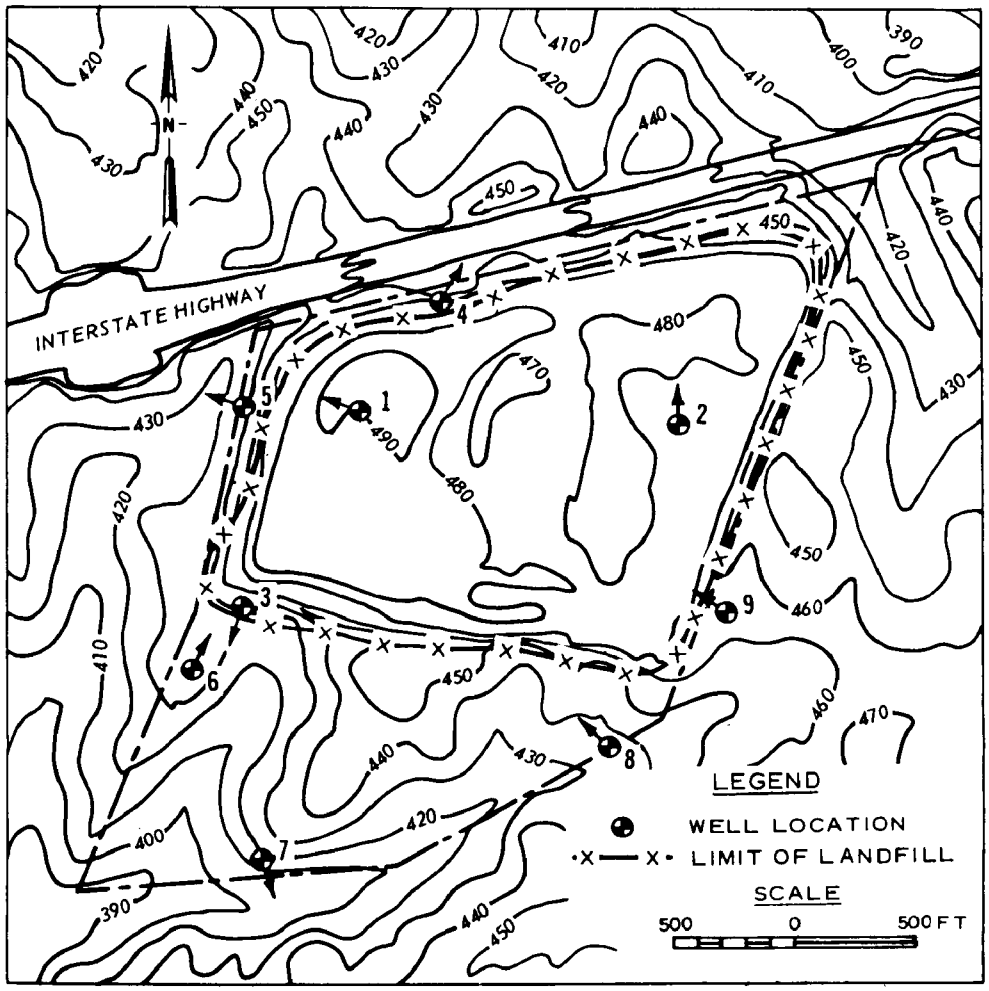


Figure 6. Topographic map of site C (contour lines are in feet above mean sea level). 0.305 m = 1 ft.

TABLE 4. METHODS OF PRESERVATION OF WATER EXTRACTS AND FILTERED GROUNDWATER SUBSAMPLES FOR CHEMICAL ANALYSIS

Chemical species to be determined	Method of preservation
SO_4, SO_3, Cl, NO_3, NO_2	Refrigeration to 4^oC
CN	Sample brought to pH 11 with NaOH
Total organic carbon	Refrigeration to 4^oC
Ca, Fe, Mg, Mn, Na, As, B, Be, Cd, Cr, Cu, Ni, Pb, Se, Zn	Samples acidified with HCl to pH 1
Hg	$KMnO_4$ added and samples acidified with HNO_3 to pH 1

For distilled water extracts, the contents of each sample bottle was mixed to assure a homogeneous sample. A 200-gram subsample of moist soil was weighed out into a 1000-ml polycarbonate centrifuge bottle and six hundred ml of distilled-deionized water was added to each. The centrifuge bottles were shaken on a rotary shaker for one hour, and then centrifuged at 2200 rpm for 30 minutes. The supernatant was filtered through a 0.45 nm membrane filter. The filtrate was split into five subsamples for chemical analysis. The subsamples were preserved as outlined in Table 4.

A second subsample consisting of 50 grams of moist soil was taken from each sample bottle for nitric acid digestion. In each digestion the soil was weighed into a 250-ml fluorocarbon beaker and 60 ml of 8N reagent grade nitric acid was added. The soil-acid suspension was heated to 95°C for 45 minutes and stirred every fifteen minutes. After cooling to room temperature, the suspension was filtered through a 0.45 nm membrane filter. The digested soil was washed in the filter three times with 20-ml portions of 8N nitric acid. The filtrate was quantitatively transferred to a 250-ml volumetric flask and brought up to volume with 8N nitric acid and then stored in a polyethylene bottle. No preservation procedure was necessary.

A third subsample was taken from each sample bottle to determine the moisture content of the soil. These moisture contents were used to correct subsequent chemical analyses so that soil acid digests could be expressed in milligrams per kilogram dry weight of soil.

PHYSICAL TESTING METHODS

The physical tests run on these samples included water content, sample dry density, permeability, and grain-size analysis. Data gathered from these tests and visual examination of the samples were used to classify the materials into standard soil engineering categories. All testing was done using standard soil engineering methods (10).

To determine water content, a sample taken from a sealed coring tube was weighed into a tared sample dish, dried at 110°C and weighed periodically until a constant weight was obtained.

Sample dry density (or dry unit weight) is the weight of oven-dried soil per unit volume of soil. This measurement can be made in two different ways: by trimming the soil sample into a precisely measured regular shape and drying and weighing the trimmed sample; or, by sealing the surface of a soil specimen with wax and measuring its volume by water displacement, then removing the sealing material and drying and weighing the specimen. The water displacement procedure was used with samples containing gravel or other coarse material that prevented the sample from being trimmed accurately.

Grain-size analysis was performed by sieving the dried, disaggregated soil through a standard sieve series. Standard hydrometer density measurements were run on a suspension prepared from the fraction passing the 200-mesh sieve.

Permeability measurements were made using a constant-head test system with coarse-grained soils, and a falling-head test system with fine sands or clays. In all cases standard procedures and equipment were employed (10).

The major characteristics (especially grain-size analyses and characteristics of the fine fraction) of the samples were used to classify the soils. The classification system is summarized in Table 5. These classification categories and symbols are used to summarize soil characteristics in the logs presented in Tables A-1--A-8, B-1--B-8, and C-1--C-9.

CHEMICAL ANALYTICAL METHODS

The techniques used in analyzing the filtered groundwater samples, distilled water extracts and nitric acid digests are summarized in Table 6. In all cases, the samples were run within the recommended time limits for the storage of samples (11).

The analyses of groundwater samples is given in milligrams per liter of filtered sample. The water extracts are also presented in milligrams per liter of filtered extractant. The water extract represents an equilibrium or near equilibrium solution with respect to the solid phases and the adsorbed phases in the soil; therefore, the analytical data are presented on a solution basis rather than a dry weight basis. The nitric acid digests are a determination of the total acid digestible fraction; therefore, the results are presented as milligrams extracted per kilogram dry weight of soil.

TABLE 5. DESCRIPTIONS OF USCS SOIL GROUPS (6)

Group symbol	Typical group description
GW	Well-graded (poorly-sorted) gravels, gravel-sand mixtures, little or no fines
GP	Poorly-graded (well-sorted) gravels, or gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well-graded (poorly-sorted) sands, gravelly sands, little or no fines
SP	Poorly graded (well-sorted) sands, gravelly sands, little or no fines
SM	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures
ML	Inorganic silts, very fine sands, clayey silts, low plasticity
CL	Inorganic clays, low to medium plasticity, lean clays
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine, sandy or silty soils, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity, organic silts
Pt	Peat and other highly organic soils

TABLE 6. TECHNIQUES USED IN THE ANALYSIS OF DISTILLED WATER EXTRACTS, NITRIC ACID DIGESTS AND GROUNDWATER FILTRATES

Chemical species	Procedures and/or instrumentation*	Lowest reporting* concentration in (ppm)
SO_4	Standard Turbidimetric Method[+] in combination with a Varian Model 635 Spectrophotometer	8
SO_3	Standard Potassium Iodide-Iodate Titration method[+]	1
Cl	Standard Mercuric Nitrate Titration method[+]	5
NO_3-N	Technicon II Auto Analyzer, Industrial Method no. 100-70W[+]	0.01
NO_2-N	Same as above	0.01
CN	Technicon II Auto-Analyzer, Industrial Method no. 315-74W[+]	0.01
TOC	Determined with Envirotech Model No. DC 50 TOC Analyzer	1
Ca	Determined with a Spectrametrics Argon Plasma Emmission Spectrophotometer Model II	0.03
Fe	Same as above	0.05
Mg	Same as above	0.03
Mn	Same as above	0.03
Na	Same as above	0.03
As	Determined with a Gaseous Hydride System, Perkin-Elmer Atomic Absorption Unit	0.001
B	Determined with a Spectrametrics Argon Plasma Emission Spectrophotometer Model II	0.02

(continued)

TABLE 6 (continued)

Chemical species	Procedures and/or instrumentation*	Lowest reporting concentration in (ppm)
Be	Same as above	0.02
Cd	Same as above	0.03
Cr	Same as above	0.03
Cu	Same as above	0.02
Hg	Determined with a Nisseisangyo Zeeman Shift Atomic Absorption Spectrophotometer	0.0002
Ni	Determined with a Spectrametrics Argon Plasma Emission Spectrophotometer Model II	0.03
Pb	Same as above	0.1
Se	Determined with a Perkin-Elmer Heated Graphite Atomizer Atomic Absorption Unit	0.002
Zn	Determined with a Spectrametrics Argon Plasma Emissions Spectrophotometer Model II	0.03

* Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

+ Standard Methods for the Examination of Water and Wastewater, American Public Health Association, New York, 13th Edition, 1971.

± Technicon Industrial Systems, Tarrytown, New York.

SECTION 5

RESULTS AND DISCUSSION

PHYSICAL TESTING

The soil parameters measured in the physical testing program are those most likely to be effected by the infiltration of leachate from overlying refuse. The literature indicates that the leachate suspension is filtered by the uppermost layer of soil below the refuse (4). Filtration of the leachate should cause the soil to show:

a) an increase in density due to the addition of fine material in intergranular spaces,

b) a decrease in permeability due to accumulation of fine-grained particles that obstruct the natural pore connections in the soil,

c) an increase in the percentage of fine silt- and clay-sized material (less than 200-mesh grain size) due to accumulated leachate residue, and

d) a change in water content due to the accumulation of water retaining organic material.

A complete tabulation of data obtained from the physical testing program is given in Tables 7, 8 and 9. A summary contrasting the physical characteristics found in the samples from directly below the landfill and at comparable elevations outside the landfill is given in Table 10. None of the sites show significant differences in dry density between soil beneath and outside the landfill. Likewise, the variation in water content shows no pattern that can be related to the position of the sample with respect to the landfill. The data available on permeability or hydraulic conductivity do show a significant difference between inside (sub-refuse) and outside samples for site B. Unfortunately, it is very difficult to obtain reliable, reproducible permeability measurements from this extremely fine-grained, loess-based soil. Laboratory experiments with reconstituted samples indicated that the permeability is very dependent on the state of compaction of the material. Slight disturbances of the samples could account for a great deal of the variation observed or the differences might have been produced by the grading and compaction when the completed fill was developed as a recreation area. There is no significant difference in the weight percentage of material finer than 200-mesh for samples under and outside the landfills at any of the three sites. If the residue from leachate is being trapped, it constitutes a very small portion of the cored sample.

TABLE 7. PHYSICAL TESTING DATA FOR SAMPLES FROM SITE A

Boring no.	Sample no.	Depth (m)	Dry density (g/cc)	Water content (%)	Permeability or hydraulic cond. (cm/sec)	Classification
1	P1	7.20 - 7.70	1.60	4.1	1.1×10^{-1}	Sand (SP), brown
1	P4	10.94 - 11.64	1.62	3.1	1.1×10^{-1}	Sand (SP) with trace gravel, brown
1	P6	22.65 - 22.84	1.59	3.9	1.4×10^{-1}	Sand (SP) with trace gravel, brown
2	P1	6.25 - 6.68	1.61	3.6	0.58×10^{-1}	Sand (SP) with trace gravel, brown
2	P2	6.92 - 7.44	1.72	3.3	--	Gravelly sand (SP), brown
2	P3	8.81 - 9.42	1.64	2.9	1.1×10^{-1}	Sand (SP) with gravel, brown
2	P4	13.87 - 14.39	1.50	6.7	0.47×10^{-1}	Sand (SP), brown
2	P5	19.51 - 19.87	1.55	3.8	0.76×10^{-1}	Sand (SP) with gravel, brown
2	P6	24.39 - 24.94	1.56	3.8	--	Sand (SP) with trace gravel, brown
3	P1	7.86 - 8.32	1.63	5.2	0.82×10^{-1}	Sand (SP) with gravel, brown
3	P3	10.82 - 11.25	1.61	2.5	1.1×10^{-1}	Sand (SP) with trace gravel, brown
3	P5	22.25 - 22.53	1.76	2.4	1.3×10^{-1}	Gravelly sand (SP), brown
4	P1	3.20 - 3.90	1.59	7.5	2.0×10^{-1}	Sand (SP), brown
4	P3	6.25 - 6.62	1.59	4.0	--	Sand (SP), brown
5	P1	4.57 - 5.29	1.65	2.8	--	Sand (SP) with gravel, brown
5	P3	7.62 - 8.20	1.67	2.9	--	Sand (SP) with gravel, brown
5	P5	18.44 - 18.83	1.74	2.7	--	Sand (SP) with gravel, brown
6	P1	4.72 - 5.33	1.57	2.8	--	Sand (SP) with gravel, brown
6	P3	7.77 - 8.42	1.71	3.2	--	Sand (SP) with gravel, brown
6	P5	19.00 - 19.48	1.69	2.9	--	Sand (SP) with gravel, brown
7	P1	4.42 - 4.76	1.62	3.3	--	Sand (SP) with trace gravel, brown
7	P3	7.77 - 8.26	1.78	3.1	--	Gravelly sand (SP), brown
7	P4	13.26 - 13.75	1.75	2.9	--	Sand (SP) with gravel, brown
8	P1	14.32 - 15.03	1.64	4.5	--	Sand (SP) with trace gravel, brown
8	P3	17.38 - 17.96	1.66	3.4	--	Sand (SP) with gravel, brown
8	P5	28.65 - 28.99	1.70	4.2	--	Sand (SP) with gravel, brown

Note: -- indicates no data available.

TABLE 9. PHYSICAL TESTING DATA FOR SAMPLES FROM SITE B

Boring no.	Sample no.	Depth (m)	Density (g/cc)	Water content (%)	Permeability or hydraulic cond. (cm/sec)	Classification
1	P1	6.25 - 6.37	--	26.7	--	Silt (ML) gray
1	P2	8.41 - 8.87	1.48	33.3	7.72×10^{-8}	Silty clay (CL) gray
2	P2	3.66 - 4.15	1.57	24.7	8.41×10^{-7}	Silt (ML) grayish brown
2	P3	5.79 - 6.52	1.56	28.8	6.22×10^{-7}	Silt (ML) grayish brown
6	P1	6.10 - 6.77	1.40	20.1	7.72×10^{-5}	Silt (ML) brownish tan
6	P3	9.15 - 9.85	1.57	30.3	3.24×10^{-6}	Silt (ML) grayish brown
7	P3	4.57 - 5.27	1.53	28.9	7.84×10^{-6}	Silt (ML) brownish gray
8	P1	6.10 - 6.68	--	32.5	--	Silt (ML) olive gray

Note: -- indicates no data available.

TABLE 9. PHYSICAL TESTING DATA FOR SAMPLES FROM SITE C

Boring no.	Sample no.	Depth (m)	Dry density (g/cc)	Water content (%)	Permeability or hydraulic cond. (cm/sec)	Classification
1	P1	25.91 - 26.36	1.53	18.5	6.6×10^{-5}	Sandy silt (ML), brown
1	P3	28.96 - 29.40	1.71	17.3	7.8×10^{-5}	Silty sand (SM), brown
2	P1	18.29 - 18.96	1.65	19.4	6.6×10^{-5}	Silty sand (SM), brown
2	P3	22.26 - 22.59	1.66	18.9	2.8×10^{-4}	Sandy silt (ML), brown
3	P1	19.97 - 20.46	1.69	21.1	1.2×10^{-6}	Clayey, sandy silt (ML), brown
3	P3	22.47 - 22.92	1.69	18.1	2.9×10^{-5}	Sandy silt (ML), brown
4	P1	1.70 - 2.03	1.52	28.9	3.0×10^{-7}	Clayey, sandy silt (ML), brown
4	P4	8.49 - 8.76	1.64	21.2	5.7×10^{-6}	Sandy silt (ML), brown
6	P2	0.91 - 1.46	1.63	16.4	5.9×10^{-5}	Clayey, sandy silt (ML), tan
6	P4	4.57 - 5.11	1.78	14.9	1.9×10^{-5}	Sandy silt (ML), brown
7	P2	0.91 - 1.58	1.52	20.3	4.3×10^{-5}	Sandy silt (ML), reddish brown
9	P4	7.32 - 7.88	1.69	19.2	1.7×10^{-5}	Silty sand (SM), brown

TABLE 10. COMPARISON OF THE PHYSICAL PROPERTIES OF THE UPPERMOST SAMPLES COLLECTED WITHIN AND OUTSIDE THE LANDFILLS

Sample	Location (inside/outside)	Dry density (gm/cc)	Water content (%)	Permeability (cm/sec)	Weight % finer than 200 mesh
A 1P1	inside	1.60	4.1	1.1×10^{-1}	<2%
A 2P1	inside	1.61	3.6	0.58×10^{-1}	<2%
A 3P1	inside	1.63	5.2	0.82×10^{-1}	<2%
A 4P1	outside	1.59	7.5	--	<2%
A 5P1	outside	1.65	2.8	--	<2%
A 8P1	outside	1.64	4.5	--	<2%
A 6P1	outside	1.57	2.8	--	<2%
A 7P1	outside	1.62	3.3	--	<2%
B 1P2	inside	1.48	33.3	7.72×10^{-8}	99%
B 2P2	inside	1.57	24.7	8.41×10^{-7}	99%
B 6P1	outside	1.40	20.1	7.72×10^{-5}	99%
B 7P3	outside	1.53	28.4	7.84×10^{-6}	96%
C 1P1	inside	1.53	18.5	6.6×10^{-5}	64%
C 2P1	inside	1.65	19.4	6.6×10^{-5}	44%
C 3P1	outside	1.69	21.1	1.2×10^{-6}	66%
C 4P1	outside	1.52	28.9	3.0×10^{-7}	82%
C 6P2	outside	1.63	16.4	5.9×10^{-5}	52%
C 7P2	outside	1.52	20.3	4.3×10^{-5}	58%

In each boring under the landfill a series of samples were taken at increasing depth. Again, no consistent pattern could be observed relating the physical characteristics to the depth (or elevation).

None of the physical tests with the possible exception of permeability measurements at site B showed any consistent differences between samples taken directly under the landfill and those taken outside the landfill. No consistent pattern could be found in samples taken at differing depths in the same borings under the landfills. Any differences which do occur apparently are confined to a narrow range immediately at the interface between the refuse and the soil. Detection of these would probably require examination of a core through this interface region in very fine detail. None of the usual engineering tests demonstrated any effects which could be attributed to attenuation.

CHEMICAL ANALYSES OF GROUNDWATER

The goal of the groundwater investigation is to determine if changes in chemical parameters observed in different borings at each site could be related to the position of the boring with regard to the landfill and the direction of groundwater movement. A survey of the literature suggests that of the chemical parameters measured those most likely to indicate contamination from leachate in the groundwater are sulfate, chloride, total organic carbon, calcium, iron, magnesium, manganese and sodium (2,3). The minor and trace elements appearing in the groundwater around a landfill vary widely depending on the concentrations present in the waste at a particular landfill.

The tabulation of groundwater analyses obtained from wells at sites A, B and C are presented in Tables 11-13. The data are divided into three groups for each site; those up the groundwater gradient from the landfill, those under the landfill and those down the groundwater gradient from the landfill. The three groups of samples at each site show different means for the parameters measured and initial statistical analysis indicated widely different variances. Because of these inhomogeneous variances, the restricted number of samples in each group, and the large number of determinations that fall below the limits of detection, a non-parametric (distribution-free) analysis of variance techniques was used to determine if differences between means of parameters measured were significant. The statistical technique employed was the Kruskal-Wallis one-way analysis of variance (12,13). This test requires only that data have an underlaying continuous distribution and that the data can be ranked. This test does not require that the data have a normal distribution or be homogeneous with regard to variance. Because of the differences in numbers of samples at different sites, two different levels of significance (95.4% and 96.8%) were used.

The analysis of variance results are given in Table 14. Strong influence of the type of geologic material at each site is evident in the differences in background levels of metals present. Site A was underlain by clean glacial outwash consisting primarily of quartz sand. The upgradient groundwater

TABLE 11. CHEMICAL COMPOSITION OF GROUNDWATER OBTAINED FROM BORINGS AT LANDFILL A

Parameters	Up groundwater gradient			Under landfill			Down groundwater gradient	
	Boring 4	Boring 5	Boring 8	Boring 1	Boring 3	Boring 2	Boring 6	Boring 7
SO_4	<8	<8	<8	25	47	23	26	35
SO_3	<1	<1	<1	<1	<1	<1	<1	<1
Cl	<5	<5	<5	5	5	5	5	5
NO_3-N	<0.01	<0.01	<0.01	0.38	0.02	<0.01	<0.01	<0.01
NO_2-N	<0.01	<0.01	<0.01	0.09	0.03	0.04	0.04	0.03
CN	<0.01	<0.01	<0.05	<0.01	0.01	<0.01	<0.01	<0.01
TOC	<1	<1	<1	21	48	50	20	27
Ca	<0.03	<0.03	<0.03	34.3	69.0	127.0	35.0	35.5
Fe	<0.05	<0.05	<0.05	3.5	10.5	18.6	22.0	22.0
Mg	<0.03	<0.03	<0.03	17.10	48.50	39.50	35.00	35.50
Mn	<0.03	<0.03	<0.03	3.2	3.0	4.9	8.3	10.3
Na	<0.03	<0.03	<0.03	19.80	72.10	63.20	41.00	7.80
As	0.005	0.003	0.006	0.002	0.003	0.007	0.006	0.003
B	<0.02	<0.02	<0.02	0.02	0.02	0.02	0.02	0.02
Be	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cd	<0.03	<0.03	<0.003	<0.03	<0.03	<0.03	<0.03	
Cr	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cu	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Ni	<0.03	<0.03	<0.03	0.04	0.07	0.13	0.12	0.21
Pb	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Se	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zn	<0.03	<0.03	<0.03	0.35	0.24	1.36	0.29	0.44

Note: All values are in mg/ℓ.

TABLE 12. CHEMICAL COMPOSITION OF GROUNDWATER OBTAINED FROM BORINGS AT LANDFILL B

Parameters	Up groundwater gradient			Under landfill			Down groundwater gradient	
	Boring 4	Boring 5	Boring 6	Boring 1	Boring 2	Boring 3	Boring 7	Boring 8
SO_4	<8	<8	<8	240	44	190	24	14
SO_3	<1	<1	<1	<1	12	10	<1	<1
Cl	<5	<5	<5	<5	12	10	<5	<5
NO_3-N	0.78	2.02	0.86	0.03	0.02	0.14	2.30	2.00
NO_2-N	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TOC	8	20	14	32	22	148	10	21
Ca	160.0	75.0	95.0	210.0	170.0	190.0	180.0	190.0
Fe	0.2	0.2	0.2	20.0	0.2	0.2	0.2	0.2
Mg	78.0	30.0	39.0	111.0	6.8	130.0	117.0	120.0
Mn	0.567	0.016	0.030	11.300	0.983	2.000	2.35	8.97
Na	32.00	22.00	20.00	75.00	35.00	33.00	37.00	33.00
As	0.008	0.004	0.002	0.210	0.008	0.007	0.010	0.004
B	0.30	0.03	0.03	0.23	0.15	0.04	0.04	0.10
Be	0.0460	0.0005	0.0006	0.0540	0.0470	0.0510	0.0350	0.041
Cd	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cr	0.05	0.05	<0.03	0.04	0.04	0.04	<0.03	<0.03
Cu	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	0.0010	<0.0002	0.0007	<0.0002	0.0002	0.0003	0.0009	<0.0002
Ni	0.536	0.225	0.270	0.630	0.539	0.573	0.450	0.540
Pb	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Se	0.005	0.002	0.002	0.004	0.007	0.006	0.007	0.007
Zn	0.05	<0.03	<0.03	0.70	0.14	0.03	<0.03	0.10

Note: All values are in mg/ℓ

TABLE 13. CHEMICAL COMPOSITION OF GROUNDWATER OBTAINED FROM BORINGS AT LANDFILL C

Parameters	Up groundwater gradient				Under landfill			Down groundwater gradient	
	Boring 6	Boring 7	Boring 8	Boring 9	Boring 1	Boring 2	Boring 3	Boring 4	Boring 5
SO_4	<8	<8	<8	<8	9	24	8	8	8
SO_3	<1	<1	<1	<1	1	<1	2	<1	1
Cl	20	5	15	5	5	415	15	365	25
NO_3-N	0.03	0.02	0.68	0.11	0.04	0.03	0.02	<0.01	0.01
NO_2-N	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CN	<0.01	<0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01
TOC	5	1	4	2	95	208	16	30	8
Ca	8.0	2.6	1.6	7.9	37.0	34.0	10.0	72.0	7.0
Fe	0.10	0.07	0.12	0.13	4.90	18.20	0.08	2.77	0.09
Mg	7.50	1.50	2.30	1.20	16.00	56.00	4.4	68.00	7.50
Mn	0.20	0.15	0.50	0.06	7.12	12.30	0.19	31.90	5.19
Na	12.00	5.90	6.00	2.90	7.50	220.00	6.70	71.00	5.90
As	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002
B	0.04	<0.02	<0.02	0.06	0.12	1.45	1.06	1.04	<0.02
Be	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cd	0.03	0.70	0.12	0.04	<0.03	<0.03	<0.03	0.05	0.09
Cr	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cu	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	0.0081	0.0039	0.0013	0.0018	0.0012	0.0014	0.0018	0.0012	0.0012
Ni	0.08	0.05	0.08	0.38	1.61	0.42	0.07	0.06	0.08
Pb	0.173	0.114	0.111	0.133	0.274	0.368	0.140	0.493	0.163
Se	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zn	0.03	0.69	0.12	0.07	2.73	0.64	0.06	0.20	0.09

Note: All values are in mg/ℓ

TABLE 14. RESULTS OF ANALYSIS OF VARIANCE FOR GROUNDWATER CHEMISTRY

Parameter	Site A*	Site B*	Site C**
SO_4	S	S	S
SO_3	N	NS	NS
Cl	S	NS	NS
NO_3-N	NS	S	S
NO_2-N	NS	N	N
CN	NS	N	S
TOC	S	NS	S
Ca	S	NS	NS
Fe	S	NS	NS
Mg	S	NS	NS
Mn	S	NS	NS
Na	S	NS	NS
As	NS	NS	NS
B	S	NS	NS
Be	NS	NS	N
Cd	N	N	NS
Cr	NS	NS	N
Cu	N	N	N
Hg	N	NS	NS
Ni	S	NS	NS
Pb	N	N	NS
Se	N	NS	N
Zn	NS	NS	NS

S = Significant difference in means.
NS = No significant difference in means.
N = No present in measurable quantities in any sample.
* = Tested at 96.8% confidence level.
** = Tested at 95.4% confidence level.

samples (Wells A-4, A-5, A-8) contain very low levels of many elements. Therefore the contrast with the sub-landfill samples is strong and the number of statistically significant differences in averages is large. Site B and site C show higher background levels in the upgradient wells reflecting the more complex chemical composition of the materials in the area (clays at site B; weathered metamorphic rocks at site C). Therefore, the contrast between the upgradient groundwater samples and the sub-landfill samples is correspondingly weaker and the number of statistically significant differences in mean values for chemical parameters is lower.

The most consistent effect of leachate contamination observed in the groundwater is the increased sulfate noted in wells under the landfill as contrasted with upgradient wells. This increase was observed at all three landfills that were investigated. Increases in nitrate, or total organic carbon were observed in the sub-landfill groundwater samples in two out of the three sites. At site A, probably because of this site's low background levels, significant contrasts could also be found in chloride, calcium, iron, magnesium, sodium, boron, and nickel. Site C showed a significant contrast in cyanide levels under and upgradient from the landfill.

The results of this investigation agree with previous investigations in indicating that increased levels of sulfate, nitrate and organic carbon levels are related to pollution from landfill leachate (3,4,14). Cyanide measurements are not usually made on groundwater in municipal landfill areas, but as indicated by site C, cyanide may be a worthwhile measurement to make on leachate-contaminated water.

CHEMICAL ANALYSES OF DISTILLED WATER EXTRACTS

The goal of distilled water extraction was to determine the availability of the potential pollutants in the soil samples to water in contact with the soil. The availability of particular materials in sub-landfill soil to a distilled water extract may vary greatly from site to site. The content of this soil extract depends upon the:

a) original constituents in the soil and their solubilities,

b) way in which the original constituents have reacted with the weak organic acids in leachate and the solubilities of new products produced,

c) extent to which the water-soluble and leachate-soluble materials have been removed from the soil through solution,

d) solubilities of materials that are precipitated, filtered, or adsorbed from the leachate passing through the soil,

e) pH and redox conditions in the soil, especially as this effects the solubility of iron and manganese, the survival of nitrates and sulfates, and the production of sulfide, and

f) amount and character of the interstitial water present in the sample.

Comparison of Distilled Water Extracts from Beneath and Outside the Landfills

The tabulation of analyses of distilled water extracts of soil samples is given in Tables 15-20. Many of the analyses are close to or below the limits of detection indicating that in general very little material is available to contacting water in soils either under or away from the landfills. A statistical comparison was made between analyses of extracts obtained from samples immediately under the landfill and those collected at comparable depths below the surface (but above the water table) outside the landfill. A randomization procedure was used to test the significance of differences between means of the two sample sets. Using five samples, an 80% significance level can be obtained in a two-tailed test. The results of the randomization test are given in Table 21.

Only sulfate levels show a significant difference between means of samples obtained inside and outside the landfill at all three sites. There is, however, no consistent relationship in the behavior of sulfate between sites. At sites A and B the sulfate levels are slightly higher in the water leach from soil under the landfill. At site C the reverse is true. At all three sites, sulfate is moving from the landfill through the sub-refuse soil as shown by the increased sulfate levels in groundwater. At site C, sulfate from the leachate may be moving through the soil without being stopped or sulfate trapped in the soil may be reduced to sulfide through the activity of anaerobic bacteria decomposing organic materials in the leachate.

Chloride levels in soil extracts were significantly different inside and outside the landfills at sites B and C. At site C the sub-landfill soil extract was high in chloride compared to the samples outside the fill. At site B the reverse was true. Groundwater analyses indicated that chloride levels increased significantly only under landfill site C. The increased chloride in the soil sample at site C is to be expected from the increased supply of chloride from leachate. Chloride ion is not readily adsorbed to solid materials and does not readily precipitate. The increased chloride observed in the water extract from soil below the landfill at site C is probably due to chloride in solution in the water associated with the wet sample. At site B the decrease in chloride in extract from soil under the landfill is consistent with the low chloride levels seen in the groundwater.

Nitrate levels were significantly different inside and outside of the landfill only at site C. Very low nitrate levels were observed inside the landfill and higher levels outside. The nitrogen present in soil under the landfill might be converted from nitrate to ammonium ion through bacterial activity associated with the leachate; reducing nitrate below levels observed in similar surrounding soils. Published analyses indicate much of the nitrogen in leachate is present as ammonium ion (1), not as nitrate, indicating nitrate reduction can occur, and that nitrogen added to the sub-landfill soil probably is in the form of ammonium ion.

Cyanide levels varied significantly only at site B. The analyses are mostly at or very near the limits of detection for this constituent and so

TABLE 15. ANALYSES OF DISTILLED WATER EXTRACTS OF SOIL SAMPLES FROM EXPERIMENTAL BORINGS AT SITE A

Boring and sample	2C4	2C5	2C6	3C1	3C2	3C3	3C4	3C5	3C6
Elevation (m)	243.00	237.11	232.08	250.53	249.53	247.60	240.27	235.72	230.73
Depth below mw/soil interface (m)	7.99	13.87	18.90	0.00	1.01	2.93	10.26	14.81	19.80
Ht. above water table (m)	11.99	6.10	1.07	19.31	18.31	16.38	9.05	4.50	-0.49
Conc. (mg/ℓ)									
SO_4	9	8	9	9	9	9	9	9	9
SO_3	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cℓ	<5	<5	<5	<5	<5	<5	<5	<5	<5
NO_3-N	0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
NO_2-N	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TOC	6	6	7	7	4	5	2	7	5
Ca	0.18	0.15	2.24	0.54	0.77	0.55	2.23	1.53	0.44
Fe	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mg	0.10	0.12	0.80	0.22	0.14	0.23	1.31	0.92	0.13
Mn	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Na	0.42	0.94	0.70	2.29	6.47	3.58	0.19	2.97	1.90
As	0.002	0.002	0.002	0.006	0.010	0.004	0.002	0.004	0.002
B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Be	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cd	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cr	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cu	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ni	<0.03	<0.03	<0.03	0.07	0.04	<0.03	<0.03	<0.03	<0.03
Pb	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Se	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zn	0.21	1.39	0.38	0.35	0.22	1.12	0.06	0.21	1.14

ND = Not determined

TABLE 15. (continued)

Boring and sample	1C1	1C2	1C3	1C4	1C5	1C6	1C7	2C1	2C2	2C3
Elevation (m)	250.57	249.77	247.58	242.08	234.81	230.83	230.83	250.98	250.14	247.99
Depth below mw/soil interface (m)	0.00	0.82	3.02	8.52	15.78	19.77	19.77	0.00	0.84	2.99
Ht. above water table (m)	18.06	17.24	15.05	9.55	2.28	-1.70	-1.70	19.97	19.13	16.98
Conc. (mg/ℓ)										
SO_4	9	10	9	10	9	42	9	9	9	9
SO_3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cl	<5	<5	<5	5	5	5	<5	<5	<5	<5
NO_3-N	0.30	0.01	<0.01	0.03	<0.01	0.13	<0.01	0.38	0.06	<0.01
NO_2-N	<0.01	<0.01	<0.01	<0.01	<0.01	0.06	<0.01	0.09	<0.01	<0.01
CN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TOC	9	11	8	8	6	8	5	10	9	10
Ca	0.31	1.40	0.35	0.70	0.59	3.03	1.22	0.41	3.58	0.95
Fe	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mg	0.48	0.97	0.33	0.67	0.18	1.69	0.29	0.30	0.68	0.20
Mn	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.07	0.06	<0.03
Na	2.94	1.40	1.10	2.62	0.93	0.53	1.78	3.20	1.82	1.94
As	0.006	0.002	0.001	0.002	0.001	0.008	0.001	0.002	0.002	0.001
B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Be	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02
Cd	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03
Cr	<0.03	<0.03	<0.03	0.03	<0.03	0.05	<0.03	0.28	<0.03	0.03
Cu	0.03	<0.02	<0.02	<0.02	<0.02	0.04	<0.02	0.17	<0.02	0.02
Hg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ni	0.09	<0.03	<0.03	0.08	<0.03	0.05	0.07	2.62	<0.03	<0.03
Pb	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Se	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zn	0.78	1.10	0.11	0.38	0.13	0.82	0.29	4.65	0.10	0.46

(continued)

TABLE 16. ANALYSES OF DISTILLED WATER EXTRACTS OF SOIL SAMPLES FROM CONTROL BORINGS AT SITE A

Boring and sample	6C1	6C2	6C3	6C4	6C5	6C6	7C1	7C2	7C3	7C4	7C5	7C6
Elevation (m)	251.09	250.20	248.08	242.05	236.86	230.84	250.49	250.15	247.99	242.23	236.37	233.32
Ht. above water table (m)	19.99	19.10	16.98	10.95	5.76	-0.26	14.97	14.63	12.47	6.71	-0.85	-2.20
Conc. (mg/ℓ)												
SO_4	9	10	8	8	8	8	8	8	8	9	10	10
SO_3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
$C\ell$	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
NO_3-N	0.02	0.01	0.01	0.16	0.06	<0.01	0.05	0.04	0.27	0.02	0.05	0.20
NO_2-N	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TOC	3	<1	3	2	2	<1	<1	<1	<1	5	5	3
Ca	0.37	0.30	1.26	0.46	0.30	0.18	0.51	0.72	0.98	0.87	1.24	2.02
Fe	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mg	0.16	0.23	0.51	0.28	0.21	0.16	0.14	0.35	0.33	0.35	0.54	0.91
Mn	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	<0.03	0.03	0.06	0.03	0.04
Na	0.27	0.21	0.30	0.32	0.39	0.49	0.73	0.39	0.70	0.61	0.37	0.33
As	0.004	0.002	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002
B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Be	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cd	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cr	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cu	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ni	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Pb	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Se	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zn	0.91	0.14	0.25	<0.03	0.68	0.27	0.35	0.09	0.22	<0.03	0.20	0.39

ND = Not determined
NOTE: All borings are positioned downdip on the groundwater gradient.

TABLE 17. ANALYSES OF DISTILLED WATER EXTRACTS OF SOIL SAMPLES FROM EXPERIMENTAL BORINGS AT SITE B

Boring and sample	1C1	1C2	2C1	2C2	2C3	3C1	3C2	3C3
Elevation (m)	55.93	54.06	56.77	55.85	53.72	56.74	55.74	53.50
Depth below soil/mw interface (m)	0.00	1.87	0.00	0.92	3.05	0.00	1.00	3.24
Ht. above water table (m)	1.57	-0.30	5.83	4.91	2.78	3.51	2.51	0.27
Conc. (mg/ℓ)								
SO_4	<8	25	<8	<8	<8	9	<8	13
SO_3	<1	<1	<1	<1	<1	<1	<1	<1
Cl^-	5	8	<5	<5	8	<5	<5	<5
NO_3-N	0.04	0.07	0.02	0.05	0.05	0.27	0.17	<0.01
NO_2-N	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CN^-	0.01	0.01	0.01	0.01	<0.01	0.02	0.01	<0.01
TOC	14	10	16	14	6	27	12	4
Ca	20.00	13.00	21.00	18.00	19.00	6.50	15.00	21.00
Fe	0.50	0.48	0.25	0.20	0.05	0.40	0.10	0.11
Mg	11.70	5.60	8.50	8.00	6.60	4.10	12.00	9.90
Mn	0.30	0.99	0.04	0.11	<0.03	<0.03	0.26	<0.03
Na	21.00	6.70	30.00	13.00	3.00	66.00	9.40	4.10
As	ND	ND	ND	ND	ND	ND	ND	ND
B	0.05	0.06	0.15	0.09	<0.02	<0.02	<0.02	<0.02
Be	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cd	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cr	0.05	0.05	0.07	0.05	<0.03	<0.03	<0.03	<0.03
Cu	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	ND	ND	ND	ND	ND	ND	ND	ND
Ni	0.10	0.08	0.13	0.11	0.05	0.06	0.05	0.07
Pb	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Se	ND	ND	ND	ND	ND	ND	ND	ND
Zn	<0.03	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

ND = Not determined.

TABLE 18. ANALYSES OF DISTILLED WATER EXTRACTS OF SOIL SAMPLES FROM CONTROL BORINGS AT SITE B

Boring and sample	5C1	5C2	5C3	6C1	6C2	6C3	7C3
Elevation (m)	55.28	54.38	52.44	54.26	53.35	51.22	42.00
Ht. above water table (m)	1.93	1.03	-0.91	4.11	3.20	1.07	0.10
Position in groundwater gradient	updip	updip	updip	updip	updip	updip	downdip
Conc. (mg/ℓ)							
SO_4	<8	<8	<8	<8	<8	<8	<8
SO_3	<1	<1	<1	<1	<1	<1	<1
Cl	8	5	12	8	13	31	<5
NO_3-N	1.56	0.25	0.09	0.24	2.11	0.05	0.08
NO_2-N	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CN	0.01	0.01	<0.01	<0.01	0.01	0.01	0.01
TOC	3	10	6	4	6	20	10
Ca	36.00	33.00	27.00	27.00	34.00	40.00	35.00
Fe	0.14	0.10	0.10	0.10	0.20	0.10	0.14
Mg	10.50	11.50	9.20	10.20	12.00	14.00	17.00
Mn	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	0.14
Na	3.30	3.50	3.60	4.30	4.30	4.30	23.00
As	ND	ND	ND	ND	ND	ND	ND
B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.06
Be	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cd	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cr	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03
Cu	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	ND	ND	ND	ND	ND	ND	ND
Ni	0.12	0.11	0.10	0.10	0.12	0.14	0.15
Pb	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	1.00
Se	ND	ND	ND	ND	ND	ND	ND
Zn	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.06

ND = Not determined.

TABLE 19. ANALYSES OF DISTILLED WATER EXTRACTS OF SOIL SAMPLES FROM EXPERIMENTAL BORINGS AT SITE C

Boring and sample	1C1	1C2	1C3	2C1	2C2	2C3	3C1	3C2	3C3
Elevation (m)	131.41	130.48	128.34	127.46	126.55	124.41	125.50	124.57	123.20
Depth below mw/soil interface (m)	0.00	0.93	3.07	0.00	0.91	3.05	0.00	0.93	2.30
Ht. above water table (m)	4.40	3.47	1.33	0.20	-0.71	-2.85	2.48	1.55	0.18
Conc. (mg/ℓ)									
SO_4	9	<8	<8	8	<8	<8	<8	<8	<8
SO_3	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cl	5	5	5	10	5	10	10	5	10
NO_3-N	0.03	0.03	0.02	0.01	0.06	0.02	0.02	0.03	0.02
NO_2-N	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TOC	21	18	4	8	1	8	8	4	2
Ca	0.60	2.10	3.00	1.60	1.30	1.20	0.70	0.80	0.80
Fe	0.09	0.15	0.09	0.07	0.06	0.07	0.05	<0.05	<0.05
Mg	1.60	1.30	1.90	1.30	1.00	0.90	1.80	0.45	0.70
Mn	0.60	0.27	0.05	0.05	0.06	0.61	0.60	0.74	<0.03
Na	2.20	2.00	2.40	3.90	2.80	9.20	4.90	5.50	2.10
As	ND	ND	ND	ND	ND	ND	ND	ND	ND
B	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	0.02	0.02	<0.02
Be	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cd	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cr	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cu	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ni	0.06	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Pb	ND	ND	ND	ND	ND	ND	ND	ND	ND
Se	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zn	0.06	0.20	0.27	0.05	0.09	0.06	0.04	0.03	0.05

ND = Not determined.

TABLE 20. ANALYSES OF DISTILLED WATER EXTRACTS OF SOIL SAMPLES FROM CONTROL BORINGS AT SITE C

Boring and sample	6C1	6C2	6C3	6C4	6C5	7C4	8C3	9C1	9C2	9C3	9C4	9C5	4C6	5C4
Elevation (m)	132.46	131.54	129.41	127.88	126.06	121.80	130.14	143.47	142.57	140.44	136.17	131.91	124.74	126.92
Ht. above water table (m)	5.42	4.50	2.37	0.84	-0.98	0.09	-0.36	11.47	10.57	8.44	4.17	-0.09	-0.66	-0.12
Position in groundwater gradient	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Downdip	Downdip
Conc. (mg/ℓ)														
SO_4	12	<8	11	<8	<8	<8	<8	20	10	16	16	<8	<8	<8
SO_3	<1	<1	<1	<1	<1	<1	<1	2	<1	2	<1	<1	<1	<1
Cl	5	5	10	5	20	20	30	5	15	5	5	15	75	30
NO_3-N	1.34	1.69	1.75	3.06	1.54	0.87	1.91	1.91	1.82	1.57	0.07	1.98	<0.01	1.27
NO_2-N	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TOC	14	13	14	6	2	1	5	6	6	1	6	6	4	6
Ca	6.90	1.10	1.40	2.10	2.60	2.20	2.70	10.00	23.00	7.40	2.30	2.70	14.00	3.80
Fe	0.89	0.34	5.26	0.10	0.10	0.05	0.08	7.95	0.08	0.06	0.05	<0.05	0.12	0.09
Mg	1.50	1.20	1.50	1.00	1.00	1.80	3.90	2.20	2.50	2.90	0.50	1.00	8.00	1.80
Mn	1.76	<0.03	<0.03	<0.03	<0.03	<0.03	0.14	0.03	<0.03	0.05	<0.03	<0.03	3.31	0.26
Na	2.60	4.60	8.10	6.60	3.20	3.60	2.30	2.80	2.20	2.10	1.90	2.10	6.70	2.10
As	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
B	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.10	0.04	0.04	0.04	<0.02	0.02	0.02
Be	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cd	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cr	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Cu	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ni	0.04	<0.03	<0.03	<0.03	0.03	<0.03	0.05	0.05	0.10	0.05	<0.03	<0.03	0.10	0.03
Pb	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	1.40	0.10	0.20	0.10	<0.10	1.59	<0.10	<0.10
Se	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zn	0.13	0.07	0.07	0.08	0.27	0.11	0.18	0.07	0.34	0.23	0.15	0.08	0.13	0.15

ND = Not determined.

TABLE 21. RESULTS OF RANDOMIZATION TEST ON DISTILLED WATER EXTRACTS OF SOIL SAMPLES DIRECTLY UNDER THE LANDFILLS AND AT COMPARABLE DEPTHS OUTSIDE THE LANDFILLS

Parameters	Site A	Site B	Site C
SO_4	S	S	S
SO_3	N	N	N
Cl	N	S	S
NO_3-N	NS	NS	S
NO_2-N	N	N	N
CN	N	S	N
TOC	S	S	NS
Ca	NS	S	S
Fe	ND	S	S
Mg	S	NS	NS
Mn	N	S	NS
Na	S	S	NS
As	NS	ND	ND
B	N	S	NS
Be	N	N	N
Cd	N	N	N
Cr	S	S	N
Cu	S	N	N
Hg	ND	ND	ND
Ni	S	NS	NS
Pb	N	N	ND
Se	N	ND	ND
Zn	NS	N	S

N = Too few samples above detection limit.

ND = Not determined.

NS = Not significant at 80% level.

S = Significant at 80% level.

cannot be regarded as firm evidence of increased cyanide levels under the landfill at site B.

Total organic carbon (TOC) analyses show a pronounced difference between sub-landfill and control samples at both sites A and B. Samples below the landfills were consistently higher in TOC than those outside the landfill. All of the analyses under the landfills were well above the detection limits and at least double the analyses of control samples from outside the landfill. The groundwater analyses also indicated higher TOC levels in some borings beneath each landfill. These increased organic carbon levels can be attributed to material derived from the refuse.

Calcium levels in extracts from soils below the landfills at sites B and C are significantly lower than those extracts obtained from similar samples outside the landfills. However, calcium levels in the groundwater showed an increase under each landfill. These analyses indicate that the calcium availability is significantly decreased at sites B and C due to removal of soluble calcium compounds by landfill leachate or the production of insoluble calcium compounds by reaction with leachate.

Total iron levels were significantly different in soil extracts obtained below and outside the landfills at sites B and C. At site B the soil under the landfill showed more water-extractable iron than the soil samples outside the landfill. Site C showed the reverse trend. The availability of iron to contacting water is related to the redox conditions present, the complexing properties of organic materials in the soil, and the presence of anions such as sulfide, etc. that can produce insoluble iron compounds. The lack of extractable iron under the landfill at site C is consistent with the evidence of sulfate reduction discussed above.

Magnesium in water extracts showed a significant difference only at site A. Magnesium availability was only slightly higher in soil under the landfill than in soil outside the landfill.

Manganese levels were very slightly higher in soil extracts obtained under the landfill at site B as compared to samples outside the landfill. However, the observed levels are close to the analytical limits of detection.

Sodium in the water extracts showed a significant difference between control and experimental samples at sites A and B. At both sites, the available sodium increased under the landfill as compared to samples outside the landfill area. Sodium is a common constitutent in municipal landfill leachate; it does not really precipitate and is only weakly adsorbed.

Boron and the trace metals chromium, copper and nickel show higher levels in water extracts from soils under the landfills as compared to soils outside the landfill. These elements may be either freed from the soil by organic acids from the leachate or introduced in a soluble form in the leachate.

Zinc levels obtained from water extracts of soil samples at site C showed significant differences between samples collected under the landfill and those collected outside the landfill. The extracts from outside the landfill were

slightly higher suggesting zinc was less available in the area affected by landfill leachate. Zinc is the only trace metal that could be shown to be extracted in greater concentrations outside the landfill than below the landfill. The immobilization of zinc may be related to sulfide production at site C.

The major factors that control availability of contaminants to a distilled water extract in sub-landfill soils studied are the supply of materials moving from the refuse to the soil, and the decrease in soluble constituents that occurs in the soil either due to leaching or production of insoluble compounds by reaction with leachate. Sulfate, if it is not reduced to sulfide, is more available under the landfill due to influx from the refuse. Chloride, total organic carbon, sodium and magnesium and all of the trace metals with the exception of zinc can appear in greater quantities in water extracts probably due to greater supply of these materials in a soluble form in the incoming leachate. Calcium in two cases showed a decrease of availability in sub-refuse soil possibly due to prior removal by solution or the formation of insoluble calcium compounds (possibly calcium salts of fatty acids). Iron and zinc at one site (site C) showed decreased availability in water extracts that can probably be attributed to formation of sulfides of these metals.

Vertical Variation of Constituents in the Distilled Water Extracts of Soil Samples

For those elements at each site that did show a significant difference in means between control (outside landfill) samples and experimental (inside landfill) samples, a test was made for a significant relationship between the available concentration of a particular constituent and sample elevation (or sample depth). The model suggests that those materials derived from the refuse would show a positive correlation with elevation in the experimental borings (below the landfill). Soil constituents that are being dissolved by the landfill leachate and moved down out of the soil and into the groundwater should, in the model situation, show a significant negative correlation with sample elevation. Outside the landfill the distribution of available soil constituents depends on weathering processes and the concentration and solubility of the particular material and could therefore have a significant positive or negative correlation with elevation, or no significant correlation at all.

The Spearman rank correlation was used to judge the strength of association because this technique could be used with small sample numbers where the statistical distribution is not known. In several cases, the small number of samples having detectable quantities of a particular constituent made it impossible to judge the significance of the correlation coefficients obtained. The results of the statistical tests are given in Tables 22-24. Plots of concentration versus sample elevation for all constituents that showed statistically significant relations with elevation in experimental borings are presented in Figures 7-18. Plots of significant relationships in control holes are included for contrast. The only significant correlation with sample elevation in borings through the landfill at site A (Borings 1, 2, and 3) involves total organic carbon. The correlation is positive as would be expected for a constituent derived from the refuse in the landfill. No significant correlation between sample elevation and total organic carbon could be observed in the control holes.

TABLE 22. CORRELATION OF CHEMICAL ANALYSES OF DISTILLED WATER EXTRACTS OF SOIL SAMPLES WITH SAMPLE ELEVATION AT SITE A

Boring No.	Experimental			Control	
	1	2	3	6	7
SO_4	NS	NS	NS	SP	SN
TOC	SP	NS	NS	NS	NS
Mg	NS	NS	NS	NS	SN
Na	NS	NS	NS	SN	SP
Cr	*	*	*	*	*
Cu	*	*	*	*	*
Ni	NS	*	NS	*	*

SP = Significant positive correlation at 95% level.

SN = Significant negative correlation at 95% level.

NS = Not significant.

* = Too few samples above detection limit.

TABLE 23. CORRELATION OF CHEMICAL ANALYSES OF DISTILLED WATER EXTRACTS OF SOIL SAMPLES WITH SAMPLE ELEVATION AT SITE B

Boring No.	Experimental			Control	
	1	2	3	5	6
SO_4	--**	*	NS	*	*
Cl	--	*	*	NS	SN
CN	--	*	SP	*	*
TOC	--	SP	SP	NS	SN
Ca	--	NS	SN	SP	SN
Fe	--	SP	NS	NS	NS
Mn	--	NS	*	*	*
Na	--	SP	SP	SN	NS
B	--	SP	*	*	*
Cr	--	SP	*	*	*
Zn	--	SP	*	*	*

SP = Significant positive correlation at 95% level.

SN = Significant negative correlation at 95% level.

NS = Not significant correlation.

* = Too few samples above detection limits.

** = Too few samples for significant test for this boring.

TABLE 24. CORRELATION OF CHEMICAL ANALYSES OF DISTILLED WATER EXTRACTS OF SOIL SAMPLES WITH SAMPLE ELEVATION AT SITE C.

Boring No.	Experimental			Control	
	1	2	3	6	9
SO_4	*	*	*	SP	NS
Cl	NS	NS	NS	NS	NS
NO_3	NS	NS	NS	NS	NS
Ca	SN	SP	NS	NS	NS
Fe	NS	NS	*	NS	SP
Zn	SN	NS	NS	NS	NS

SP = Significant positive correlation at 95% level.

SN = Significant negative correlation at 95% level.

NS = Not significant.

* = Too few samples above detection limit.

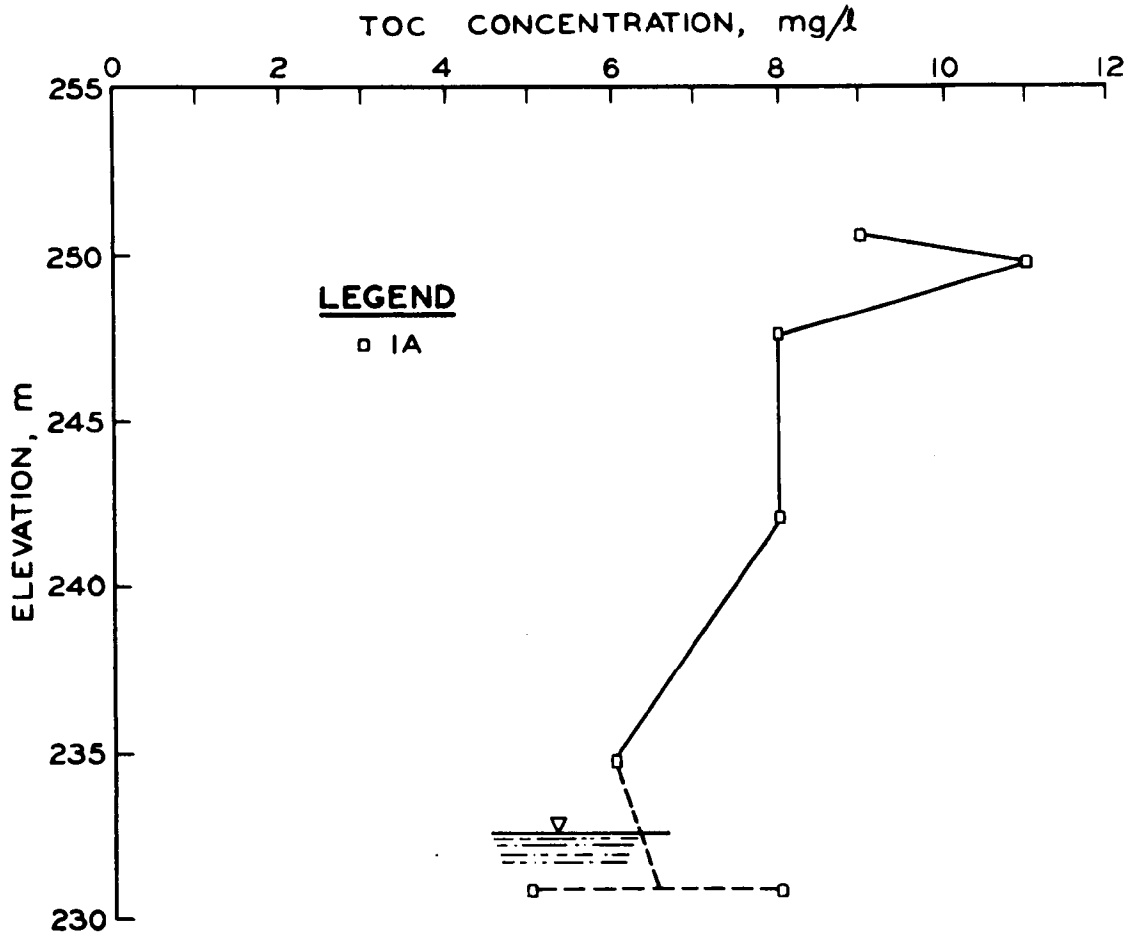


Figure 7. Variation of total organic carbon (TOC) concentration in distilled water extracts of soil/sediment samples with elevation in boring 1 at site A. Inverted triangle symbol indicates water table.

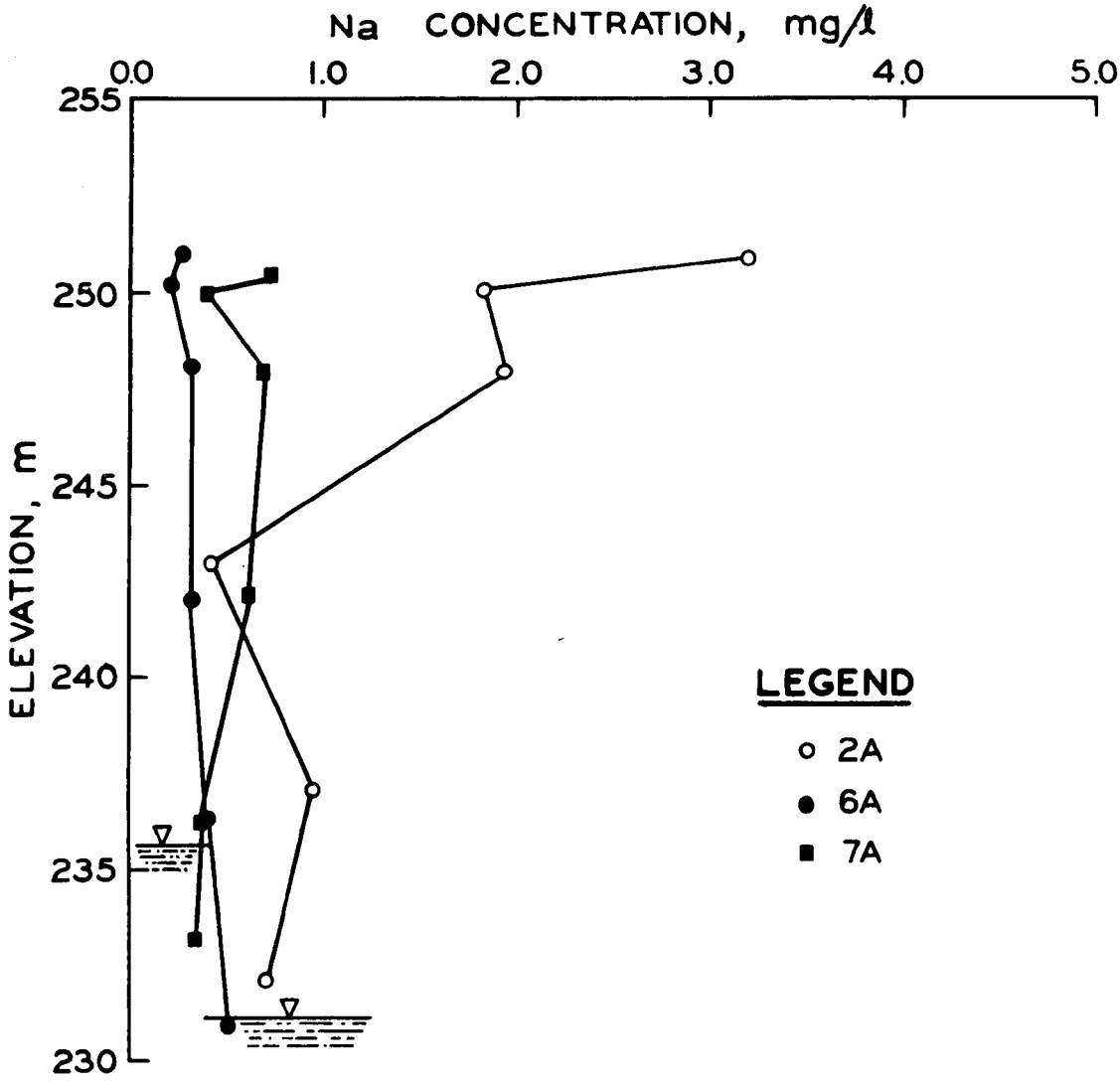


Figure 8. Variation of sodium concentration in distilled water extracts of soil/sediment samples with elevation in borings 2, 6, and 7 at site A. Inverted triangle symbols indicates water table in each boring.

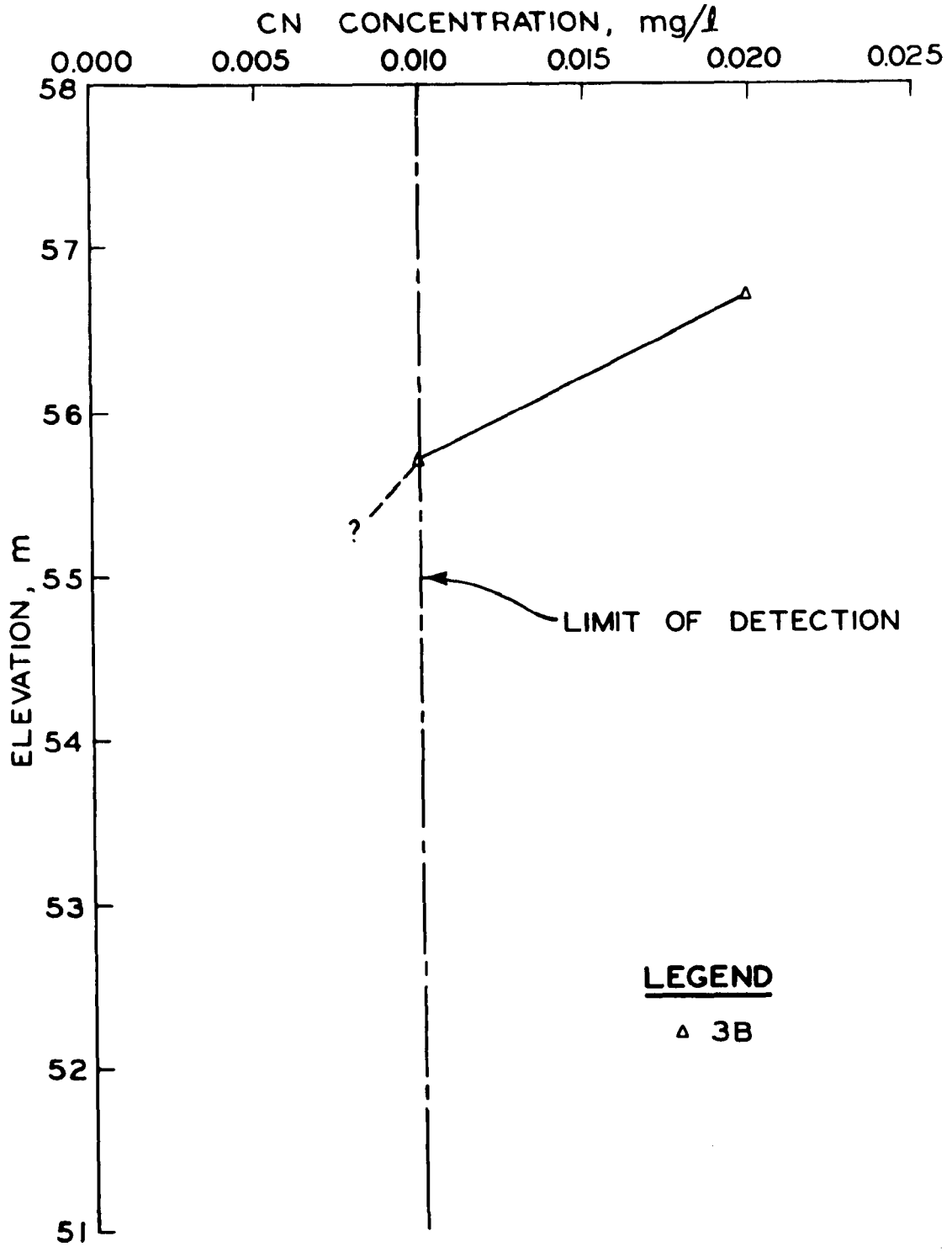


Figure 9. Variation of cyanide concentration in distilled water extracts of soil/sediment samples with elevation in boring 3 at site B.

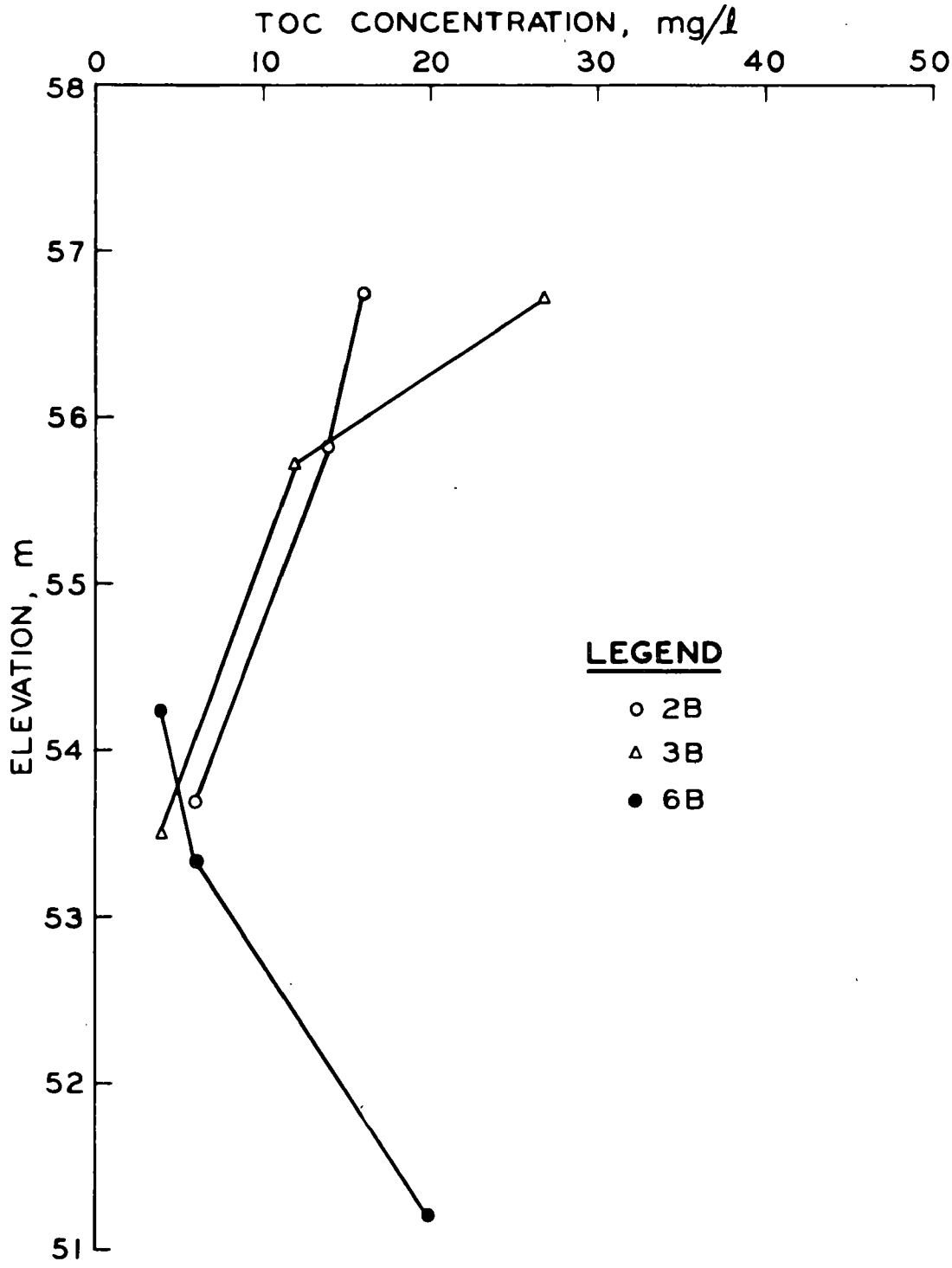


Figure 10. Variation in total organic carbon (TOC) concentration in distilled water extracts of soil/sediment samples with elevation in borings 2, 3, and 6 at site B.

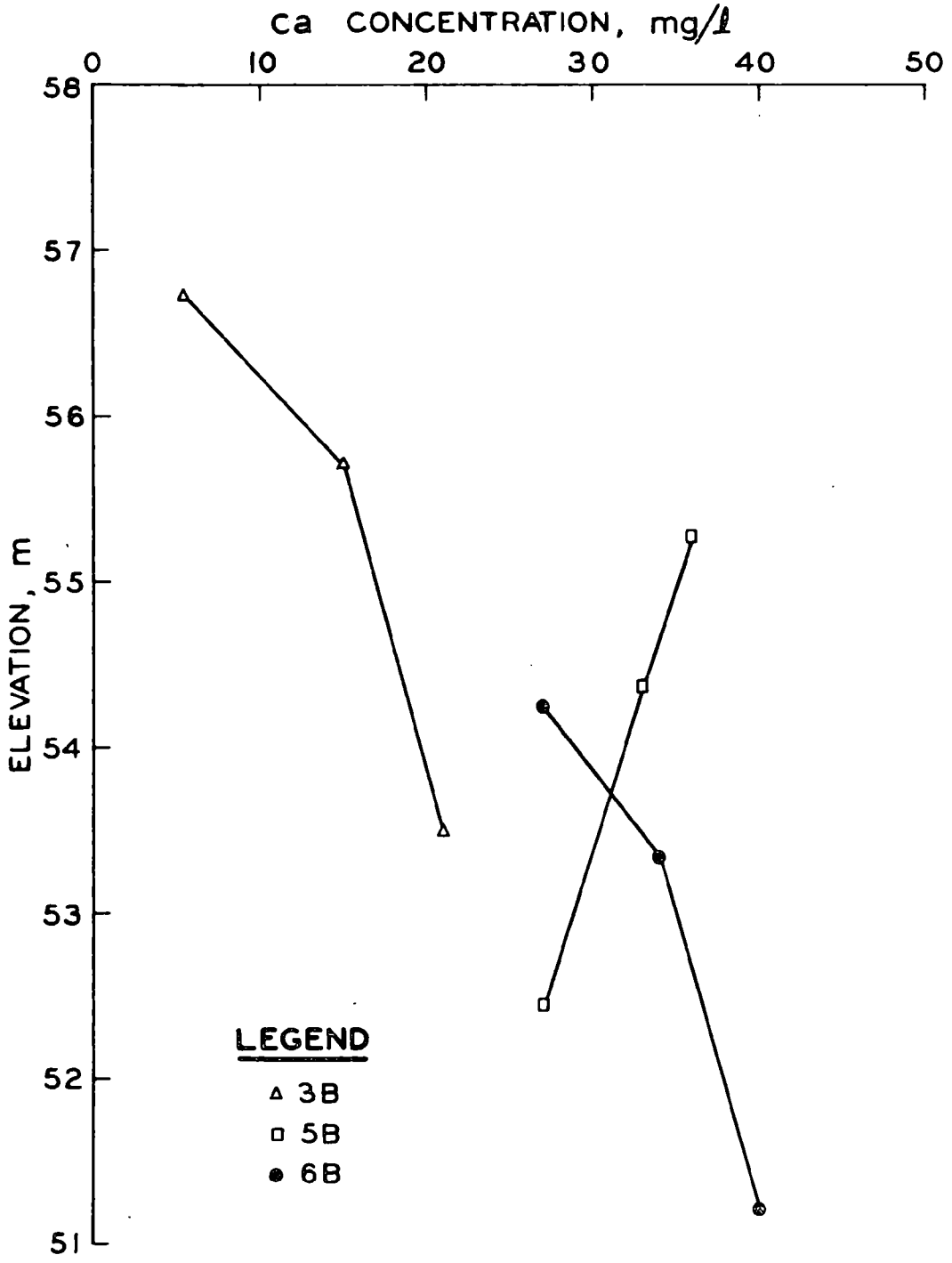


Figure 11. Variation of calcium concentration in distilled water extracts of soil/sediment samples with elevation in borings 3, 5, and 6 at site B.

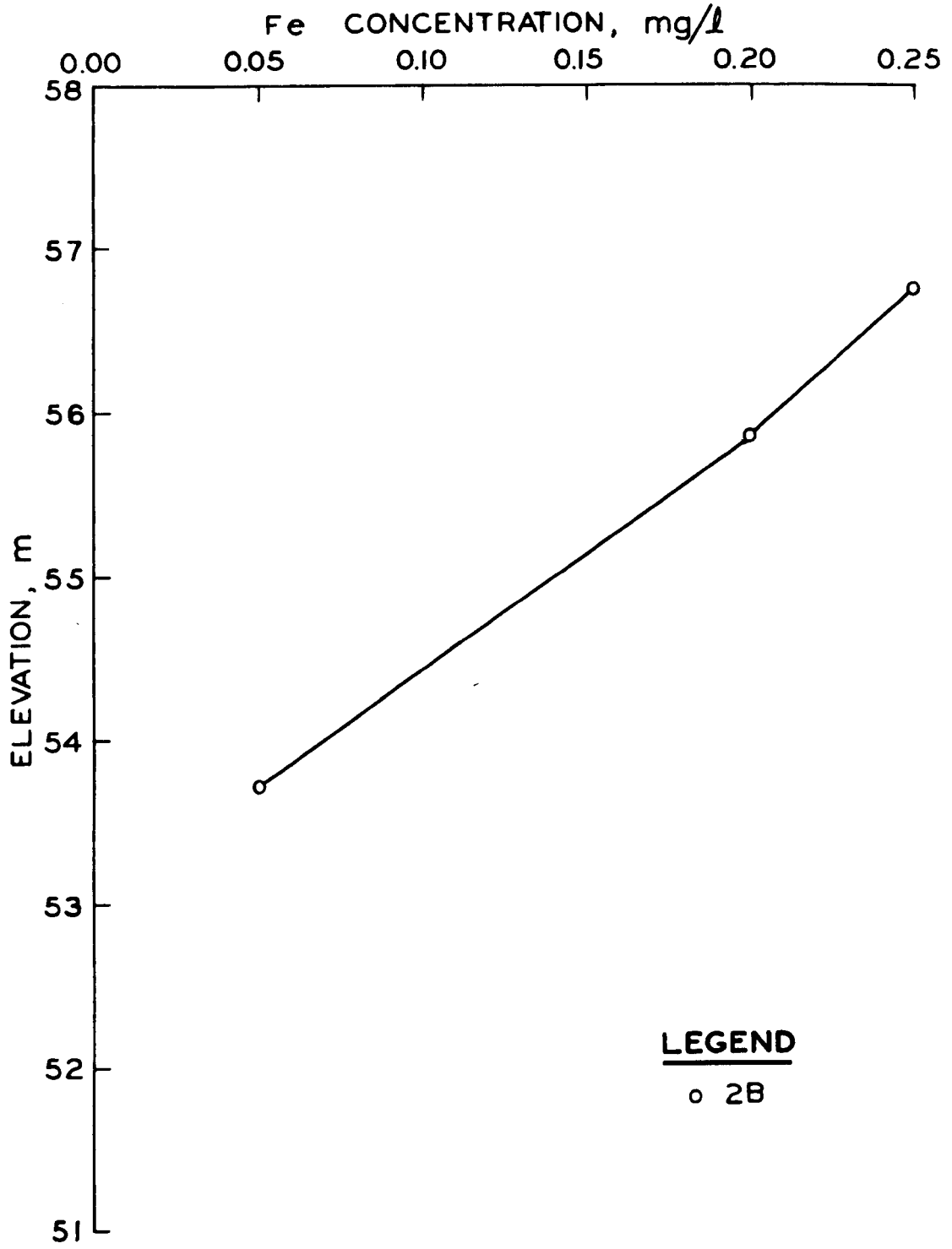


Figure 12. Variation of iron concentration in distilled water extracts of soil/sediment samples with elevation in boring 2 at site B.

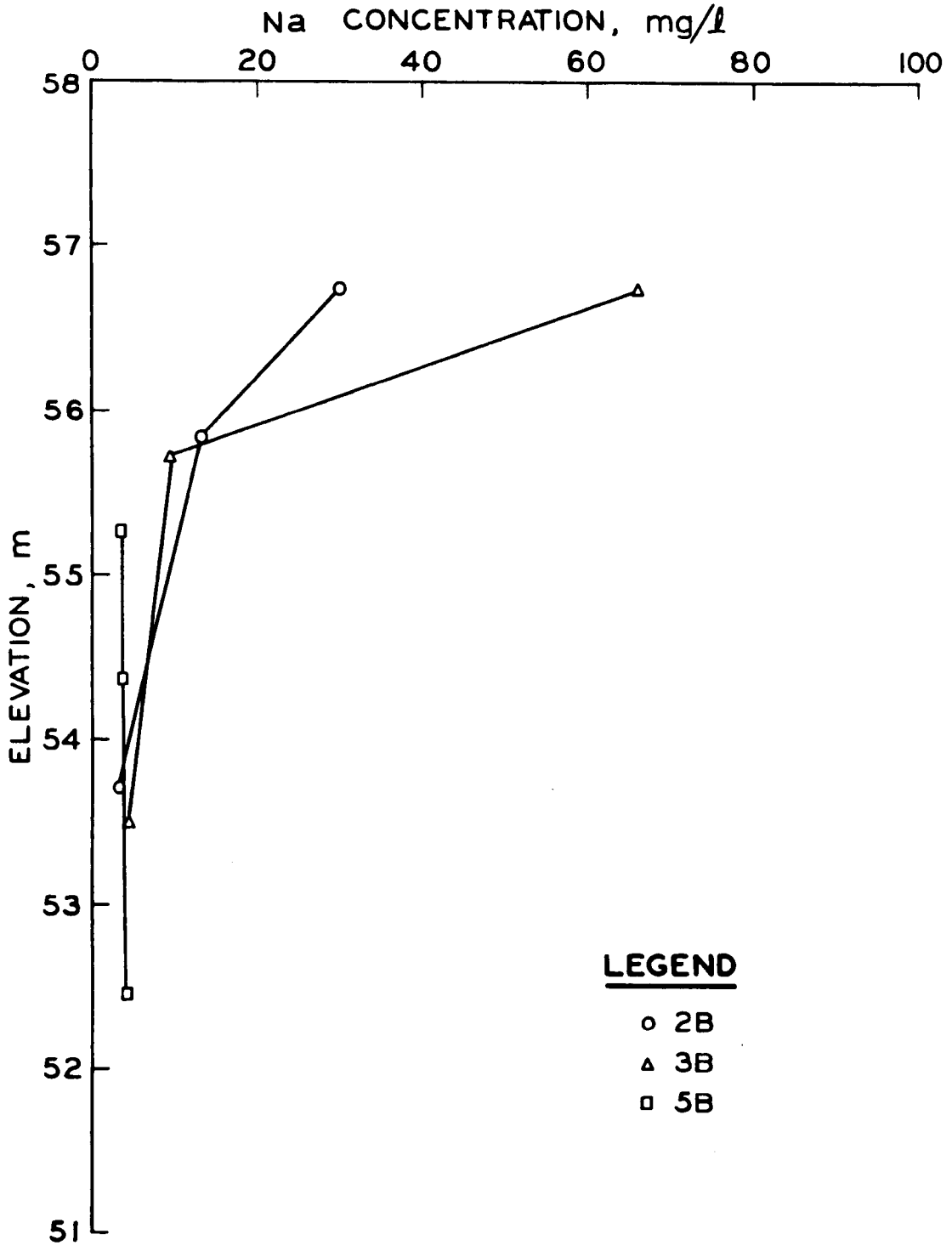


Figure 13. Variation of sodium concentration in distilled water extracts of soil/sediment samples with elevation in borings 2, 3, and 5 at site B.

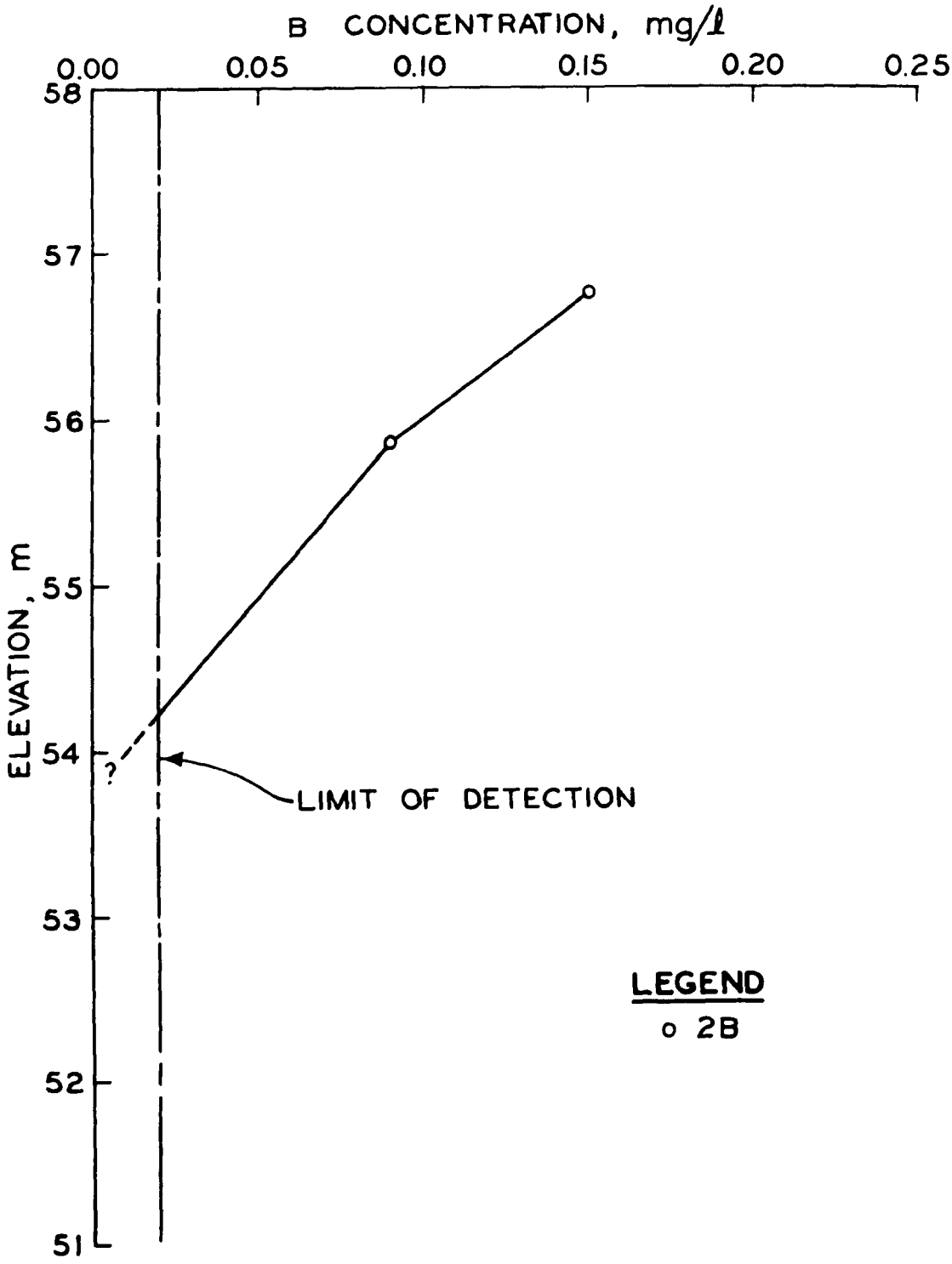


Figure 14. Variation of boron concentration in distilled water extracts of soil/sediment samples with elevation in boring 2 at site B.

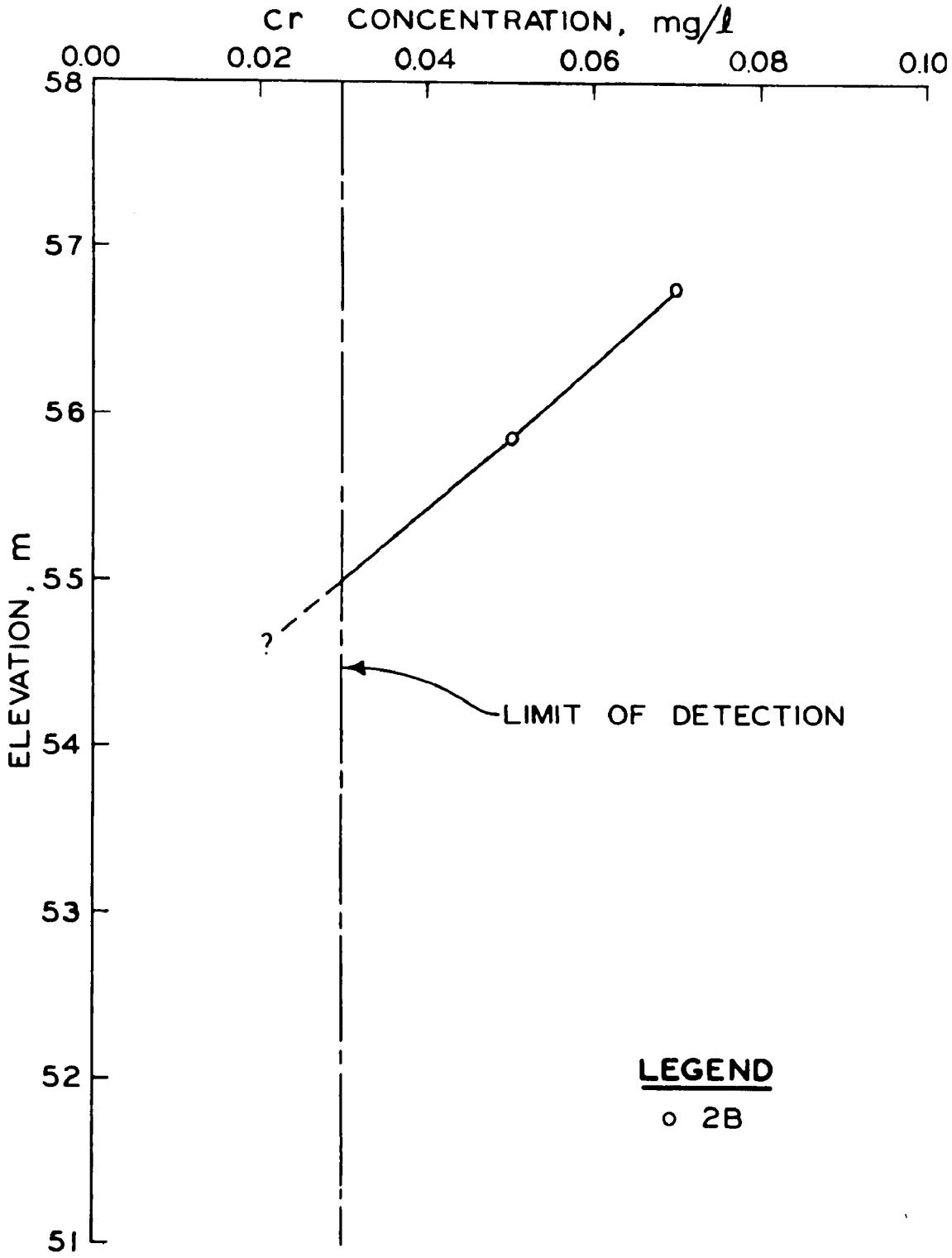


Figure 15. Variation of chromium concentration in distilled water extracts of soil/sediment samples with elevation in boring 2 at site B.

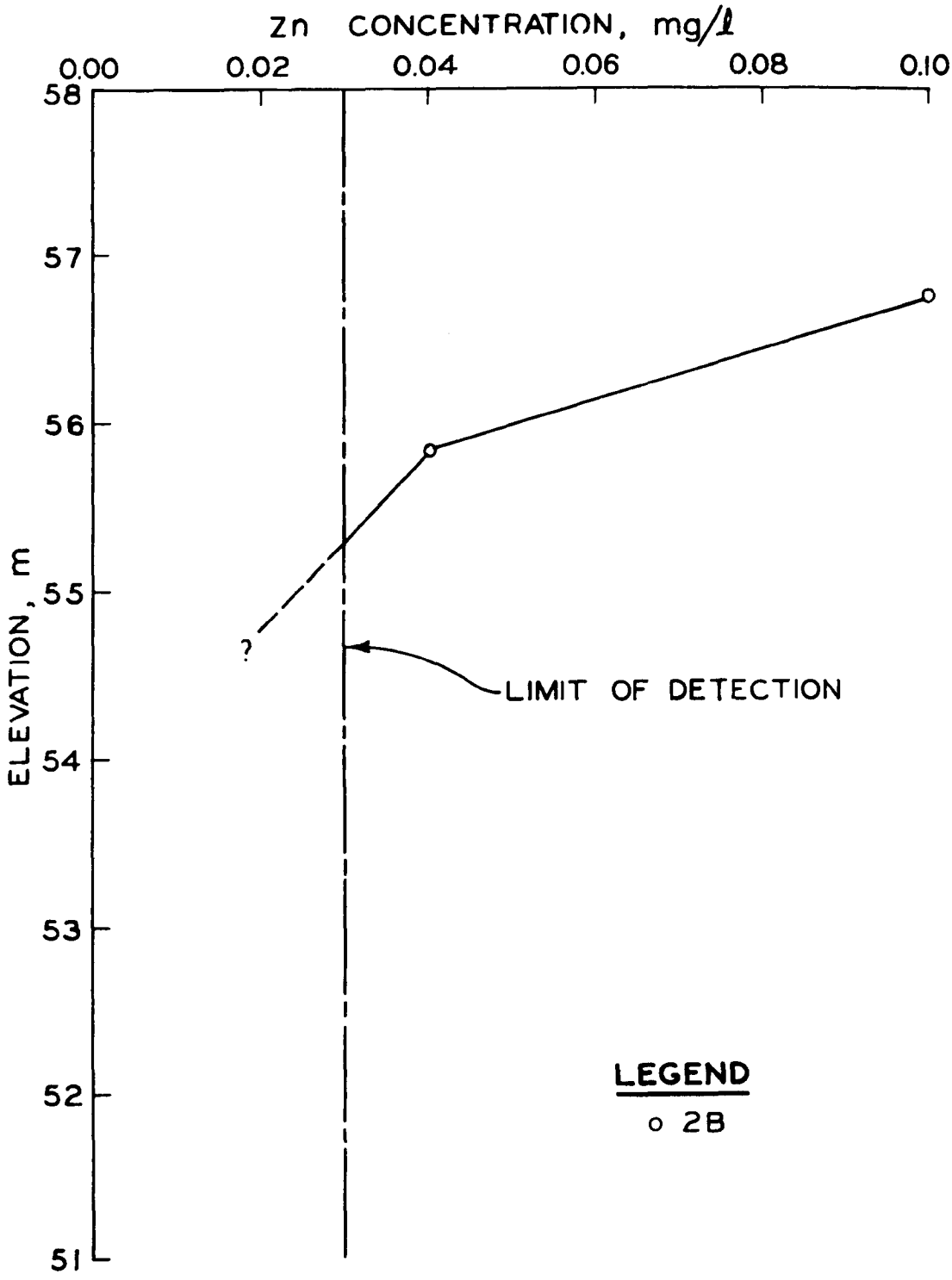


Figure 16. Variation of zinc concentration in distilled water extracts of soil/sediment samples with elevation in boring 2 at site B.

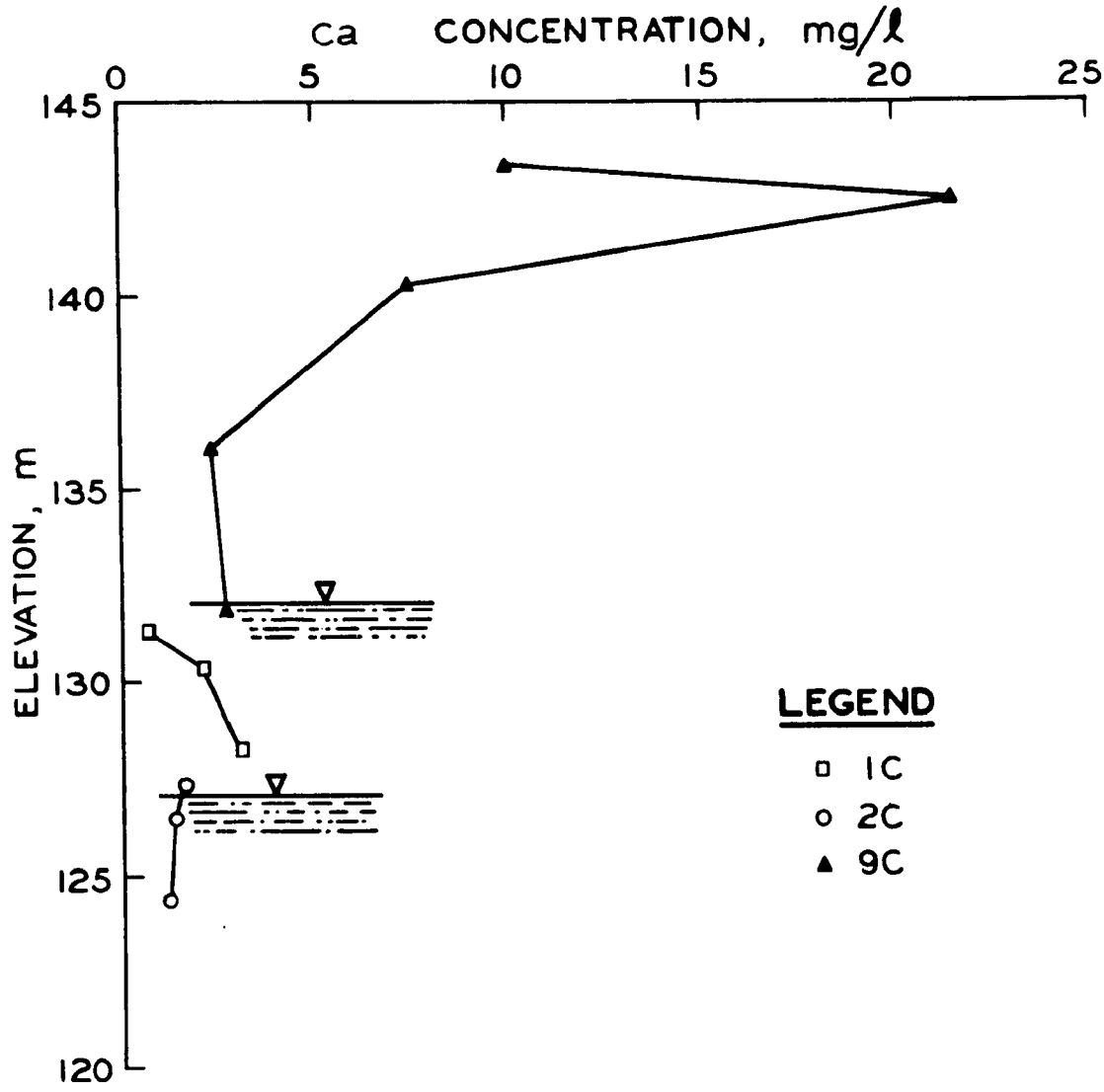


Figure 17. Variation of calcium concentration in distilled water extracts of soil/sediment samples with elevation in borings 1, 2, and 9 at site C. Inverted triangle symbols indicate water table in each boring.

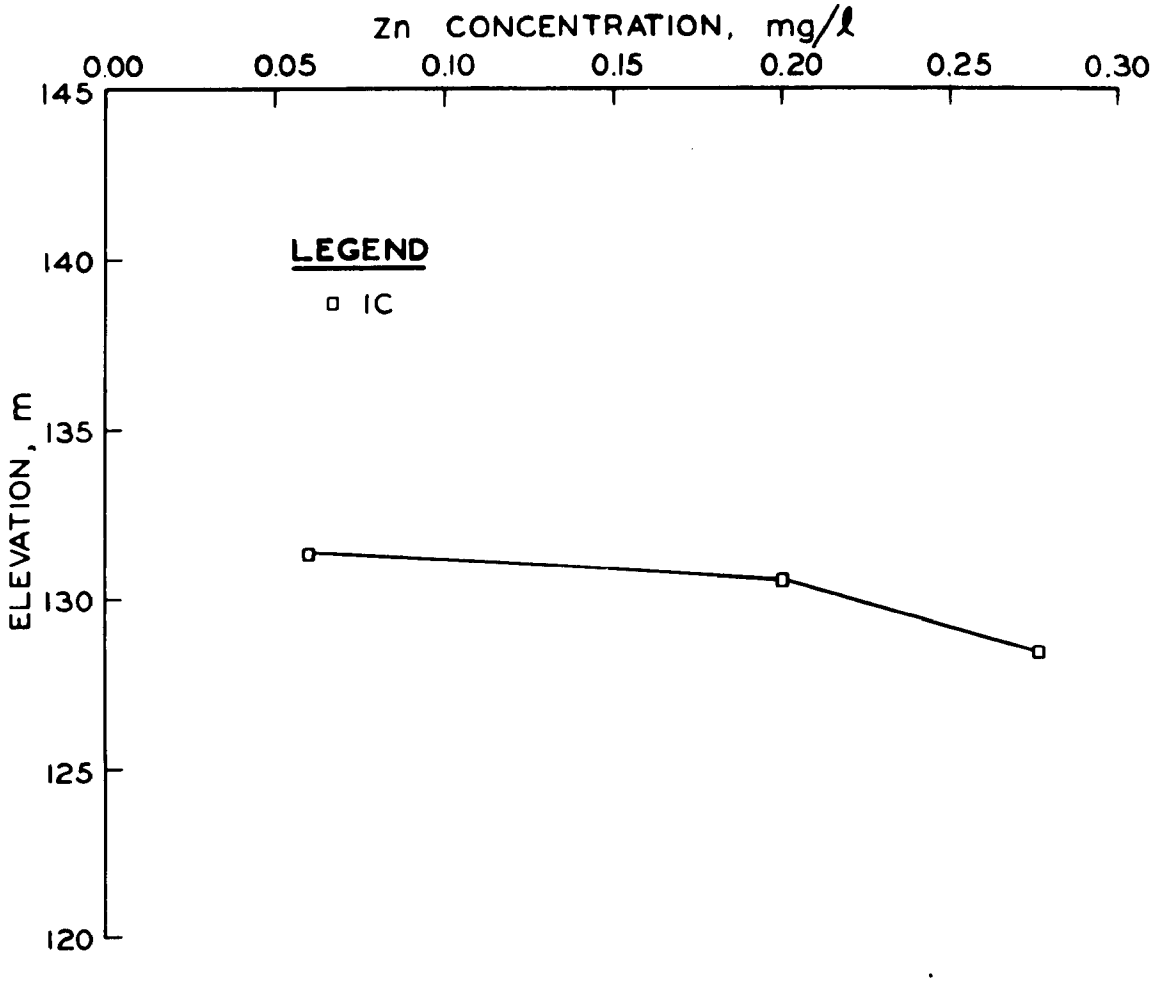


Figure 18. Variation of zinc concentration in distilled water extracts of soil/sediment samples with elevation in boring 1 at site C.

At site B, significant positive correlations with sample elevation were observed with cyanide, total organic carbon, iron, sodium, boron, chromium, and zinc. A positive correlation is expected for constituents derived from the landfill. The control holes showed significant correlations with depth only for total organic carbon and sodium. Both of these correlations were negative indicating these constituents were being leached away in a normal weathering situation.

Calcium at site B showed a significant negative correlation with sample elevation in borings under the landfill. Calcium is probably being leached away or is forming less soluble compounds under the landfill. In control holes both significant positive and negative correlations with depth are found.

At site C, zinc showed a significant negative correlation with elevation under the landfill indicating that it is becoming more available with increasing depth. Control holes indicated no significant relationship in zinc content between water extracts and elevation. Calcium showed a positive correlation with elevation in one of the holes through the landfill and a nagative correlation in a second hole indicating there may be both an increase and decrease in clacium availability under the landfill. This may be due to the variation in the age or character of refuse placed in different parts of the landfill. No significant relationship between sample depth and calcium concentration in water extracts could be seen in the control holes.

Patterns observed in the composition of distilled water extracts for samples taken from these landfill areas indicate that the availability of total organic carbon, iron, sodium, boron, and chromium to contacting waters increases under a landfill. The availability of calcium generally decreases under the landfill at site C.

Griffin and others (15) demonstrated that municipal leachate can remove calcium from clays. Calcium was the major exchangeable cation present in the clays used in their experimental leachate attenuation system and was displaced by other cations from the leachate such as sodium, or ammonium ion. The calcium level was higher in the effluent coming out of the clays than in the original leachate. Municipal leachate is mildly acid and contains carbon dioxide in solution. Calcium in the soil in the form of carbonate could be taken directly into solution by the leachate and removed from the soil below the refuse.

Horizontal Variation in Distilled Water Extracts of Sediment/Soil Samples Near the Water Table

According to the model for leachate movement under a landfill (Figure 1) horizontal movement of contaminants takes place below the water table. The model suggests that upgradient samples should have low levels of contamination. The highest levels of contamination should occur below the landfill, and a gradual decrease should occur down the groundwater gradient from the landfill. The decrease in contaminant concentration is related to the dilution effects of the groundwater and the filtration and adsorption in the soil/sediment. The distilled water extracts measure availability of the chemical constituents

to contacting water. The concentration of any constituent in the distilled water extract depends not only on the amount of contaminant present; but also on the solubility of the contaminant under the pH and redox conditions present in the soil/sediment sample. Chemical analyses of distilled water extracts of soil samples collected near the existing water table were examined to determine if any pattern of contaminant distribution in the extracts could be related to the direction of movement of groundwater.

The number of samples available at each site was too small to allow the use of analysis of variance. Graphs showing concentration of various constituents versus relative position of the boring with respect to the landfill are given in Figures 19-21.

At site A, maximum levels for sulfate, nitrite, total organic carbon (TOC), calcium, magnesium, sodium, arsenic, cadmium, nickel and zinc occurred in distilled water extracts taken from samples under the landfill. The amounts available decreased down the groundwater flow gradients. This is the pattern expected for materials added from the refuse. Manganese levels were below detection limits under the landfill at site A and increased downgradient from the landfill. The unusually low levels of manganese below the landfill may be related to its chemical reduction to the soluble manganous ion and its loss into water percolating through the soil.

At site B, maximum levels for sulfate, cyanide, TOC, iron, manganese, boron and chromium were observed in distilled water leaches from samples taken under the landfill. Chloride showed a maximum level in a boring located upgradient from the fill. Chloride may be depleted under the fill due to slightly increased infiltration through the refuse. Calcium, magnesium, sodium, nickel, lead, and zinc showed maximum levels in the distilled water leaches in downgradient wells. The maxima observed in downgradient wells may represent materials transported in the groundwater and deposited in surrounding soil.

At site C, the maximum levels for nitrate, TOC, calcium, iron, magnesium, manganese, sodium, and boron were all found in extracts from borings down the groundwater gradient from the landfill. No maxima were found under the landfill. Lead and zinc were both more concentrated in distilled water leaches from sediment/soil samples obtained from upgradient borings. The high levels in downgradient holes may represent materials displaced from the landfill and moved downgradient. Lead and zinc may have been made less soluble in the sub-landfill and downdip holes by precipitation in some insoluble form such as sulfide.

There is evidence at sites B and C of displacement of materials from the area under the refuse down the groundwater flow gradient. In slow flow through a porous medium such as sediment/soil, some separation of constituents can be expected due to differing affinities for the solid phases present (clays carbonates, etc.) and participation in solution/precipitation reactions. Zones of high concentrations of various contaminants (as seen in water extractions) may be displaced by this type of chromatographic activity. Recharge events such as heavy rainfall at the landfill may further add to the uneven pattern observed in contaminant distribution. The sulfides associated with some of

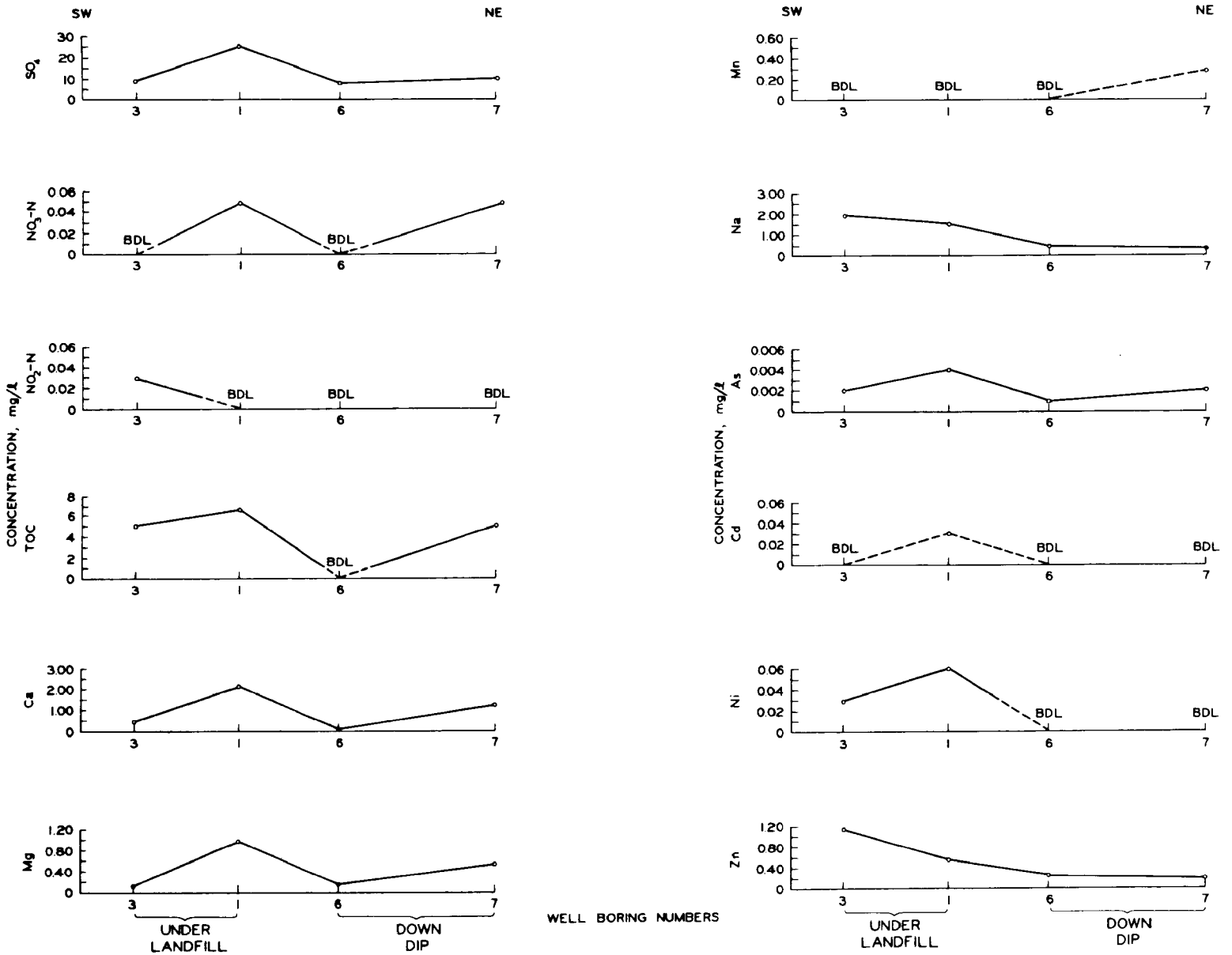


Figure 19. Horizontal variation in chemical composition of distilled water extracts at site A. BDL indicates below detection limits.

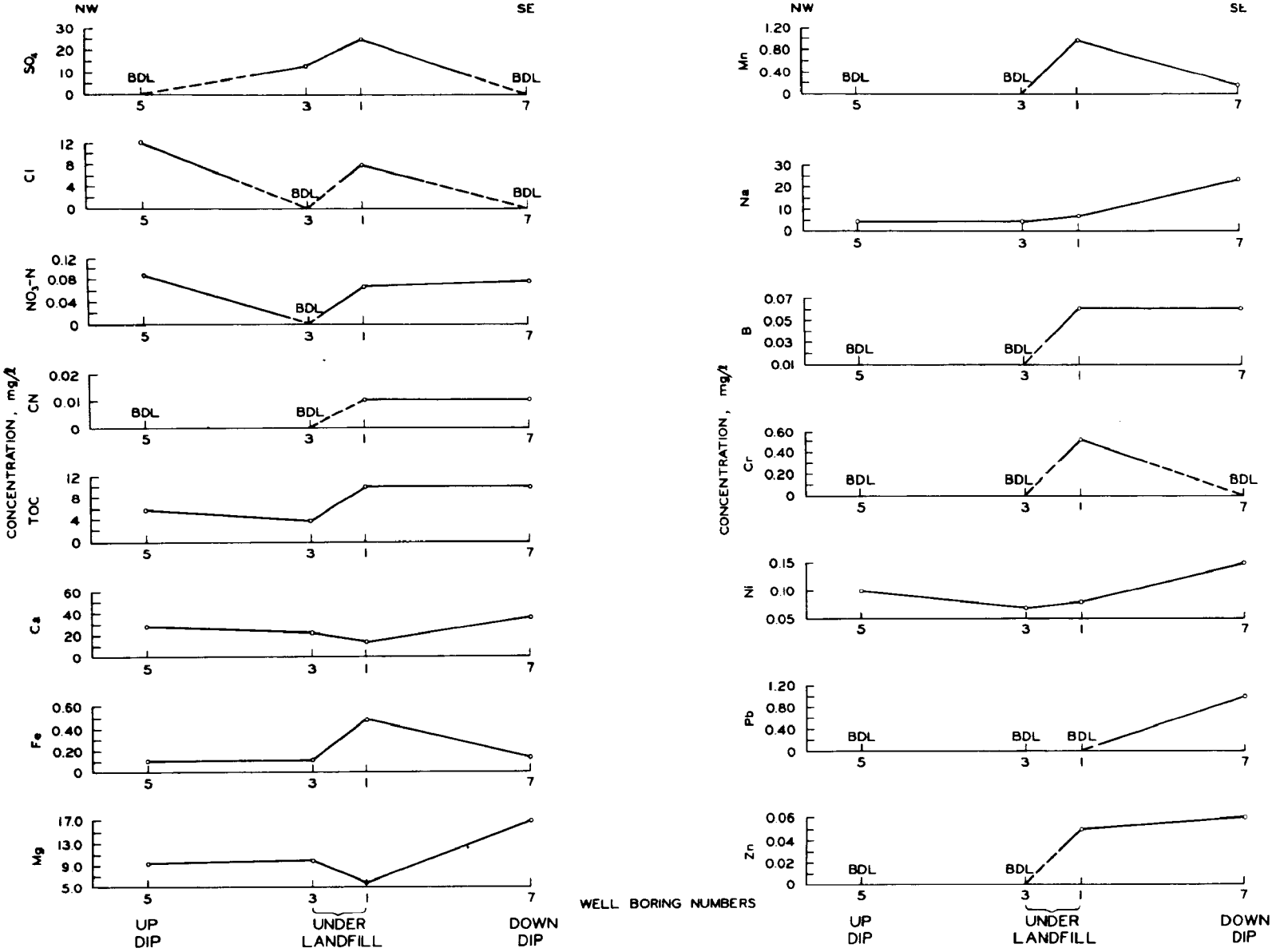


Figure 20. Horizontal variation in chemical composition of distilled water extracts at site B. BDL indicates below detection limits.

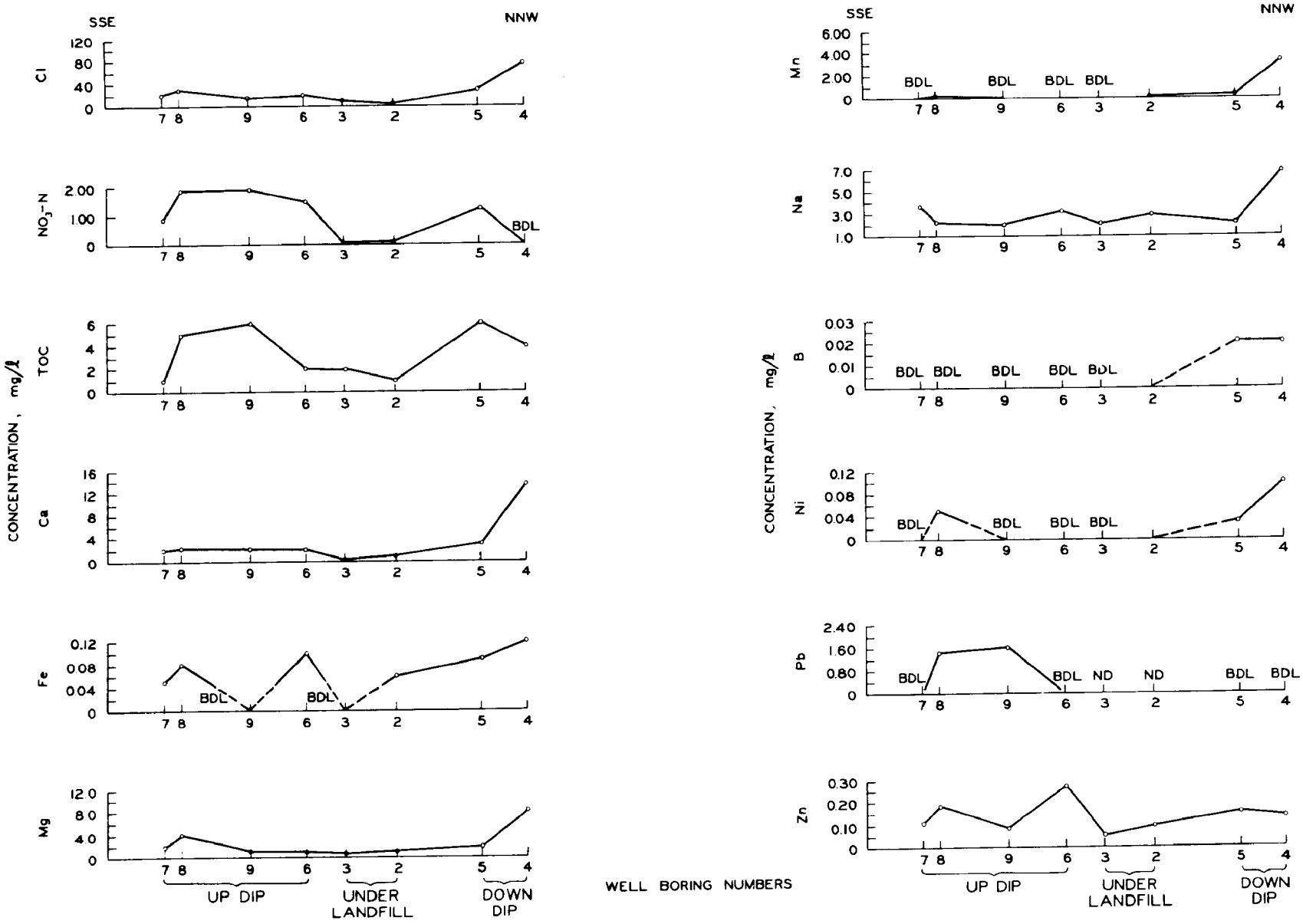


Figure 21. Horizontal variation in chemical composition of distilled water extracts at site C. BDL indicates below detection limits.

the landfills may also reduce the level of some metals in water extracts below the concentrations found in sediment/soil samples up the groundwater gradient from the landfill.

CHEMICAL ANALYSES OF NITRIC ACID EXTRACTS

The goal of the nitric acid digest was to determine the concentration of pollutants that could be released under the most extreme conditions of weathering. The concentration of materials in the nitric acid digest depends upon:

a) the original constituents in the soil and their reactivity with the hot acid,

b) the extent to which water-soluble and leachate-soluble materials have been removed from the soil by solution in rainwater or leachate, and,

c) the solubility in acid of materials which have been precipitated, filtered or absorbed from the leachate passing through the soil.

The analyses of nitric acid digests are given in Tables 25-30. The analytical results are expressed in milligrams per kilogram dry weight of sample.

Comparison of Nitric Acid Digests from Beneath and Outside the Landfills

Soil samples from directly below the landfill (experimental samples) and samples taken at comparable depths outside the landfill (control samples) were digested in nitric acid and the digests were analyzed for selected cations. Care was taken to select samples outside the landfill that were above the water table so that the samples were not contaminated by horizontal movement of leachate from the landfill.

A randomization test was used to evaluate the significance of any differences in means observed between experimental samples and control samples. This procedure was used to avoid the assumption of normal distribution and homogeneous variance required by the more commonly used t-test. With the small sample size, five samples at each site, the highest level of significance that could be assigned to a two-tailed, randomization test was 80%. The results of the randomization tests are presented in Table 31.

In the majority of cases, the nitric acid digests of soil samples from below the landfills showed higher metal content than the nitric acid digest of soil outside the landfills. The increased metal content in the soil represents material filtered, absorbed or precipitated from the leachate (i.e. attenuated) on its contact with the sub-landfill soil.

At site A, significant differences in concentration in the acid digests of samples beneath and outside the landfill occurred with arsenic, boron, beryllium, nickel and selenium. Boron and beryllium showed higher concentrations in the nitric acid digests from samples taken from below the landfill. The levels of arsenic, nickel and selenium in the sub-landfill soil were

TABLE 25. ANALYSES OF NITRIC ACID DIGESTS OF SOIL SAMPLES FROM EXPERIMENTAL BORINGS AT SITE A

Boring and sample	1C1	1C2	1C3	1C4	1C5	1C6	1C7	2C1	2C2	2C3
Elev (m)	250.57	249.77	247.58	242.08	234.81	230.83	230.83	250.98	250.14	247.99
Depth below mw/soil interface (m)	0.00	0.82	3.02	8.52	15.78	19.77	19.77	0.00	0.84	2.99
Ht above water table (m)	18.06	17.24	15.05	9.55	2.28	-1.70	-1.70	19.97	19.13	16.98
Conc. (mg/kg dry wt)										
Fe	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mn	302.25	399.52	444.63	462.02	593.04	287.36	320.14	894.94	374.26	579.75
As	0.10	0.17	0.15	0.14	0.14	0.22	0.17	0.16	0.14	0.14
B	2.90	4.10	3.54	2.99	2.10	2.87	1.60	2.07	1.29	1.63
Be	0.07	0.11	0.08	0.09	0.11	0.30	0.09	0.08	0.06	0.07
Cd	0.27	0.42	0.35	0.49	0.41	0.47	0.36	0.29	0.28	0.30
Cr	2.96	2.73	3.13	2.85	2.58	5.75	2.02	2.96	1.94	2.90
Cu	8.06	6.52	8.65	7.34	9.95	10.54	6.74	9.77	5.42	10.99
Hg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	5.04	5.57	6.01	6.79	5.93	6.70	4.38	5.23	4.00	5.80
Pb	25.19	17.87	26.35	16.31	21.04	28.74	21.90	11.34	12.26	8.48
Se	0.32	0.46	0.53	0.68	0.44	0.50	0.39	0.26	0.40	0.34
Zn	17.95	10.93	10.54	7.88	7.36	11.97	8.17	7.44	6.13	7.97

(continued)

TABLE 25. (continued)

Boring and sample	2C4	2C5	2C6	3C1	3C2	3C3	3C4	3C5	3C6
Elev (m)	243.00	237.11	232.08	250.53	249.53	247.60	240.27	235.72	230.73
Depth below mw/soil interface (m)	7.99	13.87	18.90	0.00	1.00	2.93	10.26	14.81	19.80
Ht. above water table (m)	11.99	6.10	1.07	19.31	18.31	16.38	9.05	4.50	-0.49
Conc. (mg/kg dry wt)									
Fe	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mn	340.26	618.55	366.97	312.12	1015.93	741.15	410.14	356.57	209.50
As	0.14	0.16	0.16	0.16	0.47	0.40	0.26	0.28	0.19
B	1.24	1.29	0.86	1.35	1.39	1.50	0.75	0.84	1.00
Be	0.06	0.06	0.10	0.11	0.08	0.07	0.06	0.06	0.05
Cd	0.24	0.30	0.22	0.33	0.32	0.32	0.27	0.28	0.22
Cr	2.27	2.45	1.65	2.48	2.99	3.44	2.61	2.34	1.86
Cu	6.80	10.44	8.13	7.38	7.17	9.75	8.70	9.02	7.86
Hg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	4.76	5.54	4.16	5.25	5.84	6.24	5.59	4.90	4.00
Pb	9.64	11.60	10.40	12.77	11.83	11.70	12.43	10.03	9.05
Se	0.27	0.30	BDL	0.31	0.31	0.32	0.31	0.28	0.27
Zn	6.24	12.50	6.18	36.18	54.97	7.80	6.84	6.68	10.23

BDL = Below detection limits.

ND = Not determined.

TABLE 26. ANALYSES OF NITRIC ACID DIGESTS OF SOIL SAMPLES FROM CONTROL BORINGS AT SITE A

Boring and sample	6C1	6C2	6C3	6C4	6C5	6C6	7C1	7C2	7C3	7C4	7C5	7C6
Elev (m)	251.09	250.20	248.08	242.05	236.86	230.84	250.49	250.15	247.99	242.23	236.37	233.32
Ht. above water table (m)	19.99	19.10	16.98	10.95	5.76	-0.26	14.97	14.63	12.47	6.71	-0.85	-2.20
Conc. (mg/kg dry wt)												
Fe	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mn	566.29	503.83	546.34	417.92	632.26	295.05	447.30	561.80	986.56	810.06	72.08	96.42
As	0.51	0.64	0.60	0.49	0.55	0.50	0.41	0.50	0.75	0.51	0.26	0.24
B	1.08	1.08	1.34	0.82	0.86	0.72	0.95	1.24	1.50	1.29	0.79	0.56
Be	0.06	0.07	0.07	0.07	0.07	0.05	0.07	0.06	0.06	0.07	0.04	0.05
Cd	0.27	0.27	0.27	0.29	0.28	0.19	0.31	0.33	0.27	0.35	0.30	0.24
Cr	2.95	3.32	3.46	2.88	3.23	1.79	2.78	3.66	7.52	3.86	0.92	0.81
Cu	7.83	9.76	10.26	9.59	11.46	6.75	7.05	9.21	12.45	12.02	0.92	1.67
Hg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	5.72	6.38	6.07	6.17	6.45	3.84	5.96	6.73	7.28	7.91	1.44	1.41
Pb	8.43	10.85	8.92	9.59	9.87	7.15	11.52	12.41	8.93	12.22	6.55	6.00
Se	0.36	0.36	0.31	0.30	0.32	0.25	0.36	0.27	0.34	0.29	0.43	0.46
Zn	7.59	8.54	17.28	8.22	9.48	4.52	6.78	10.06	9.67	10.22	2.29	1.71

Note: All borings are positioned downdip on the groundwater gradient.

BDL = Below detection limits.

ND = Not determined.

TABLE 27. ANALYSES OF NITRIC ACID DIGESTS OF SOIL SAMPLES FROM EXPERIMENTAL BORINGS AT SITE B

Boring and sample	1C1	1C2	2C1	2C2	2C3	3C1	3C2	3C3
Elev (m)	55.93	54.06	56.77	55.85	53.72	56.74	55.74	53.50
Depth below mw/soil interface (m)	0.00	1.87	0.00	0.92	3.05	0.00	1.00	3.24
Ht above water table (m)	1.57	-0.30	5.83	4.91	2.78	5.51	2.51	0.27
Conc. (mg/kg dry wt)								
Fe	18007.	15241.	14425.	15552.	11351.	17246.	10028.	12099.
Mn	945.76	1443.93	559.55	450.69	342.08	505.12	343.56	306.60
As	4.81	4.30	5.25	3.84	2.10	4.43	1.75	1.19
B	5.63	4.53	6.96	6.57	5.14	8.66	5.39	6.78
Be	1.05	1.03	1.76	1.74	1.41	1.70	1.57	1.56
Cd	0.15	0.54	0.23	0.21	0.15	0.43	0.19	0.13
Cr	8.78	7.49	7.46	9.19	7.60	8.08	7.83	7.60
Cu	13.47	12.30	11.31	9.61	8.68	11.55	10.16	11.47
Hg	0.08	0.08	0.04	0.03	0.02	0.04	0.05	0.03
Ni	21.56	22.26	29.23	21.70	17.87	22.37	20.38	25.33
Pb	10.59	9.36	58.46	8.30	7.19	8.66	7.76	7.60
Se	2.95	2.95	2.20	1.52	1.28	1.80	1.94	1.65
Zn	50.54	61.23	54.28	45.97	38.47	57.72	40.11	39.28

TABLE 28. ANALYSES OF NITRIC ACID DIGESTS OF SOIL SAMPLES FROM CONTROL BORINGS AT SITE B

Boring and sample	5C1	5C2	5C3	6C1	6C2	6C3	7C3
Elev (m)	55.28	54.38	52.44	54.26	53.35	51.22	42.00
Ht. above water table (m)	1.93	1.03	-0.91	4.11	3.20	1.07	0.10
Position in groundwater gradient	updip	updip	updip	updip	updip	updip	downdip
Conc. (mg/kg dry wt)							
Fe	13054.	11336.	13214.	12924.	13486.	8692.	4062.
Mn	497.27	352.03	233.26	428.78	445.18	113.75	2784.25
As	3.95	3.04	2.46	3.04	3.41	0.89	BDL
B	7.32	5.55	5.78	5.12	5.54	3.68	73.73
Be	1.77	1.52	1.51	1.46	1.80	1.26	1.20
Cd	0.26	0.18	0.16	0.20	0.22	0.25	0.21
Cr	7.80	6.62	9.79	6.64	8.48	8.00	15.00
Cu	9.88	9.72	9.57	8.01	9.13	9.04	23.25
Hg	0.06	0.04	0.03	0.02	0.03	0.03	BDL
Ni	29.72	24.58	24.29	23.77	26.90	21.86	32.12
Pb	7.73	7.75	7.49	7.60	7.97	6.95	39.54
Se	3.00	2.03	1.12	1.52	0.94	1.44	BDL
Zn	42.68	39.26	37.77	35.83	48.00	35.91	42.23

TABLE 29. ANALYSES OF NITRIC ACID DIGESTS OF SOIL SAMPLES FROM EXPERIMENTAL BORINGS AT SITE C

Boring and sample	1C1	1C2	1C3	2C1	2C2	2C3	3C1	3C2	3C3
Elev (m)	131.41	130.48	128.34	127.46	126.55	124.41	125.50	124.57	123.20
Depth below mw/soil interface (m)	0.00	0.93	3.07	0.00	0.91	3.05	0.00	0.93	2.30
Ht. above water table (m)	4.40	3.47	1.33	0.20	-0.71	-2.85	2.48	1.55	0.18
Conc. (mg/kg dry wt)									
Fe	25871.0	24824.	23065.	22119.	28710.	24573.	27563.	24723.	36287.
Mn	869.23	585.91	431.75	386.14	642.77	339.37	710.84	409.30	84.28
As	0.52	0.72	0.48	0.52	0.72	0.52	0.76	0.77	0.73
B	226.31	230.89	217.17	209.19	235.07	207.82	232.60	210.14	292.87
Be	1.36	1.36	1.89	2.03	1.47	1.27	0.90	0.79	1.94
Cd	2.08	2.22	2.12	2.24	1.93	1.77	2.00	1.74	2.92
Cr	19.29	21.82	16.79	15.42	10.65	9.59	9.38	16.13	11.36
Cu	40.22	34.17	45.87	55.36	42.36	41.56	11.12	31.11	17.71
Hg	0.03	0.05	0.02	0.03	0.03	0.05	0.04	0.04	0.03
Ni	28.29	29.10	36.13	33.94	32.93	34.03	10.40	15.60	14.79
Pb	21.71	21.35	18.71	23.51	22.83	17.08	18.09	17.86	18.79
Se	0.57	0.50	0.39	0.37	0.39	0.16	0.16	0.37	0.31
Zn	60.07	66.07	78.78	96.69	91.21	85.41	31.38	35.30	55.79

TABLE 30. ANALYSES OF NITRIC ACID DIGESTS OF SOIL SAMPLES FROM CONTROL BORING AT SITE C

Boring and sample	6C1	6C2	6C3	6C4	6C5	7C4	8C3	9C1	9C2	9C3	9C4	9C5	4C6	5C4
Elev (m)	132.46	131.54	129.41	127.88	126.06	121.80	130.14	143.47	142.57	140.44	136.17	131.91	124.74	126.92
Ht. above water table (m)	5.42	4.50	2.37	0.84	-0.98	0.09	-0.36	11.47	10.57	8.44	4.17	-0.09	-0.66	-0.12
Position in groundwater gradient	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Updip	Downdip	Downdip
Conc. (mg/kg dry wt)														
Fe	17938.	22378.	12745.	30634.0	12124.7	18140.	15277.	21340.	20419.	23658.	22352.	15584.	23137.	12719.
Mn	46.21	13.90	20.85	160.59	194.73	121.83	231.70	118.74	71.71	110.27	210.50	76.39	655.94	149.64
As	1.12	0.97	0.49	0.75	0.54	0.81	0.53	1.14	0.89	0.41	0.57	0.79	0.72	1.49
B	180.68	337.89	141.55	298.24	102.35	137.00	116.13	180.03	182.31	205.84	211.94	122.23	182.29	107.47
Be	0.54	0.66	1.05	2.26	0.84	0.95	1.97	0.69	1.05	0.89	1.10	0.92	1.39	1.12
Cd	1.89	3.10	1.60	2.96	2.08	2.12	1.90	2.10	2.28	2.55	2.42	2.14	2.30	1.50
Cr	14.10	19.28	7.87	9.99	10.60	15.54	7.72	14.01	10.63	14.63	8.39	5.02	13.79	14.2
Cu	11.50	17.67	24.14	46.33	15.22	21.93	15.28	18.99	49.95	51.26	29.37	16.58	37.63	63.12
Hg	0.03	0.06	0.05	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.07	0.02
Ni	6.63	7.64	14.70	32.30	19.11	25.50	13.25	9.47	14.28	7.42	7.01	5.00	31.78	21.42
Pb	11.37	15.12	11.98	22.67	14.07	12.56	13.30	20.79	23.82	24.39	18.24	7.94	26.64	11.09
Se	0.24	0.19	0.23	0.21	0.30	0.15	0.16	0.11	0.17	0.25	0.25	0.30	0.16	0.29
Zn	21.25	24.53	30.01	81.42	49.13	89.89	47.52	17.56	17.74	16.77	13.09	11.31	85.69	67.34

TABLE 31. RESULTS OF RANDOMIZATION TEST ON NITRIC ACID DIGESTS OF SOIL SAMPLES DIRECTLY UNDER THE LANDFILLS AND AT COMPARABLE DEPTHS OUTSIDE THE LANDFILLS

Parameter	Site A	Site B	Site C
Fe	ND	S	S
Mn	NS	S	S
As	S	S	S
B	S	NS	S
Be	S	NS	S
Cd	NS	NS	NS
Cr	NS	NS	NS
Cu	NS	S	NS
Hg	N	NS	S
Ni	S	NS	S
Pb	NS	S	NS
Se	S	NS	NS
Zn	NS	S	S

S = Significant at 80% level.

NS = Not significant at 80% level.

ND = Not determined.

N = Not detected in any sample.

lowered possibly by leaching effects due to the organic acids and chemically reducing conditions produced by the landfill.

At site B, significant differences in concentrations in acid digests were found for iron, manganese, arsenic, copper, lead and zinc. All of these metals showed increased levels in soil beneath the landfill as would be expected from consideration of the model (Figure 1).

At site C, significant differences were found in the concentration of iron, manganese, arsenic, boron, beryllium, mercury, nickel and zinc. Only arsenic showed a decrease in concentration beneath the landfill. Arsenic is behaving at site C as it did at site A and is being depleted in the soil immediately below the landfill.

If the number of metals that are found in significantly higher quantities under a landfill is used as a rough index of attenuation, the sand and gravel at site A is definitely poorer in attenuation than is the loess clay at site B or the deep, residual soil at site C. The material at site A would have both poorer filtering qualities because of its larger grain size and lower adsorption properties because of the lack of clay minerals.

None of the metals determined was shown to have a significant increase in the sub-landfill samples at all three sites. Iron, manganese, boron, beryllium and zinc all showed significant accumulation below the landfills at two of the three sites. These differences in metal levels probably reflect the differing composition of leachates at the three sites.

Vertical Variation of Constituents in Nitric Acid Digests of Soil Samples

For those elements that did show a significant difference in means between sub-landfill samples and samples from comparable depths outside the landfill, a test was made for a significant relationship between the concentration of a particular cation and the sample elevation in the borings. The model of leachate movement requires that those materials derived from the refuse show a positive correlation with elevation in the borings through the landfill. Outside the landfill the concentration of these materials in a nitric acid digest would depend on the prevailing weathering processes. There could be a positive or negative correlation or no correlation at all between sample elevation and the concentration of metals. In the model situation soil constituents that are being dissolved by the landfill leachate should show a negative correlation with sample elevation for samples from under the landfill. Outside the landfill, these elements may or may not show any correlation with sample elevation depending on their response to local weathering processes.

The Spearman rank correlation coefficient was used to judge the strength of association because this technique could be used with small numbers of samples where the sample distribution is not known. The results of the Spearman rank correlation are given in Tables 32-34. Graphs of concentrations versus sample elevation for all cations that showed statistically significant correlations in experimental borings are given in Figures 22-34. Significant correlations in control holes are shown for contrast.

TABLE 32. CORRELATION OF CHEMICAL ANALYSES OF NITRIC ACID DIGESTS OF SOIL SAMPLES WITH SAMPLE ELEVATION AT SITE A

	Experimental			Control	
Boring No.	1	2	3	6	7
Mn	NS	NS	NS	NS	NS
As	NS	NS	NS	NS	NS
B	SP	SP	NS	SP	NS
Be	NS	NS	SP	NS	NS
Ni	NS	NS	NS	NS	NS
Se	NS	NS	NS	NS	NS

SP = Significant positive correlation at 95% level.

SN = Significant negative correlation at 95% level.

NS = Not significant.

TABLE 33. CORRELATION OF CHEMICAL ANALYSES OF NITRIC ACID DIGESTS OF SOIL SAMPLES WITH SAMPLE ELEVATION AT SITE B

Boring No.	Experimental			Control	
	1*	2**	3	5	6
Fe	--	NS	NS	NS	NS
Mn	--	SP	SP	SP	NS
As	--	SP	SP	SP	NS
Cu	--	SP	NS	SP	NS
Pb	--	SP	SP	NS	NS
Zn	--	SP	SP	SP	NS

SP = Significant positive correlation at 95% level.

SN = Significant negative correlation at 95% level.

NS = Not significant.

* = No critical confidence level available for this size sample.

** = Due to small sample sizes all tests of significance are at 80% confidence level.

TABLE 34. CORRELATION OF CHEMICAL ANALYSES OF NITRIC ACID DIGESTS OF SOIL SAMPLES WITH SAMPLE DEPTH AT SITE C

	Experimental			Control	
Boring No.	1	2	3	6	9
Fe	SP	NS	NS	NS	NS
Mn	SP	NS	SP	NS	NS
As	NS	NS	NS	NS	NS
B	NS	SP	NS	NS	NS
Be	NS	SP	NS	NS	NS
Hg	NS	NS	NS	NS	SP
Ni	SN	NS	NS	SN	SP
Zn	SN	SN	SN	SN	SP

SP = Significant positive correlation at 95% level.

SN = Significant negative correlation at 95% level.

NS = Not significant.

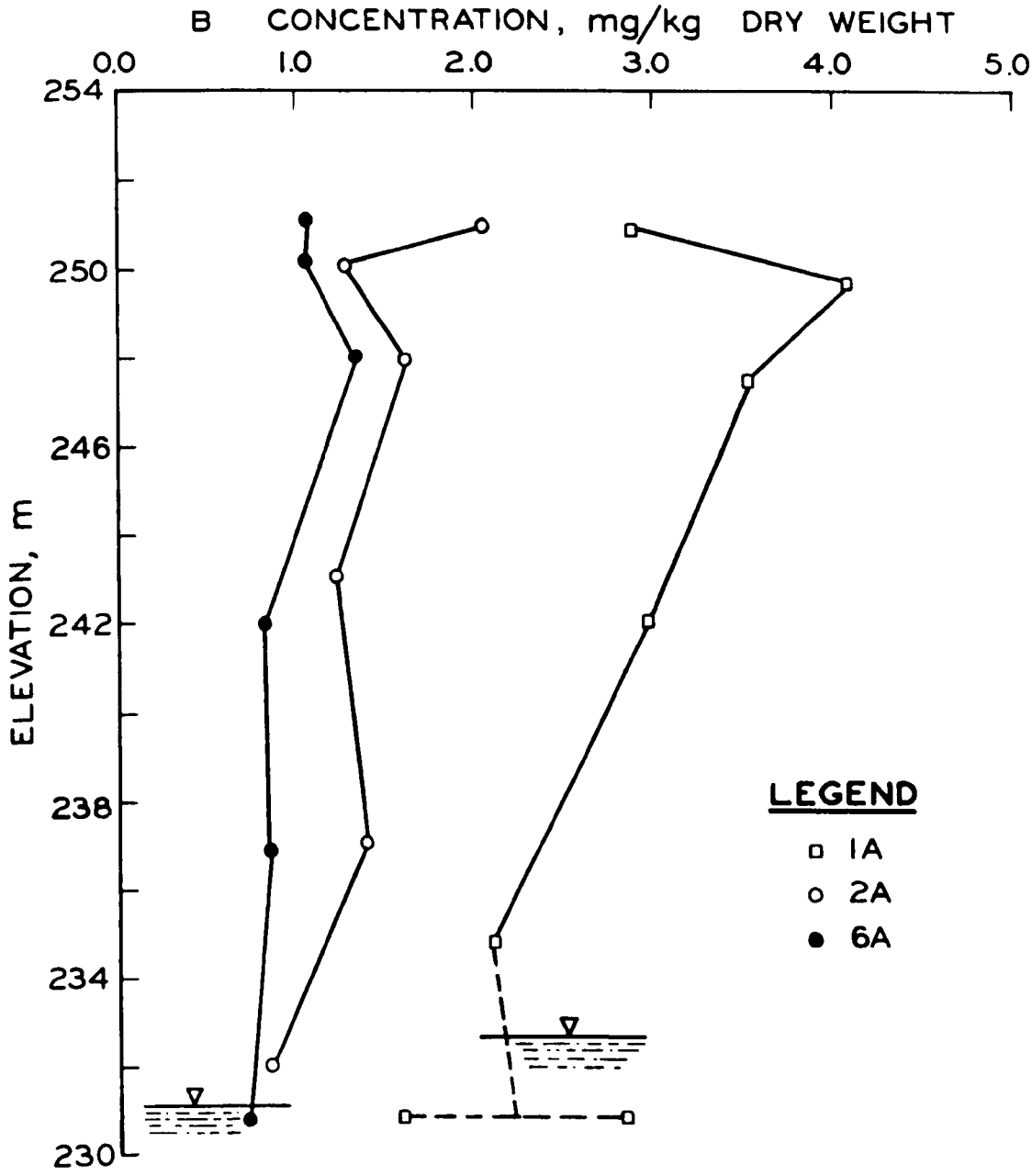


Figure 22. Variation of boron concentration in nitric acid digests of soil/sediment samples with elevation in borings 1, 2, and 6 at site A. Inverted triangle symbols indicate water table in each boring.

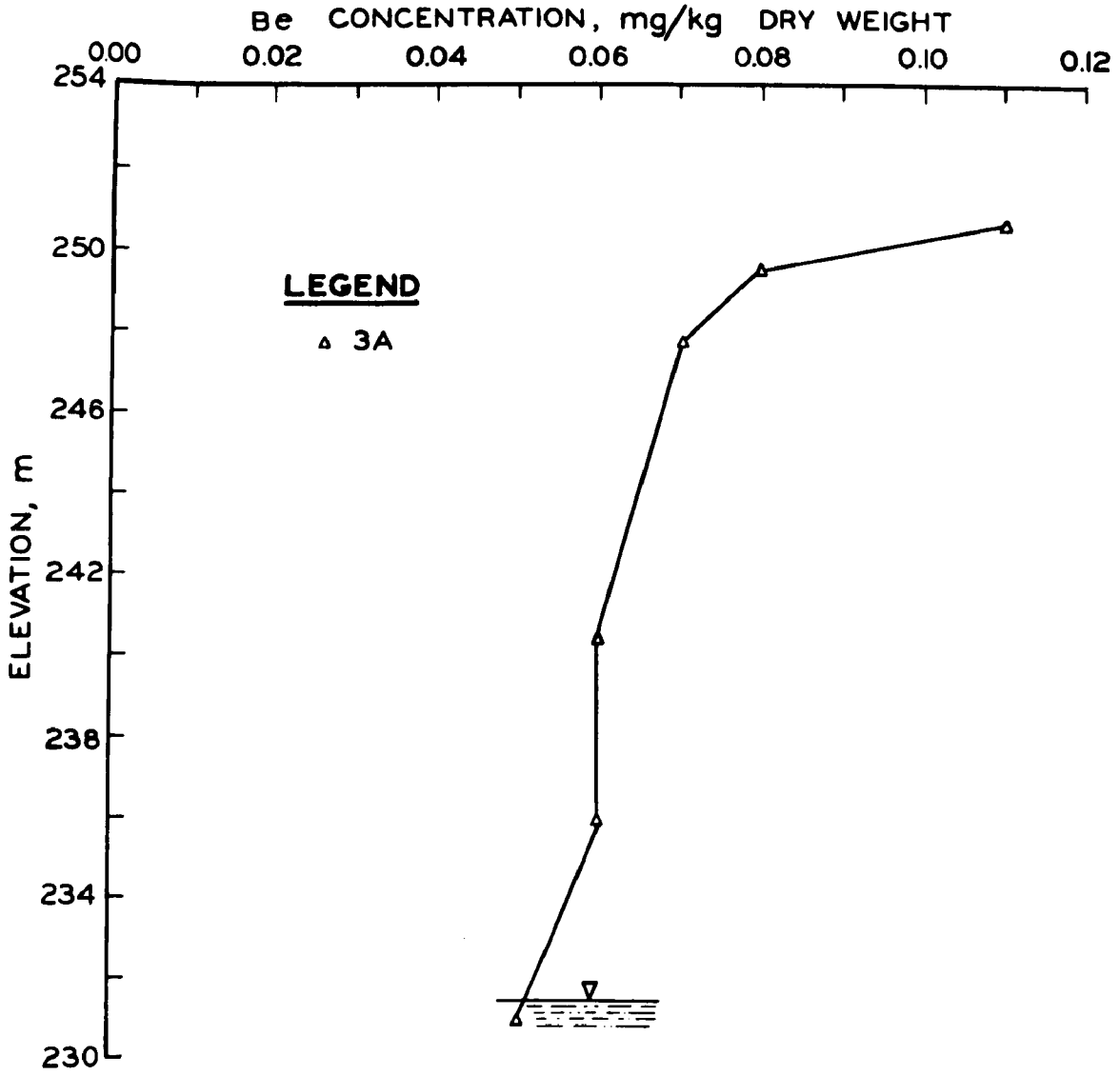


Figure 23. Variation of beryllium concentration in nitric acid digests of soil/sediment samples with elevation in boring 3 at site A. Inverted triangle symbol indicates water table.

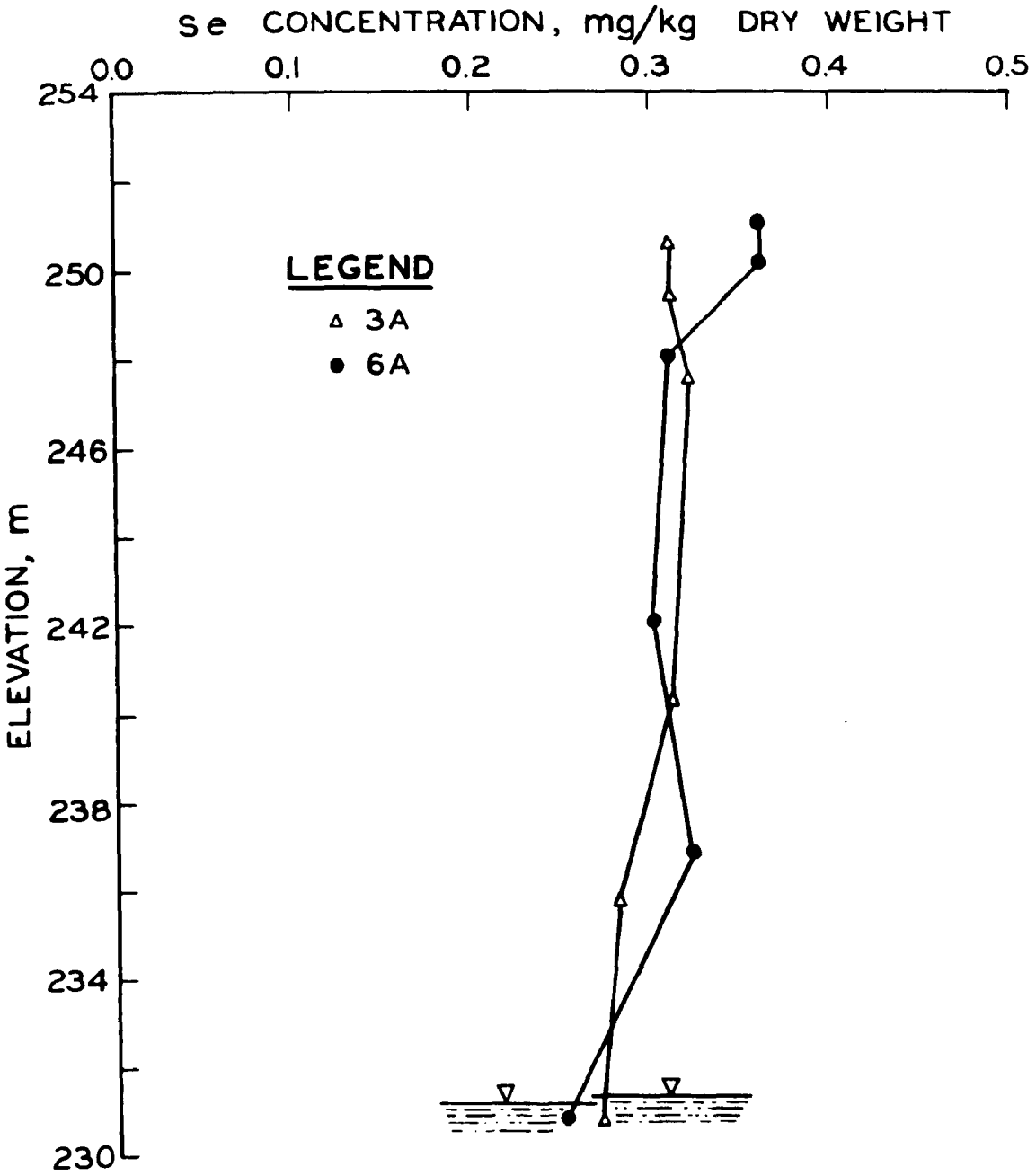


Figure 24. Variation of selenium concentration in nitric acid digests of soil/sediment samples with elevation in borings 3 and 6 at site A. Inverted triangle symbols indicate water table in each boring.

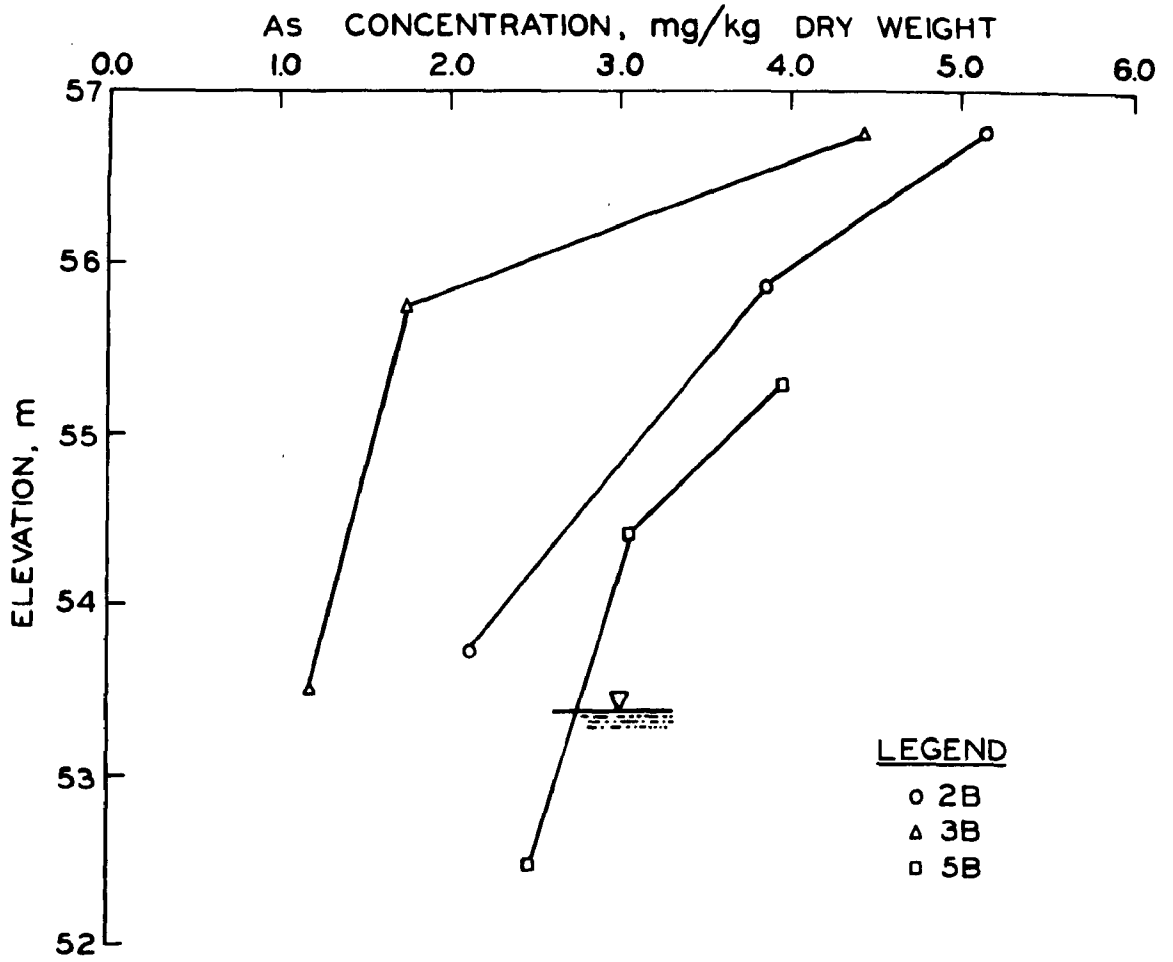


Figure 25. Variation of arsenic concentration in nitric acid digests of soil/sediment samples with elevation in borings 2, 3, and 5 at site B. Inverted triangle symbol indicates water table.

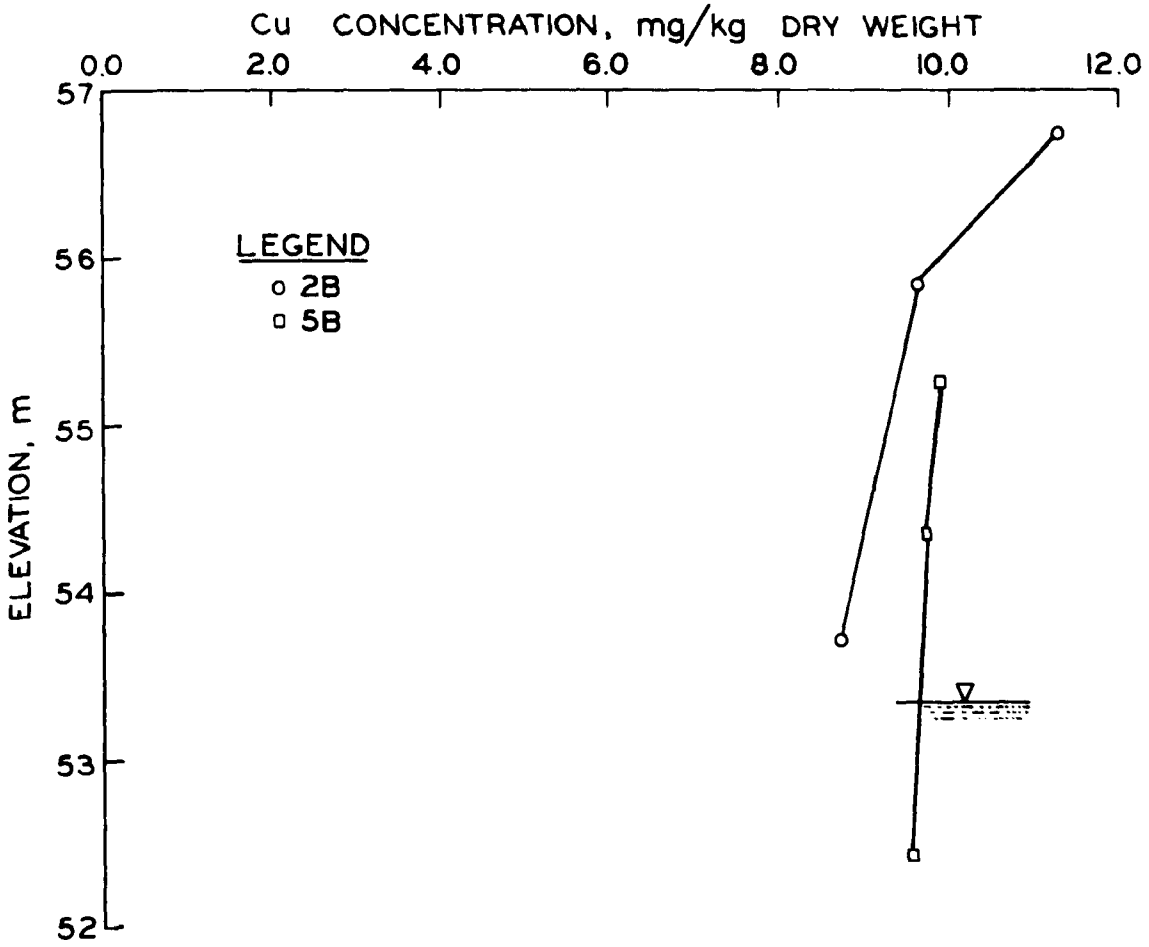


Figure 26. Variation of copper concentration in nitric acid digests of soil/sediment samples with elevation in borings 2 and 5 at site B. Inverted triangle symbol indicates water table.

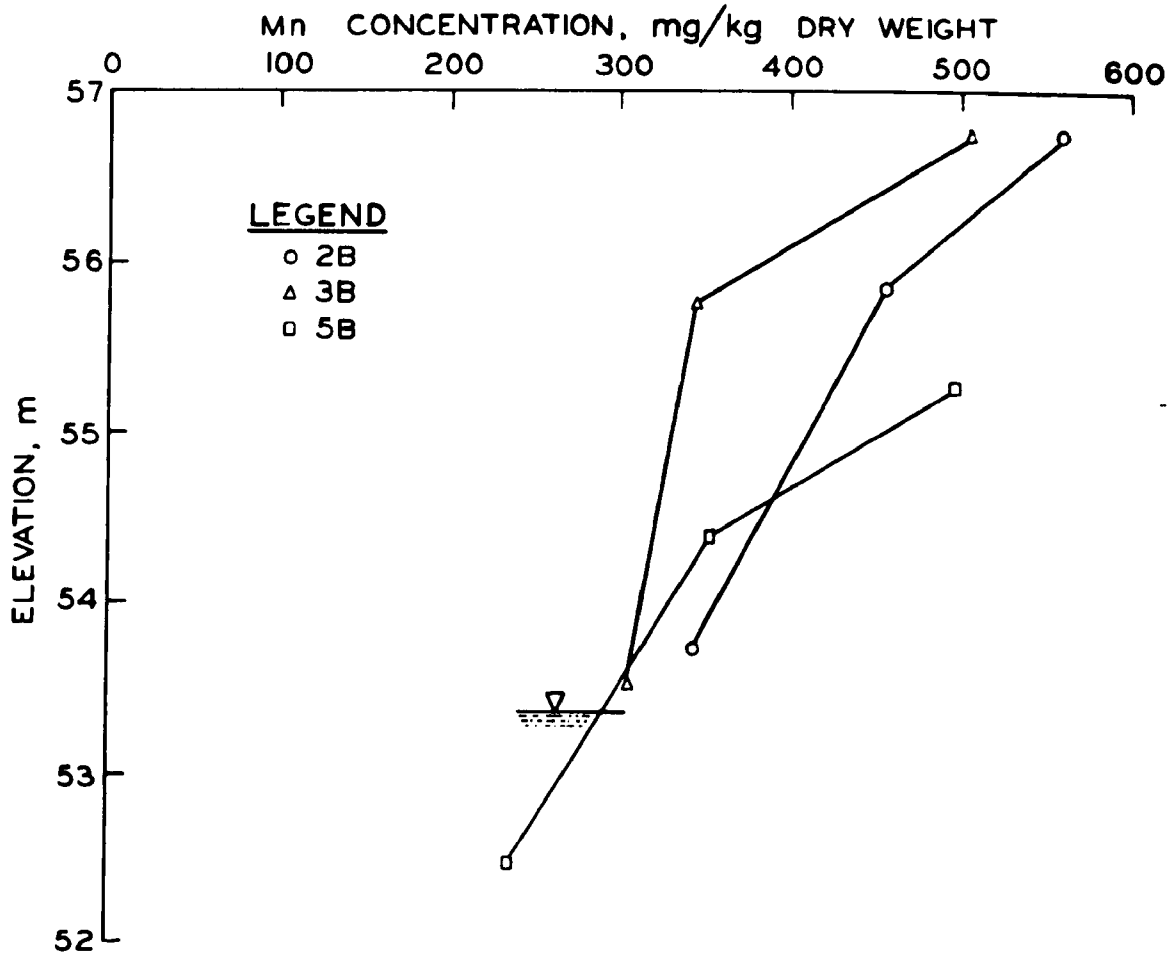


Figure 27. Variation in manganese concentration in nitric acid digests of soil/sediment samples with elevation in borings 2, 3 and 5 at site B. Inverted triangle symbol indicates water table.

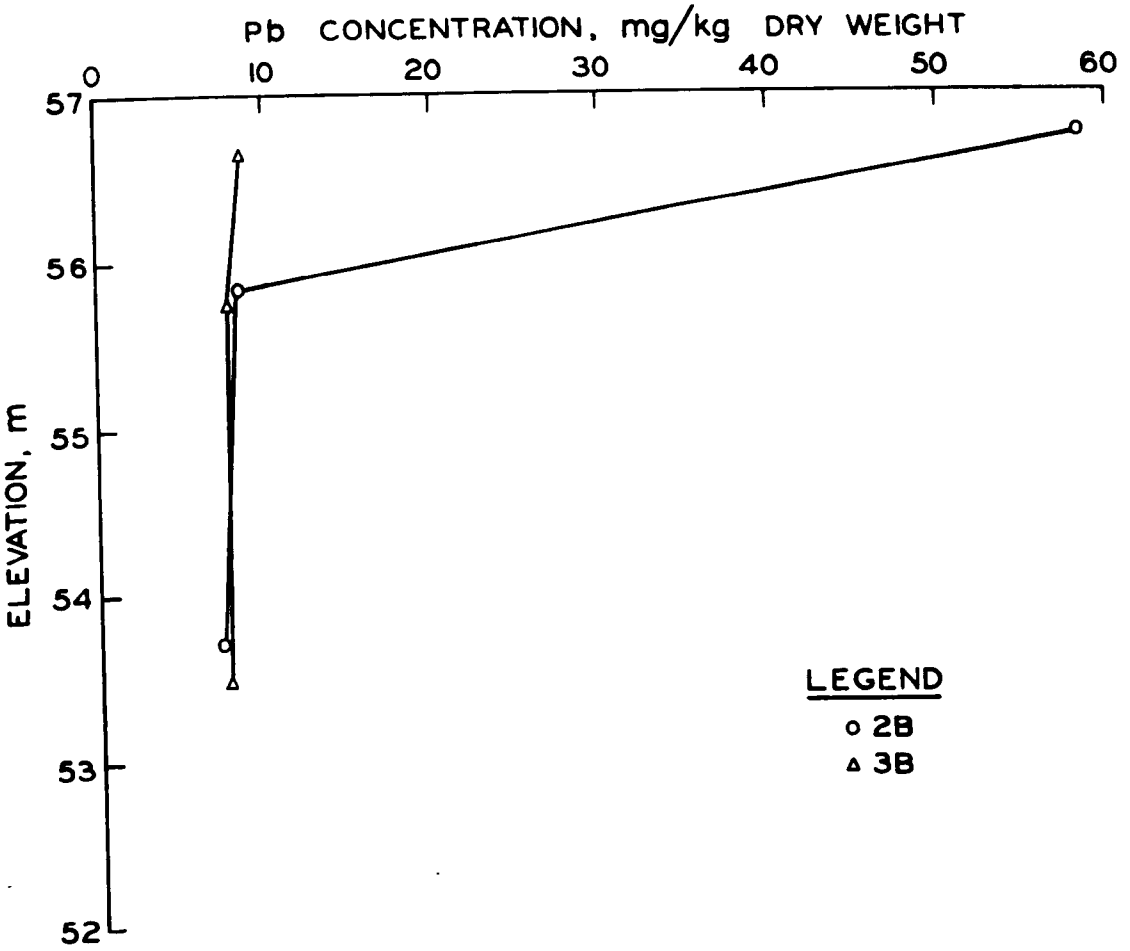


Figure 28. Variation of lead concentration in nitric acid digests of soil/sediment samples with elevation in borings 2 and 3 at site B.

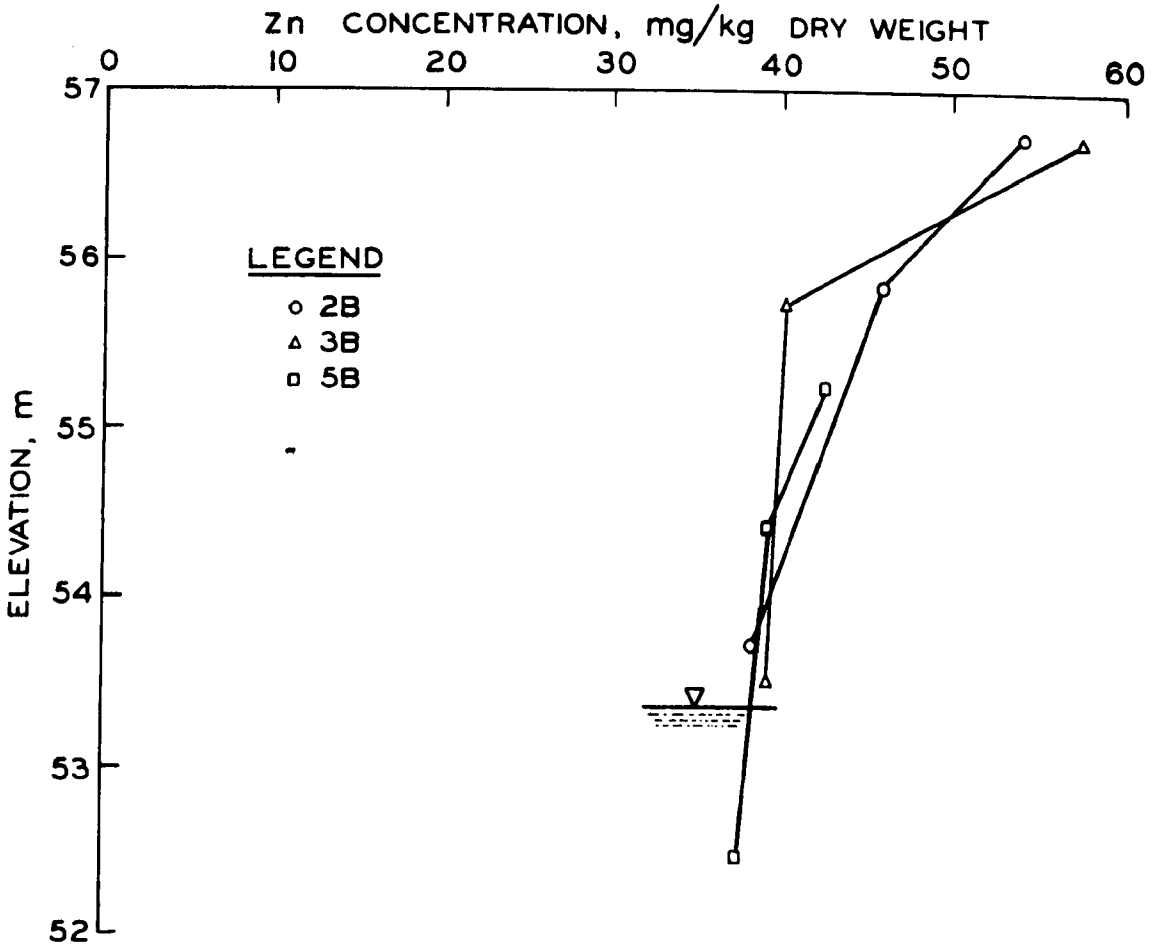


Figure 29. Variation of zinc concentration in nitric acid digests of soil/sediment samples with elevation in borings 2, 3, and 5 at site B. Inverted triangle symbol indicates water table.

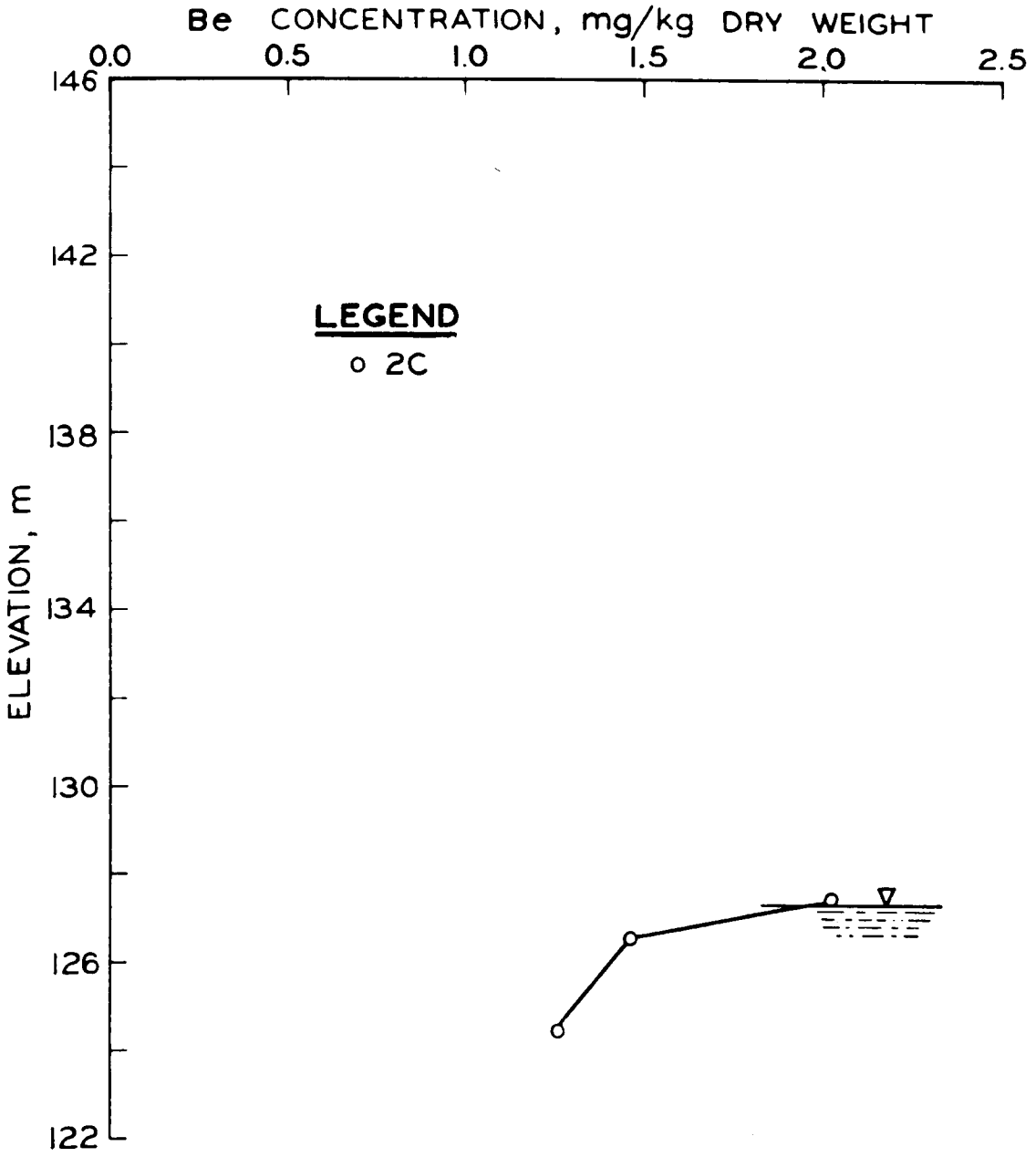


Figure 30. Variation of beryllium concentration in nitric acid digests of soil/sediment samples with elevation in boring 2 at site C. Inverted triangle symbol indicates water table.

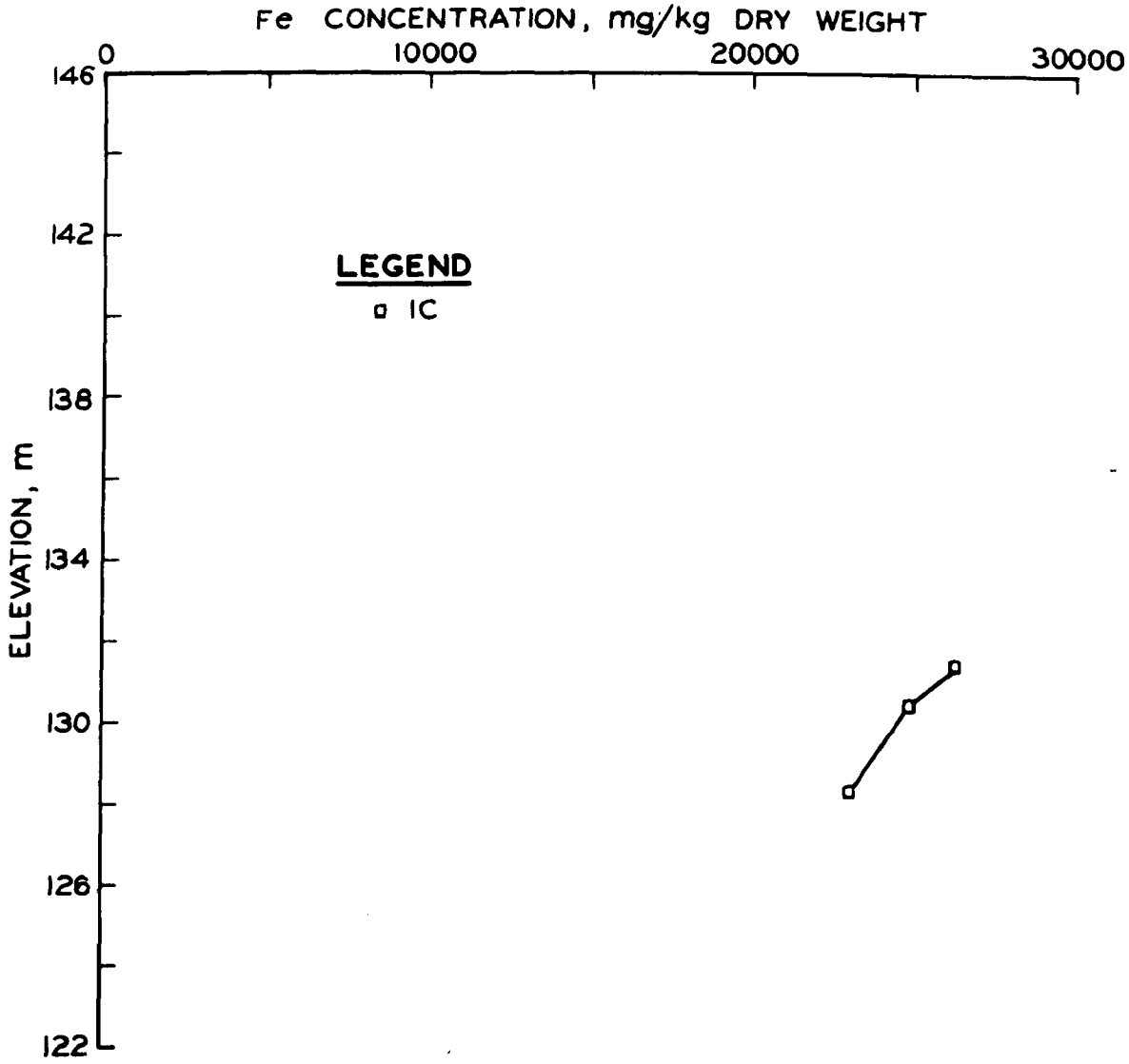


Figure 31. Variation of iron concentration in nitric acid digests of soil/sediment samples with elevation in boring 1 at site C.

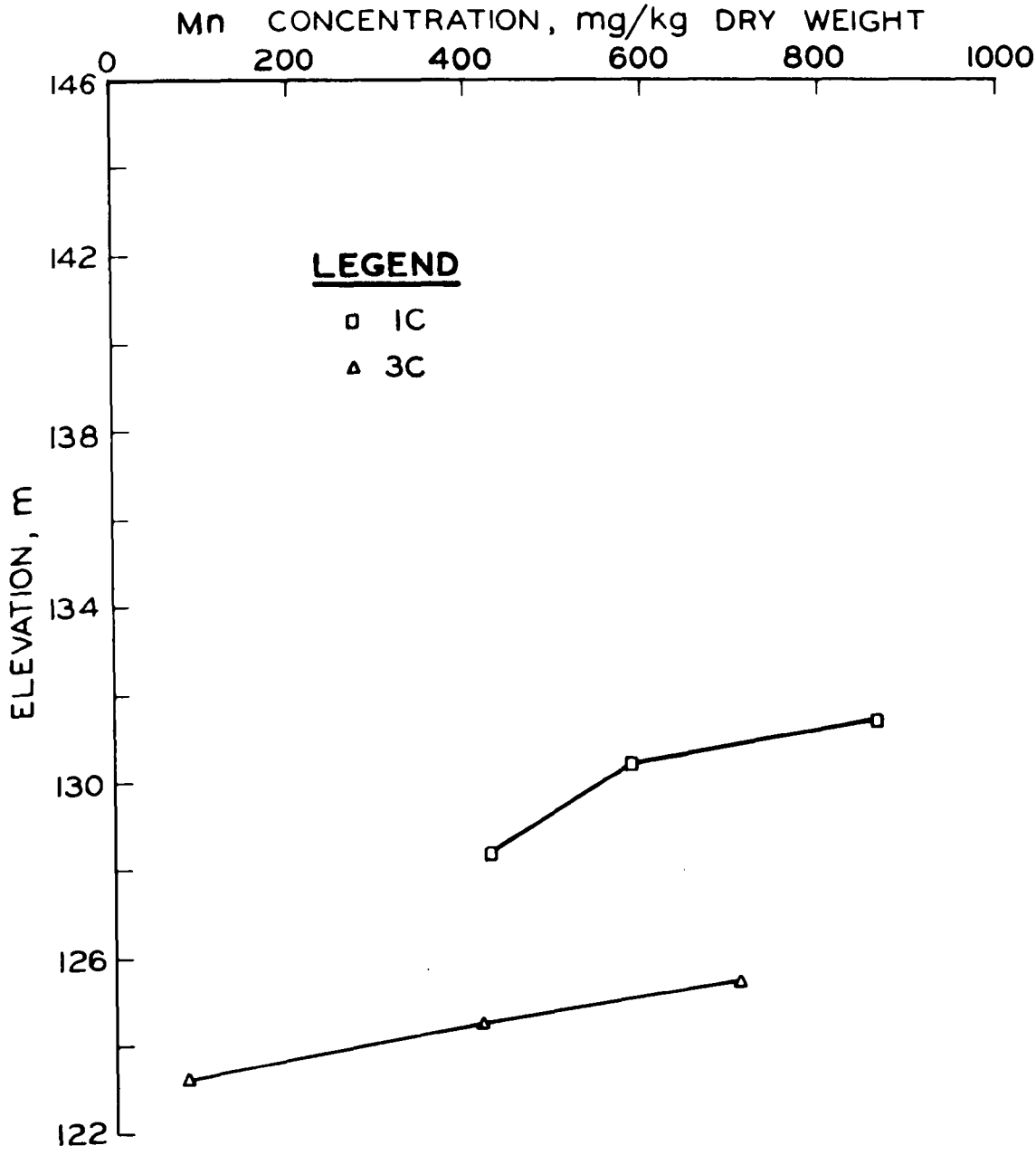


Figure 32. Variation in manganese concentration in nitric acid digests of soil/sediment samples with elevation in borings 1 and 3 at site C.

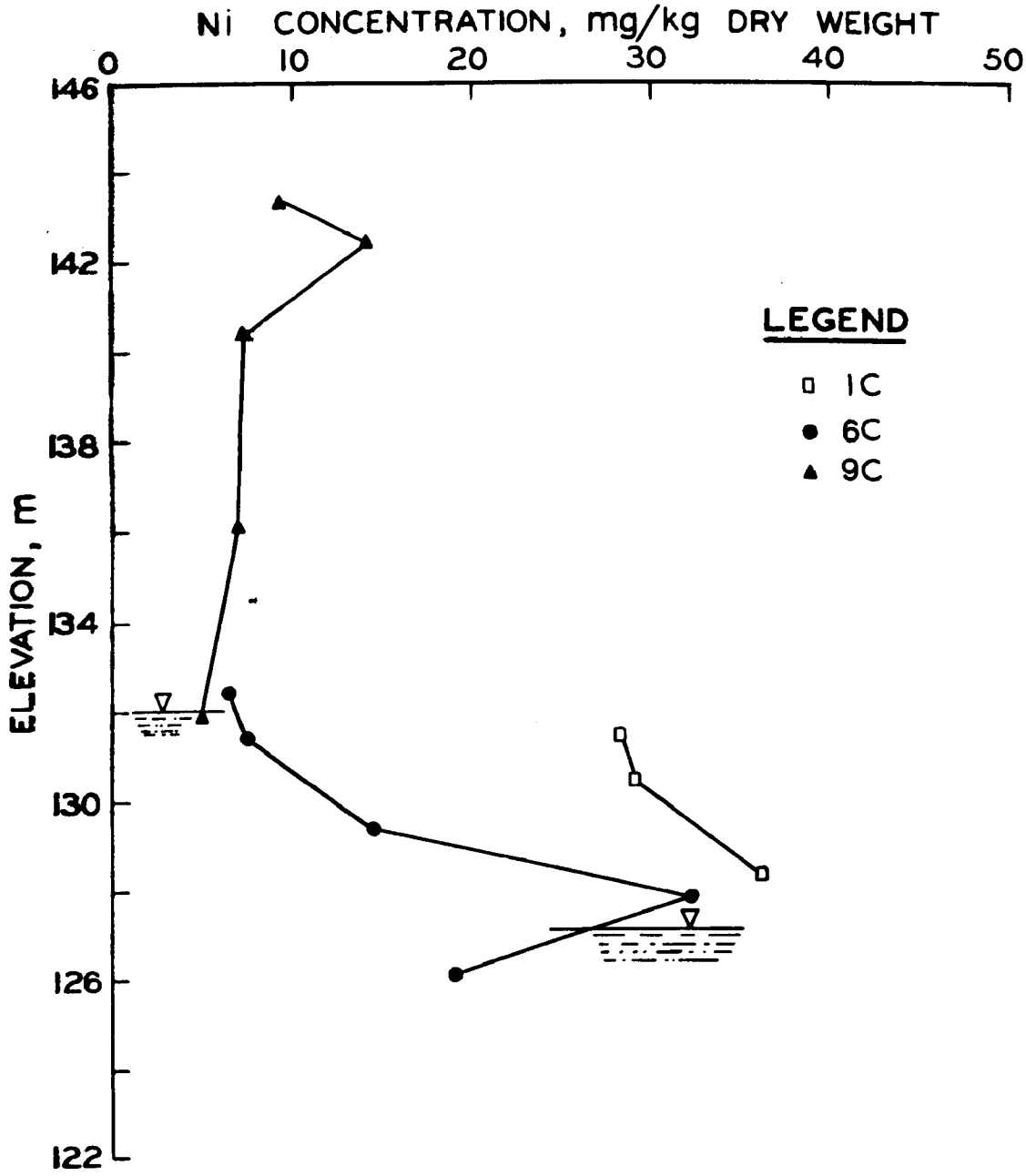


Figure 33. Variation of nickel concentration in nitric acid digests of soil/sediment samples with elevation in borings 1, 6 and 9 at site C. Inverted triangle symbols indicate water table in each boring.

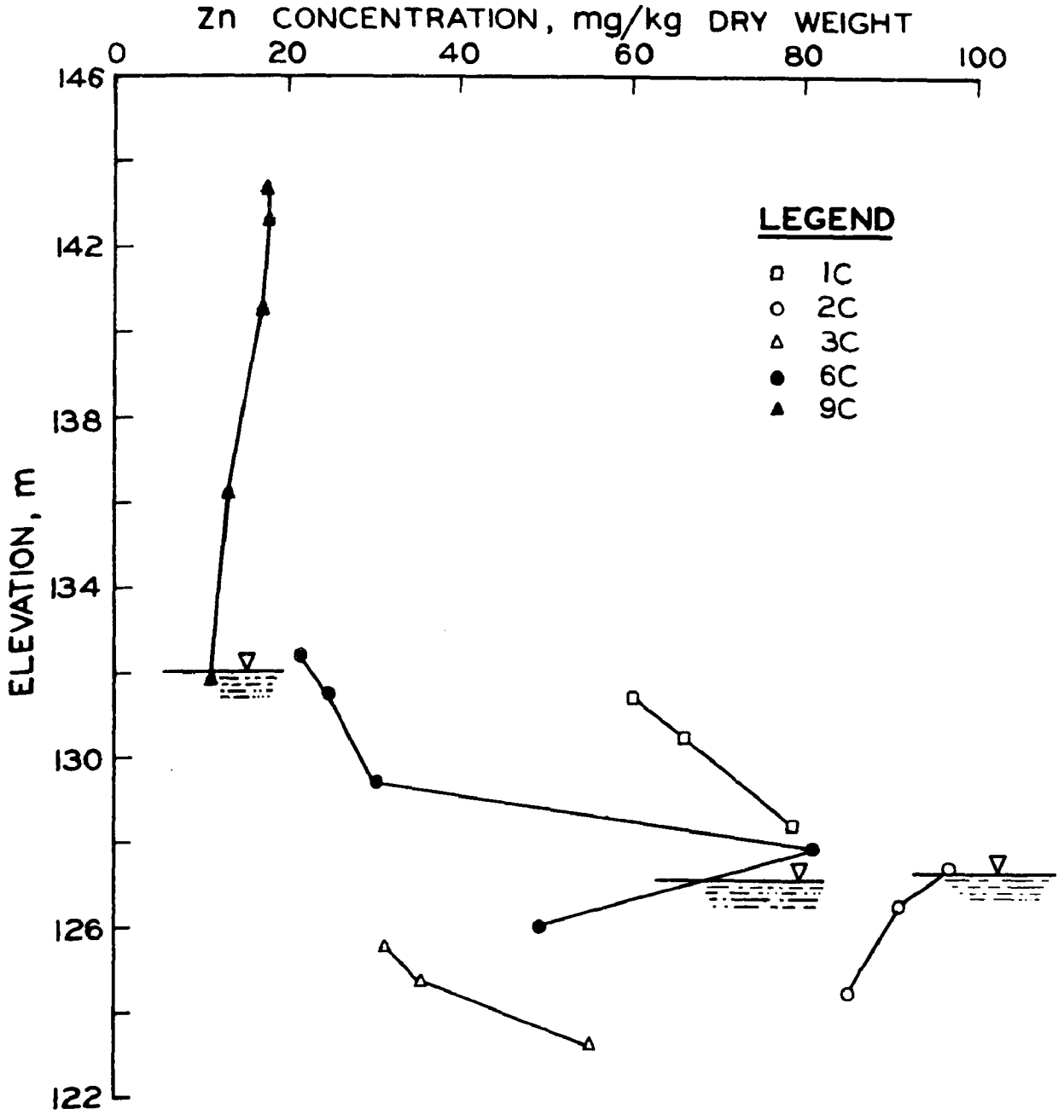


Figure 34. Variation of zinc concentration in nitric acid digests of soil/sediment samples with elevation in borings 1, 2, 3, 6 and 9 at site C. Inverted triangle symbols indicate water table in each boring.

At site A, boron and beryllium showed significant positive correlations with elevation. This correlation, together with their increased abundance under the fill suggests they are being added to the soil by landfill leachate. Selenium shows a positive correlation with elevation, but is not as abundant under the fill as outside the fill. This suggests selenium does leach down from the landfill but is being moved out and is not being held by the soil.

At site B, manganese, arsenic, copper, lead and zinc all showed significant positive correlations with sample elevation. The positive correlations together with the increased levels occurring under the landfill suggest that these constituents are being added to the soil under the landfill and are being retained.

At site C, iron, manganese, and beryllium showed significant positive correlations with sample elevation in borings below the landfill. The increased concentration of these metals under the landfill and the increasing concentrations upward suggest these metals are being leached from the landfill and held by the sub-landfill soil. Nickel and zinc showed a significantly larger concentration of metal under the landfill; but an increasing concentration downward suggests they are leaching from sub-refuse soil.

The ability of landfills to generate metal-rich leachates and the capacity of soils to retain these metals varies greatly from site to site. For the three sites studied, iron, manganese, arsenic, boron, beryllium, copper, lead, selenium and zinc all showed evidence of being derived from the landfills. Selenium, while it did appear to be most available immediately below the landfill at site A, was present in the samples in concentrations below that seen in surrounding soils of comparable depths indicating it was being leached from the landfill; but not being held by soil effectively. At site C, there is an indication that zinc and nickel were present in larger quantities under the landfill than in the area outside the landfill; but both metals showed increasing concentration with increasing depth suggesting they are being moved down into the soil.

Horizontal Variation in Nitric Acid Digests of Sediment/Soil Samples Near the Water Table

The model developed for leachate movement indicates that the major horizontal movement of contaminants from leachate takes place below the water table. If a contaminant is being added to the local soil or sediment by the landfill the highest concentrations should be in the soil below the landfill. Lower concentrations should be found in soil below the water table down the groundwater gradient from the landfill. This decrease in concentration is related to the filtration, absorption or precipitation occurring in the soil or sediment as the groundwater flow moves the leachate away from the landfill. Samples of geologic materials (sediments or soils) were digested to determine if any pattern of contaminant concentration could be related to the direction of movement of groundwater.

At site A, the samples collected near the water table in borings 6 and 7 (downgradient) are from a sandstone unit below the glacial valley-fill material thus some influence of the changing nature of the sediment may be

expected in these acid digests. At site C, one sample taken upgradient (boring 4) and one sample taken downgradient (boring 7) were taken from the surface of the underlying schist. Digests from this less-weathered metamorphic rock would be expected to differ considerable from that of the soil produced by the weathering of the rock. At these two sites some reservations must be taken with regard to interpreting the variation in chemistry as due solely to the influence of the landfill.

The small number of samples precluded use of statistical comparison techniques. Graphs showing the concentration of various metals versus the relative positions of the borings with respect to the landfill are given in Figures 35-37.

At site A, maximum concentrations of manganese, boron, cadmium, chromium, copper, nickel, lead, selenium and zinc occurred in samples taken under the landfill. Samples taken at or near the water table downdip showed decreasing amounts of these constituents. Arsenic is the only contaminant that showed a maximum concentration in a downdip boring.

At site B, iron, arsenic, beryllium, cadmium, mercury, selenium and zinc all reached maximum concentrations in samples collected under the landfill. Manganese, boron, chromium, copper, nickel and lead all reach maximum concentrations in borings downdip from the landfill.

At site C, iron, boron, cadmium, nickel, selenium, and zinc all reached maximum concentrations in samples collected under the landfill. Manganese, arsenic, copper, mercury and lead all reached maximum concentrations in samples collected downdip from the landfill. Beryllium and chromium were found in their greatest concentrations in samples taken updip from the landfill.

A pattern can be observed in the location of concentration maxima. At all three sites the maximum concentration of arsenic is displayed downdip. At two sites (B and C) maximum concentrations for manganese, copper and lead were found in downdip borings.

DISCUSSION

Physical testing showed no consistent attribute in the soil/sediment samples collected at the landfill sites that could be related to the presence of the landfilled refuse. There was no detectable change in density, permeability, grain size distribution or water content that could be shown to be a response to the movement of leachate. Griffin and others (15) showed that changes in permeability could be observed in experimental columns filled with clay and then subjected to landfill leachate. Permeability changes that occurred probably involved a relatively small volume of the soil at the very top of the soil column. However, in this investigation, field conditions did not always permit recovery of the sample which included only the interface between the refuse and soil/sediment.

Extending the model, the chemical behavior of contaminants in soil under ideal conditions can be broken into three basic types of interactions: flow through, attenuation and mobilization. Flow through is essentially that

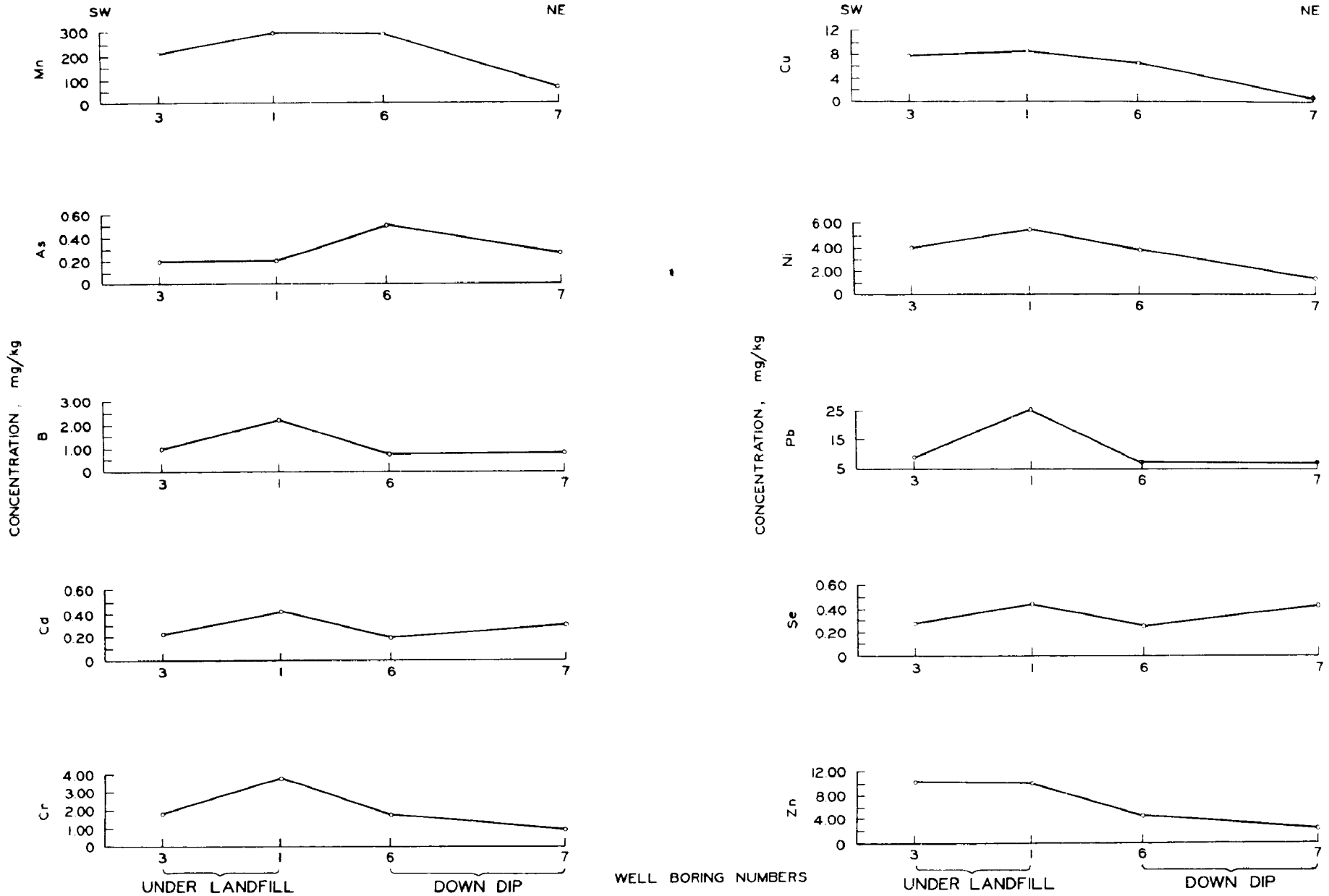


Figure 35. Horizontal variation in chemical composition of nitric acid digests at site A.

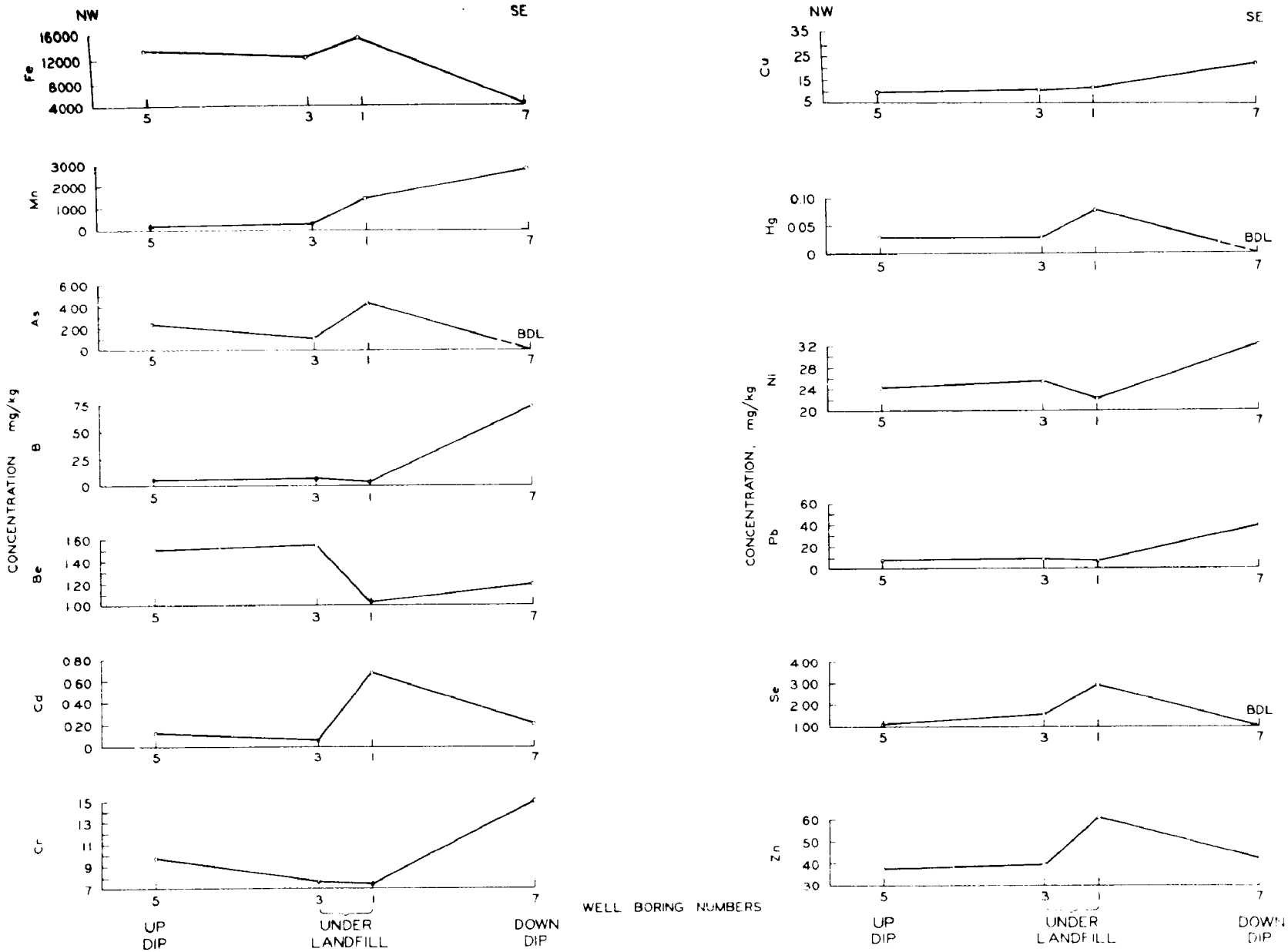


Figure 36. Horizontal variation in chemical composition of nitric acid digests at site B. BDL indicates below detection limits.

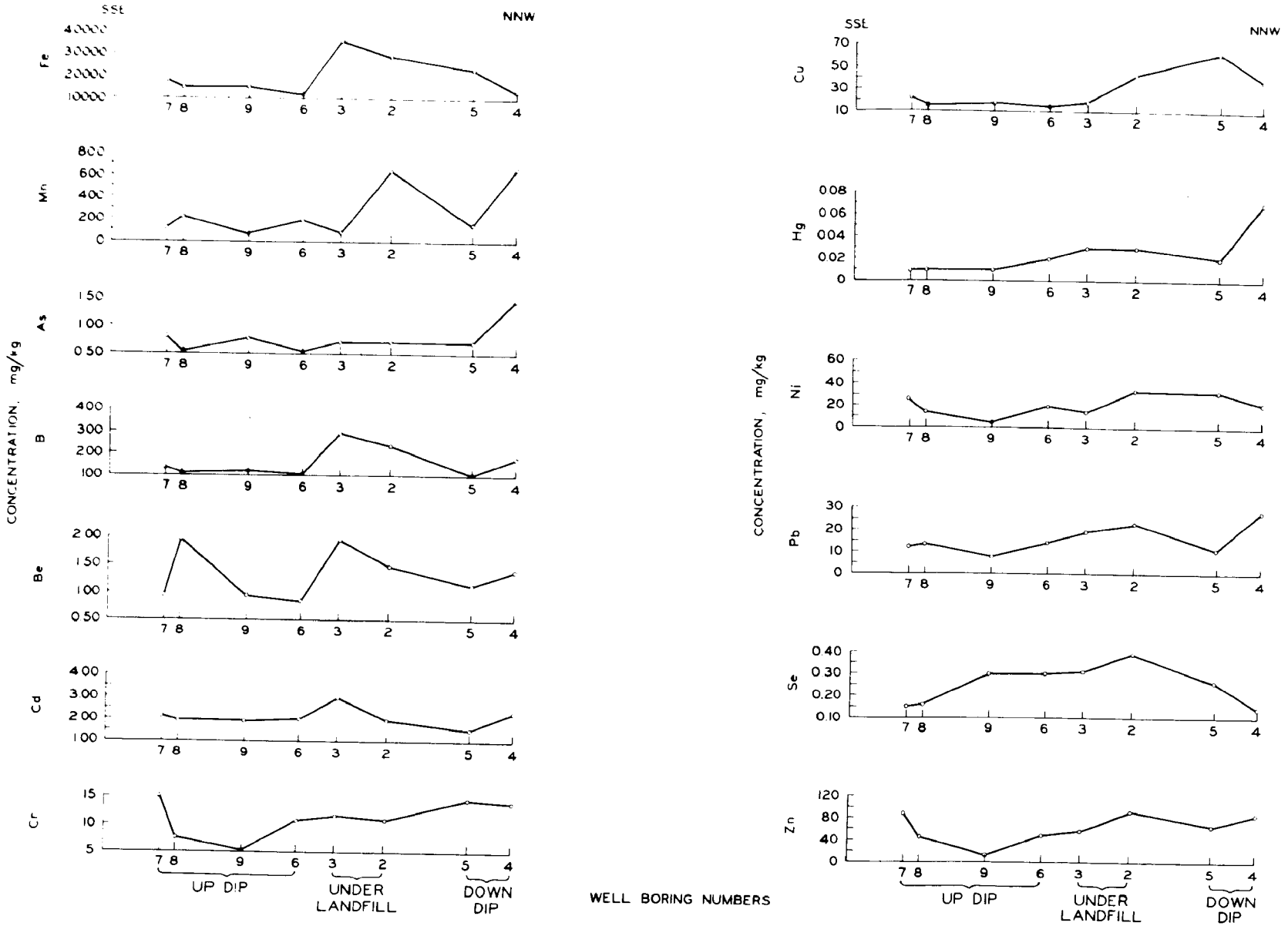


Figure 37. Horizontal variation in chemical composition of nitric acid digests at site C.

where negligible chemical interaction takes place. The porous matrix (soil) is inert and does not effectively filter, absorb or precipitate the contaminants. Therefore, no changes can be detected in the composition of the soil. Cases in which the difference in concentration of contaminants in the nitric acid digests of the soil samples varied less than 25% between samples inside the landfill and outside were judged to be examples of "flow through". The instances of "flow through" are indicated in Table 35 (samples marked "X" in nitric acid digest column). At all three sites cadmium and chromium had essentially the same concentrations in the nitric acid digests of soil inside and outside the landfill. Similarly, nickel (sites A and B), boron (sites B and C), selenium (sites A and B), beryllium (site B), copper (site A), manganese (site A) and mercury (site A) were found in equal concentrations. In most of these cases, the metals are also found in higher concentrations in groundwater collected under the refuse as would be expected. Earlier investigations (15) have indicated that attenuation should be effective in removing toxic metals, the analyses of soil digests given here do not demonstrate a trapping mechanism for most contaminants.

A second type of interaction takes place when the soil removes contaminants by filtration, absorption and/or precipitation. The ability of soil to attenuate contaminants in this manner is limited by the capacity of the soil to contain pollutants. Up to the time when the capacity is reached, the amount of contaminant in the soil increases while the amount passing through to the groundwater is lessened (Table 35). Therefore, the nitric acid digest analyses should show higher levels of contaminants under the refuse and the concentrations in groundwater under and outside the landfill should be nearly equal. After the capacity of the soil for attenuating the contaminant has been reached, concentrations of these contaminants in the groundwater should increase.

Examples of attenuation where soil capacity has not been reached and groundwater concentrations have not increased are beryllium (sites A and C), arsenic (site A), copper (site B) and mercury (site C). Examples of cases where the capacity of the soil to attenuate the contaminant has been reached or exceeded (concentrations in the groundwater have increased under the refuse) are zinc (all three sites), iron and manganese (sites B and C), lead (sites A and C), arsenic (site B), boron (site A) and nickel (site C).

The third possible interaction is the mobilization of soil constituents by the acids typically occurring in the leachate from the refuse. This action brings materials into solution that would normally remain fixed in the soil and brings about a lower concentration of the material in the nitric acid digests of the soil samples from under the landfill when compared with those outside the landfill (Table 35). Only arsenic at site C showed a distribution pattern in the nitric acid digest and the groundwater that would indicate mobilization is occurring.

In some of the samples where attenuation was indicated, this trend was further substantiated by the decreased extractability (into distilled water) observed in samples collected underneath the landfill. While this decreased extractability was not observed in all cases, it might be a useful indicator of the formation of highly insoluble phases during attenuation.

TABLE 35. COMPARISON OF AVERAGE CHEMICAL COMPOSITION OF GROUNDWATER AND SOIL SAMPLES FROM EXPERIMENTAL AND CONTROL BORINGS FOR ALL SITES

Chemical constituents	Site A Groundwater	Site A distilled* water extract	HNO_3* digest	Site B Groundwater	Site B distilled water extract	HNO_3 digest	Site C Groundwater	Site C distilled water extract	HNO_3 digest
SO_4	+	X	ND	+	BDL	ND	+	-	ND
SO_3	BDL	BDL	ND	+	BDL	ND	BDL	BDL	ND
Cl	+	BDL	ND	+	BDL	ND	+	+	ND
NO_3-N	+	+	ND	-	-	ND	-	-	ND
NO_2-N	+	BDL	ND	BDL	BDL	ND	BDL	BDL	ND
CN	+	BDL	ND	+	+	ND	+	BDL	ND
TOC	+	+	ND	+	+	ND	+	+	ND
Ca	+	X	ND	+	+	ND	+	-	ND
Fe	+	ND	ND	+	+	+	+	-	+
Mg	+	+	ND	+	X	ND	+	X	ND
Mn	+	BDL	X	+	+	+	+	-	+
Na	+	+	ND	+	+	ND	+	+	ND
As	X	+	+	+	ND	+	+	ND	-
B	+	BDL	+	X	+	X	+	+	X
Be	-	BDL	+	+	BDL	X	+	BDL	+
Cd	+	BDL	X	X	BDL	X	+	BDL	X
Cr	-	+	X	X	+	X	BDL	BDL	X
Cu	X	+	X	X	BDL	+	BDL	BDL	+
Hg	BDL	ND	BDL	-	ND	X	-	ND	+
Ni	+	+	X	+	-	X	+	-	+
Pb	+	BDL	+	BDL	BDL	+	+	ND	+
Se	BDL	BDL	X	+	ND	X	BDL	ND	+
Zn	+	+	+	+	BDL	+	+	-	+

+ = >125% of average control sample.

X = 75% to 125% of average control sample.

- = <75% of average control sample.

BDL = More than one half samples below detection limits.

ND = Not determined.

* Note that soil samples used in averages were those at the interface between refuse and subsoil, and comparable levels outside the landfill.

If the number of metals found in greater abundance in the nitric acid digest from samples taken directly under the landfill is used as an index of overall attenuation; site C shows the most active attenuation. Site B and site A rank second and third respectively, although they are nearly identical.

The character of the soil/sediment in the area of attenuation and the chemical activity within the refuse leachate appear to be of prime importance in the attenuation process. In the present study, the poorest attenuation was associated with an older site having coarse sandy material under the landfill. The most effective attenuation appears in a landfill that is relatively young and underlain by fine-grained material. The high rate of microbial activity associated with this younger landfill should produce a large quantity of hydrogen sulfide in the leachate and precipitate the chalcophile elements (i.e., those having an affinity for sulfur) such as iron, nickel, copper, zinc, mercury and lead.

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APPENDIX A

SUB-SURFACE INFORMATION FOR SITE A

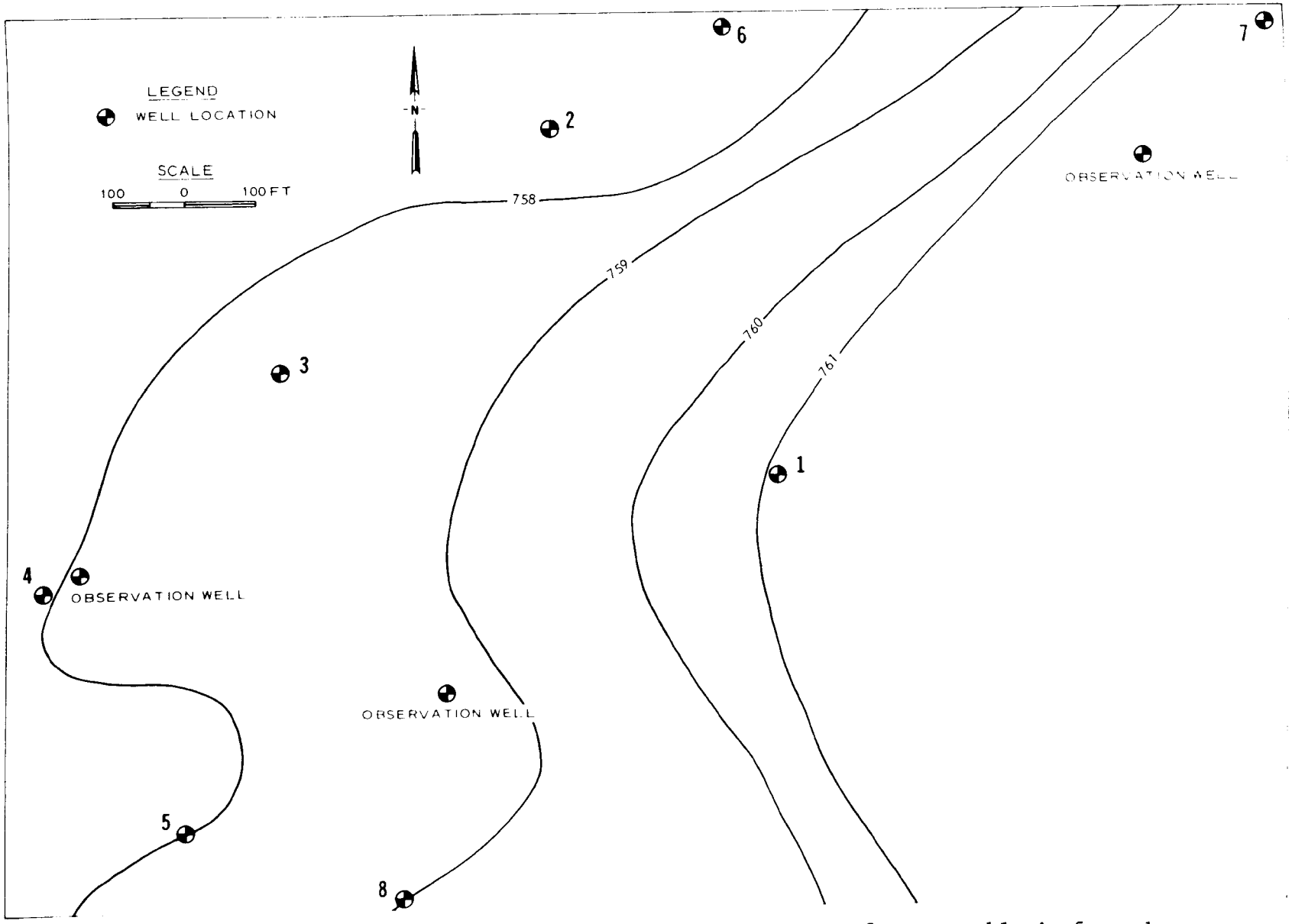


Figure A-1. Water table map of site A (contour lines are elevation of water table in feet above mean sea level). 0.305 m = 1 ft.

TABLE A-1. LOG OF BORING 1 AT SITE A

Elevation above MSL* (m)	Depth (m)	Description
257.96 - 257.29	0.0 - 0.67	Cover material (sand with some large gravel)
257.29 - 250.76	0.67 - 7.20	Fill
250.76 - 247.08	7.20 - 10.88	Sand (SP) medium, light brown with traces of small gravel
247.08 - 235.58	10.88 - 22.38	Sand (SP) medium, light brown
235.58 - 232.53	22.38 - 25.43	Sand (SP) medium to coarse tan with scattered gravel
232.53 - 229.88	25.43 - 28.08	Sand (SP) fine, tan with orange streaks

* MSL = mean sea level

Water table elevation above MSL = 232.53 m

TABLE A-2. LOG OF BORING 2 AT SITE A

Elevation above MSL* (m)	Depth (m)	Description
257.00 - 255.78	0.0 - 1.22	Cover material (sand (SP)) medium to coarse, some gravel
255.78 - 251.24	1.22 - 5.76	Waste
251.24 - 250.32	5.76 - 6.68	Sand (SP) medium, light brown
250.32 - 247.58	6.68 - 9.42	Sand (SP) medium to coarse, light brown with gravel
247.58 - 230.5	9.42 - 26.50	Sand (SP) medium to coarse light brown with gravel

Water table elevation above MSL = 231.01 m

TABLE A-3. LOG OF BORING 3 AT SITE A

Elevation above MSL (m)	Depth (m)	Description
258.57 - 255.52	0.0 - 3.05	Cover material (sand (SP)) medium to coarse brown
255.52 - 250.71	3.05 - 7.86	Fill
250.71 - 236.31	7.86 - 22.26	Sand (SP), medium to coarse, brown with gravel
236.31 - 229.97	22.26 - 28.60	Gravely sand (SP) medium to coarse, brown

Water table elevation above MSL = 231.22 m

TABLE A-4. LOG OF BORING 4 AT SITE A

Elevation above MSL (m)	Depth (m)	Description
253.60 - 249.49	0.0 - 4.11	Sand (SP) medium to coarse, light brown
249.49 - 247.35	4.11 - 6.25	Sand (SP) medium, brown with some gravel
247.35 - 242.78	6.25 - 10.82	Sand (SP) fine to medium, light brown
242.78 - 241.80	10.82 - 11.80	Sandy gravel (GP), light brown
241.80 - 236.99	11.80 - 16.61	Sand (SP) medium to coarse, light brown with some gravel
236.99 - 236.38	16.61 - 17.22	Sandy gravel (GP), light brown
236.38 - 230.12	17.22 - 23.48	Gravelly sand (SP), medium to coarse

Water table elevation above MSL = 230.91 m

TABLE A-5. LOG OF BORING 5 AT SITE A

Elevation above MSL (m)	Depth (m)	Description
255.02 - 241.91	0.0 - 13.11	Sand (SP), medium to coarse, light brown with gravel
241.91 - 237.18	13.11 - 17.84	Sand (SP), medium to coarse, light brown
237.18 - 236.57	17.84 - 18.45	Gravelly sand (SP), brown
236.57 - 236.06	18.45 - 18.96	Sand (SP), medium to coarse, light brown
236.06 - 231.24	18.96 - 23.78	Sand (SP), medium to coarse, light brown with gravel
231.24 - 230.23	23.78 - 24.79	Sand (SP), medium to coarse, brown

Water table elevation above MSL = 231.10 m

TABLE A-6. LOG OF BORING 6 AT SITE A

Elevation above MSL (m)	Depth (m)	Description
256.01 - 255.77	0.0 - 0.24	Sand (SP) fine-medium, dark brown
255.77 - 254.33	0.24 - 1.68	Sand (SP), fine-medium, brown
254.33 - 242.23	1.68 - 13.78	Sand (SP) medium-coarse, brown with gravel
242.23 - 232.08	13.78 - 23.93	Sand (SP), medium-coarse, light brown scattered small gravel
232.08 - 231.47	23.43 - 24.54	Gravelly sand (SP), brown
231.47 - 231.16	24.54 - 24.85	Sand (SP), medium-coarse, light brown, with gravel
231.16 - 231.10	24.85 - 24.91	Sandstone, tan
231.10 - 229.95	24.91 - 26.06	Sand (SP), medium, brown

Water table elevation above MSL = 231.10 m

TABLE A-7. LOG OF BORING 7 AT SITE A

Elevation above MSL (m)	Depth (m)	Description
255.64 - 254.73	0.0 - 0.91	Sand (SP), fine-medium, dark brown
254.73 - 252.60	0.91 - 3.04	Sand (SP), fine-medium, brown
252.60 - 250.82	3.04 - 4.82	Sand (SP), coarse, light brown with gravel
250.82 - 250.30	4.82 - 5.34	Sand (SP), medium-coarse, light brown
250.30 - 247.16	5.34 - 8.48	Gravelly sand (SP), medium-coarse, brown
247.16 - 240.40	8.48 - 15.24	Sand (SP), medium-coarse, brown with gravel
240.40 - 238.87	15.24 - 16.77	Sandy gravel (GP), brown
238.87 - 237.20	16.77 - 18.44	Sand (SP), medium-coarse, light brown with gravel
237.20 - 235.52	18.44 - 20.12	Sandstone, tan
235.52 - 233.08	20.12 - 22.56	Sand, fine-medium, light brown

Water table elevation above MSL = 235.52 m

TABLE A-8. LOG OF BORING 8 AT SITE A

Elevation above MSL (m)	Depth (m)	Description
265.04 - 264.28	0.0 - 0.76	Sand (SP), fine, dark brown
264.28 - 264.13	0.76 - 0.91	Sand (SP), medium, brown with gravel
264.13 - 258.94	0.91 - 6.10	Sand (SP), coarse, brown with gravel
258.94 - 249.10	6.10 - 15.94	Sand (SP), medium-coarse, brown, trace of gravel
249.10 - 242.18	15.94 - 22.86	Sand (SP), medium-coarse, brown, with gravel
242.18 - 241.72	22.86 - 23.32	Sandy gravel (GP), brown
241.72 - 231.35	23.32 - 33.69	Sand (SP), medium-coarse, brown with gravel
231.35 - 230.34	33.69 - 34.7	Sand (SP), medium-coarse, light brown

Water table elevation above MSL = 235.52 m

TABLE A-9. LIST OF SAMPLES EXAMINED FROM SITE A

Boring	Elevation of top of hole (m)	Elevation of water table (m)	Total depth (m)	Thickness of cover (m)	Thickness of refuse (m)	Elevation MW/soil interface (m)	Sampled depth interval (m) From	To	Elevation of sampled intervals (m) From	To	Type of sample	Sample number
1	257.96	232.53	28.26	0.67	6.52	250.77	7.20	7.70	250.76	250.26	physical	1C1
							7.37		250.59		chemical	1C2
							8.19		249.77		chemical	1C3
							10.38		247.58		chemical	1C4
							10.94	11.64	247.02	246.32	physical	1P1
							15.88		242.08		chemical	1C5
							22.65	22.84	235.31	235.12	physical	1P2
							23.15		234.81		chemical	1C6
							27.13		230.83		chemical	1C7
							27.13		230.83		chemical	1C8
2	257.01	231.01	29.52	1.22	4.85	250.94	6.03		250.98		chemical	2C1
							6.25	6.68	250.76	250.33	physical	2P1
							6.87		250.14		chemical	2C2
							6.92	7.44	250.09	249.57	physical	2P2
							8.81	9.42	248.20	249.59	physical	2P3
							9.02		247.99		chemical	2C3
							13.87	14.39	243.14	242.62	physical	2P4
							14.01		243.00		chemical	2C4
							19.51	19.87	237.50	237.14	physical	2P5
							19.90		237.11		chemical	2C5
							24.39	24.94	232.62	232.07	physical	2P6
							24.93		232.08		chemical	2C6
3	258.57	231.22	31.80	3.05	4.82	250.70	7.86	8.32	250.71	250.25	physical	3P1
							8.04		250.53		chemical	3C1
							9.04		249.53		chemical	3C2

(continued)

TABLE A-9. (continued)

Boring	Elevation of top of hole (m)	Elevation of water table (m)	Total depth (m)	Thickness of cover (m)	Thickness of refuse (m)	Elevation MW/soil interface (m)	Sampled depth interval(m) From	To	Elevation of sampled intervals(m) From	To	Type of sample	Sample number
							10.82	11.25	247.75	247.32	physical	3P2
							17.97		240.60		chemical	3C3
							18.30		240.27		chemical	3C4
							22.25	22.53	236.32	236.04	physical	3P3
							22.85		235.72		chemical	3C5
							27.84		230.73		chemical	3C6
4	253.60	230.91	23.48	NA	NA	NA	3.20	3.90	250.4	249.7	physical	4P1
							6.25	6.62	247.35	246.98	physical	4P2
5	257.15	231.10	24.79	NA	NA	NA	4.57	5.29	252.58	251.86	physical	5P1
							7.62	8.20	249.53	248.95	physical	5P2
							18.44	18.83	238.71	238.32	physical	5P3
6	256.01	231.10	26.06	NA	NA	NA	4.72	5.33	251.29	250.69	physica	6P1
							4.92		251.09		chemical	6C1
							5.81		250.20		chemical	6C2
							7.77	8.42	248.24	247.59	physical	6P2
							7.93		248.08		chemical	6C3
							13.96		242.05		chemical	6C4
							19.00	19.48	237.01	236.53	physical	6P3
							19.15		236.86		chemical	6C5
							25.17		230.84		chemical	6C6
7	255.64	235.52	22.56	NA	NA	NA	4.42	4.76	251.22	250.88	physical	7P1
							5.15		250.44		chemical	7C1
							5.49		250.15		chemical	7C2
							7.65		247.99		chemical	7C3
							7.77	8.26	247.87	247.38	physical	7P2
							13.26	13.75	242.38	241.89	physical	7P3

(continued)

TABLE A-9. (concluded)

Boring	Elevation of top of hole (m)	Elevation of water table (m)	Total depth (m)	Thickness of cover (m)	Thickness of refuse (m)	Elevation MW/soil interface (m)	Sampled depth interval(m) From	To	Elevation of sampled intervals(m) From	To	Type of sample	Sample number
							13.41		242.23		chemical	7C4
							19.27		236.37		chemical	7C5
							22.32		233.32		chemical	7C6
8	265.04	231.37	34.70	NA	NA	NA	14.32	15.03	250.72	250.01	physical	8P1
							17.38	17.96	247.66	247.08	physical	8P2
							28.65	28.99	236.39	236.05	physical	8P3

NA = not applicable

APPENDIX B

SUB-SURFACE INFORMATION FOR SITE B

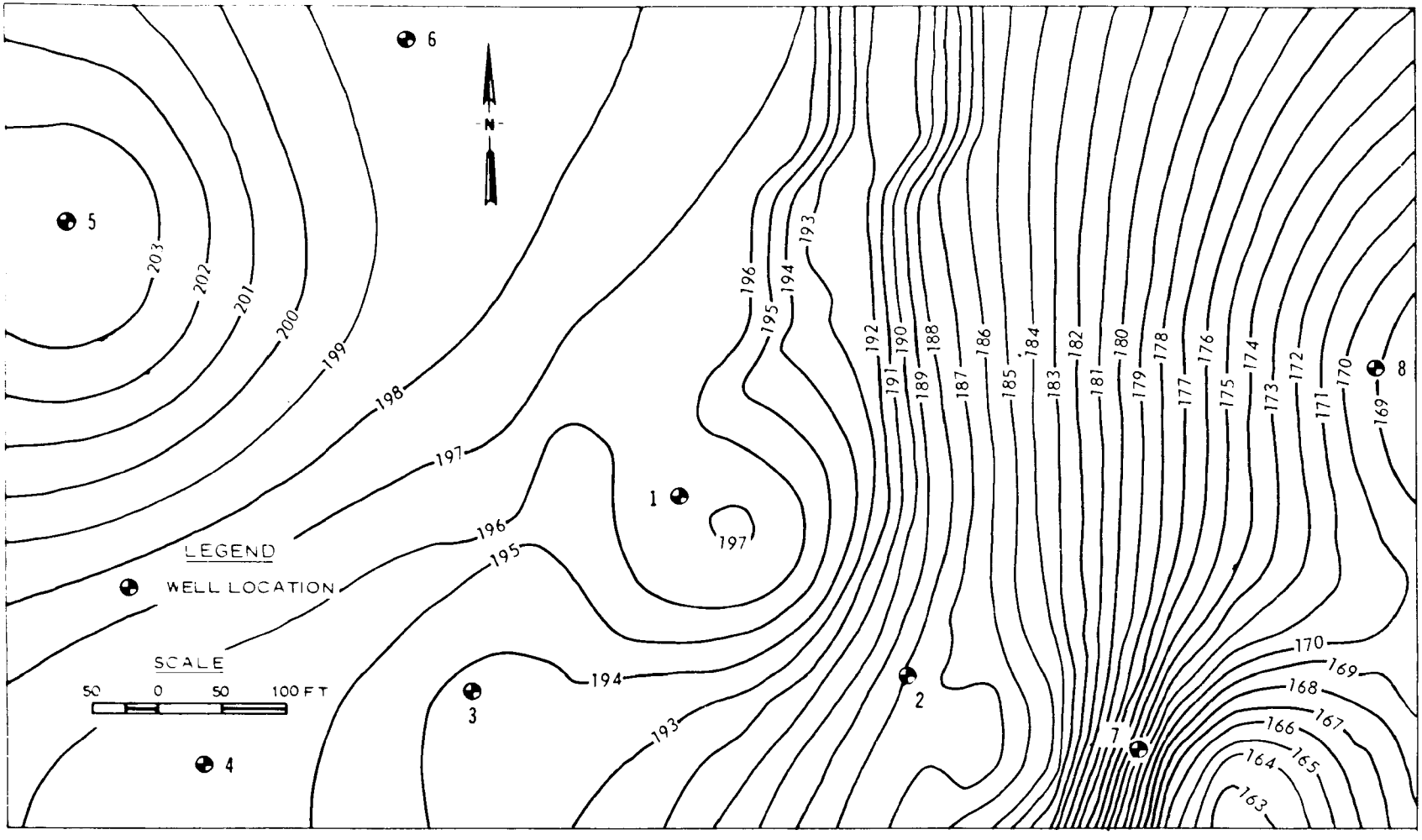


Figure B-1. Water table map of site B (contour lines are elevation of water table in feet above mean sea level). 0.305 m = 1 ft.

TABLE B-1. LOG OF BORING 1 AT SITE B

Elevation above MSL(m)	Depth (m)	Description
60.15 - 54.27	0.0 - 5.88	Refuse
54.27 - 51.74	5.88 - 8.41	Clayey silt (ML), gray
51.74 - 51.03	8.41 - 9.12	Silty clay (CL), gray

Water table elevation above MSL = 54.34 m

TABLE B-2. LOG OF BORING 2 AT SITE B

Elevation above MSL(m)	Depth (m)	Description
57.20 - 57.9	0.0 - 0.30	Backfill
57.90 - 54.46	0.30 - 2.74	Refuse
54.46 - 51.41	2.74 - 5.79	Clayey silt (ML), gray
51.41 - 48.05	5.79 - 9.15	Clayey silt (ML), tan

Water table elevation above MSL = 50.94 m

TABLE B-3. LOG OF BORING 3 AT SITE B

Elevation above MSL (m)	Depth (m)	Description
58.96 - 58.66	0.0 - 0.30	Topsoil
58.66 - 56.74	0.30 - 2.22	Refuse
56.74 - 56.22	2.22 - 2.74	Silt (ML), gray
56.22 - 52.86	2.74 - 6.10	Silt (ML), tan, wet

Water table elevation above MSL = 53.23 m

TABLE B-4. LOG OF BORING 4 AT SITE B

Elevation above MSL (m)	Depth (m)	*Description*
59.51 - 55.24	0.0 - 4.27	Silt (ML), tan
55.24 - 51.89	4.27 - 7.62	Silt (ML), tan and grayish tan, wet

Water table elevation above MSL = 53.84 m

TABLE B-5. LOG OF BORING 5 AT SITE B

Elevation above MSL (m)	Depth (m)	Description
62.20 - 57.63	0.0 - 4.57	Silt (ML), tan
57.63 - 54.58	4.57 - 7.62	Silt (ML), tan, wet
54.58 - 52.44	7.62 - 9.76	Silt (ML), tan with gray specks, wet

Water table elevation above MSL = 53.35 m

TABLE B-6. LOG OF BORING 6 AT SITE B

Elevation above MSL (m)	Depth (m)	Description
60.52 - 54.42	0.0 - 6.10	Silt (ML), tan
54.42 - 51.37	6.10 - 9.15	Silt (ML), tan and gray
51.37 - 49.54	9.15 - 10.98	Silt (ML), tan with shells

Water table elevation above MSL = 50.15 m

TABLE B-7. LOG OF BORING 7 AT SITE B

Elevation above MSL (m)	Depth (m)	Description
49.42 - 48.81	0.0 - 0.61	Refuse
48.81 - 45.91	0.61 - 3.51	Silt (ML), gray
45.91 - 41.80	3.51 - 7.62	Silt (ML) tan, moist

Water table elevation above MSL = 42.10 m

TABLE B-8. LOG OF BORING 8 AT SITE B

Elevation above MSL (m)	Depth (m)	Description
50.91 - 46.34	0.0 - 4.57	Silt (ML)
46.34 - 43.29	4.57 - 7.62	Silt (ML), gray, wet
43.29 - 43.08	7.62 - 7.83	Silt (ML), tan
43.08 - 42.65	7.83 - 8.26	Silt (ML), light gray with shells

Water table elevation above MSL = 45.61 m

TABLE B-9. LIST OF SAMPLES EXAMINED FROM SITE B

Boring	Elevation of top of hole (m)	Elevation of water table (m)	Total depth (m)	Thickness of cover (m)	Thickness of refuse (m)	Elevation MW*/soil interface (m)	Sampled depth interval(m) From	To	Elevation of sampled intervals(m) From	To	Type of sample	Sample number
1	60.15	54.36	9.14	0.0	4.88	55.27	4.22		55.93		chemical	1C1
							6.09		54.06		chemical	1C2
							6.25	6.37	53.90	53.78	physical	1P1
							8.41	8.87	51.74	51.28	physical	1P2
2	57.20	50.94	9.14	0.3	2.44	54.46	0.43		56.77		chemical	2C1
							1.35		55.85		chemical	2C2
							3.48		53.72		chemical	2C3
							3.66	4.15	53.54	53.05	physical	2P1
							5.79	6.52	51.41	50.68	physical	2P2
3	58.96	53.23	6.10	0.3	1.92	56.74	2.22		56.74		chemical	3C1
							3.22		55.74		chemical	3C2
							5.46		53.50		chemical	3C3
4	59.51	53.84	7.62	NA	NA	NA**	--		--		--	--
5	62.20	53.35	9.76	NA	NA	NA	0.20		55.28		chemical	5C1
							0.92		54.38		chemical	5C2
							3.05		52.44		chemical	5C3
6	60.52	50.15	10.98	NA	NA	NA	5.9		54.26		chemical	6C1
							6.10	6.77	54.42	53.75	physical	6P1
							7.17		53.35		chemical	6C2
							9.15	9.85	51.37	50.67	physical	6P2
							9.30		51.22		chemical	6C3
7	49.42	42.10	7.62	0.0	0.61	0.61	4.57	5.27	44.85	44.15	physical	7P1
							7.42		42.00		chemical	7C1
8	50.91	45.61	8.26	NA	NA	NA	6.10	6.68	44.81	44.23	physical	8P1

* municipal waste
** not applicable
-- no sample selected

APPENDIX C

SUB-SURFACE INFORMATION FOR SITE C

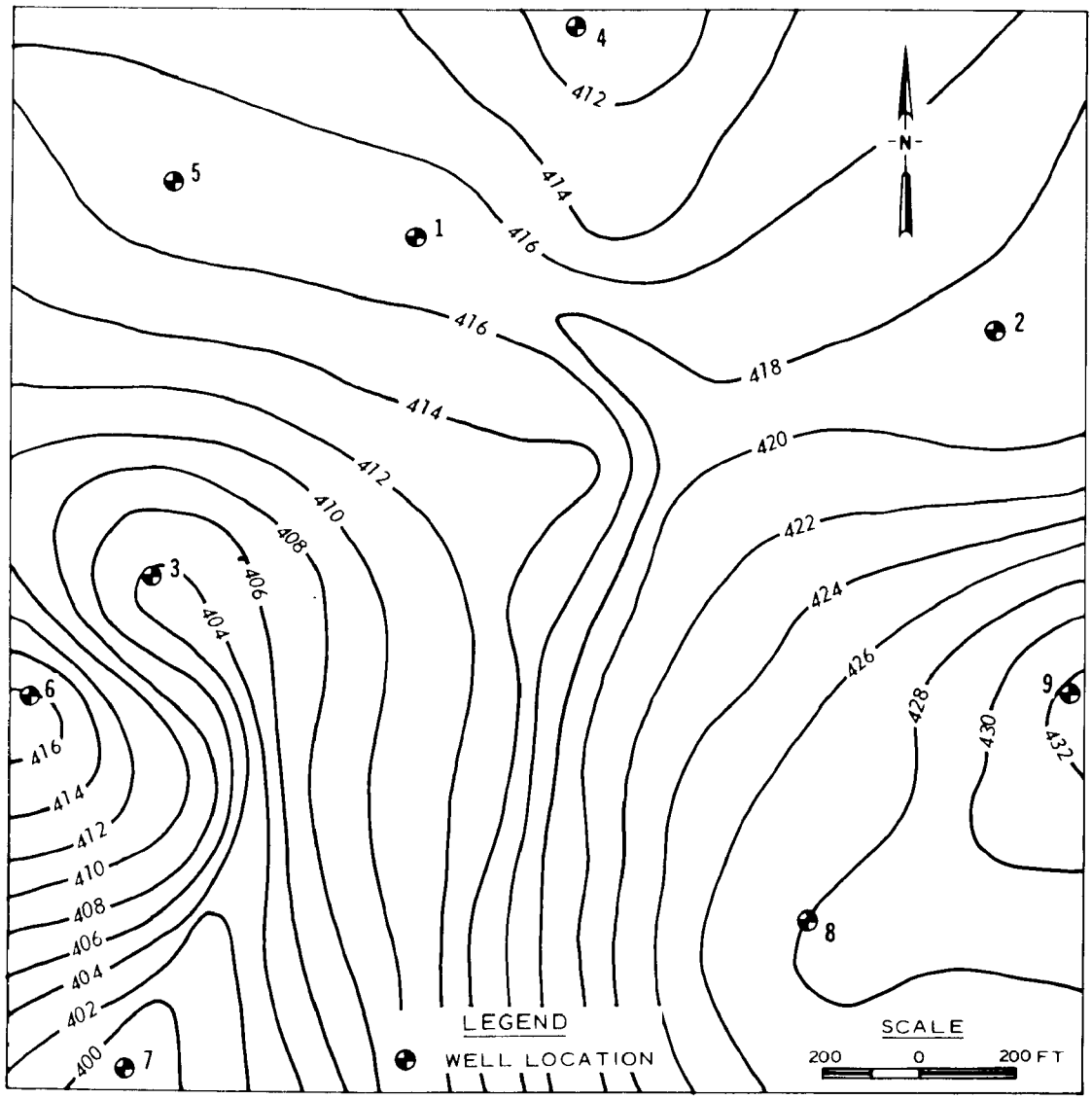


Figure C-1. Water table map of site C (contour lines are elevation of water table in feet above mean sea level). 0.305 m = 1 ft.

TABLE C-1. LOG OF BORING 1 AT SITE C

Elevation above MSL* (m)	Depth (m)	Description
157.40-156.49	0.0 - 0.91	Clay (cover material)
156.49-131.79	0.91-25.61	Refuse
131.79-131.33	25.61-26.07	Silt (ML), tan
131.33-128.38	26.07-29.02	Silt (ML), red
128.38-124.78	29.02-32.62	Silty sand (SM), brown
124.78	32.62	Schist

* MSL = mean sea level

Water table elevation above MSL = 127.01 m

TABLE C-2. LOG OF BORING 2 AT SITE C

Elevation above MSL (m)	Depth (m)	Description
145.85-144.63	0.0 - 1.22	Clay (cover material)
144.63-139.75	1.22- 6.10	Refuse
139.75-137.31	6.10- 8.54	Saturated fill
137.31-128.17	8.54-17.68	Refuse very wet
128.17-126.64	17.68-19.21	Silty sand (SM)
126.64-123.26	19.21-22.59	Sandy silt (ML)

Water table elevation above MSL = 127.26 m

TABLE C-3. LOG OF BORING 3 AT SITE C

Elevation above MSL (m)	Depth (m)	Description
145.58-145.28	0.0 - 0.30	Cover material
145.28-125.61	0.30-19.97	Refuse
125.61-124.70	19.97-20.88	Clayey sandy silt (ML), light green
124.70-123.32	20.88-22.26	Sandy silt (ML), brown with gravel
123.32-122.72	22.26-22.86	Sandy silt (ML), brown

Water table elevation above MSL = 123.02 m

TABLE C-4. LOG OF BORING 4 AT SITE C

Elevation above MSL (m)	Depth (m)	Description
136.43-135.39	0.0 - 1.04	Backfill
135.39-130.33	1.04- 6.10	Clayey sandy silt (ML), brown
130.33-125.36	6.10-11.07	Sandy silt (ML), brown
125.36-124.91	11.07-11.52	Highly weathered schist

Water table elevation above MSL = 125.40 m

TABLE C-5. LOG OF BORING 5 AT SITE C

Elevation above MSL (m)	Depth (m)	Description
131.61-131.00	0.0 -0.61	Backfill
131.00-130.09	0.61-1.52	Silty clay (CL), dark gray
130.09-127.95	1.52-3.66	Silty clay (CL), tan
127.95-127.04	3.66-4.57	Sandy silt (ML), red, tan
127.04-126.31	4.57-5.30	Sandy silt (ML), red and tan, wet

Water table elevation above MSL = 127.04 m

TABLE C-6. LOG OF BORING 6 AT SITE C

Elevation above MSL (m)	Depth (m)	Description
133.81-132.90	0.0 -0.91	Silty clay (CL), brown
132.90-130.76	0.91-3.05	Clayey sandy silt (ML), tan
130.76-126.71	3.05-7.01	Sandy silt (ML), brown

Water table elevation above MSL = 6.77 m

TABLE C-7. LOG OF BORING 7 AT SITE C

Elevation above MSL (m)	Depth (m)	Description
125.27-122.83	0.0 -2.44	Sandy silt (ML), reddish brown
122.83-121.92	2.44-3.35	Sandy silt (ML) brown, damp
121.92-121.64	3.35-3.63	Silty sand (SM) fine, green

Water table elevation above MSL = 121.71 m

TABLE C-8. LOG OF BORING 8 AT SITE C

Elevation above MSL (m)	Depth (m)	Description
132.38-131.47	0.0 -0.91	Clayey silt (ML), tan with gravel
131.47-130.25	0.91-2.13	Clayey silt (ML), brown
130.25-129.18	2.13-3.20	Sandy silt (ML), brown

Water table elevation above MSL = 130.55 m

TABLE C-9. LOG OF BORING 9 AT SITE C

Elevation above MSL (m)	Depth (m)	Description
145.55-142.70	0.0 - 3.35	Sandy silt (ML), reddish brown
142.70-133.90	3.35-11.65	Sandy silt (ML), brown
133.90-131.53	11.65-14.02	Silty sand (SM), brown

Water table elevation above MSL = 131.95 m

TABLE C-10. LIST OF SAMPLES EXAMINED FROM SITE C

Boring	Elevation of top of hole (m)	Elevation of water table (m)	Total depth (m)	Thickness of cover (m)	Thickness of refuse (m)	Elevation MW/soil interface (m)	Sampled depth interval (m) From	To	Elevation of sampled intervals (m) From	To	Type of sample	Sample number
1	157.41	127.01	32.62	0.91	24.70	131.80	25.91	26.36	131.50	131.05	physical	1P1
									131.41		chemical	1C1
									130.48		chemical	1C2
							28.96	29.40	128.45	128.01	physical	1P2
									128.34		chemical	1C3
2	145.85	127.26	22.59	1.22	16.46	128.17	18.29	18.96	127.56	126.89	physical	2P1
							18.39		127.46		chemical	2C1
							19.30		126.55		chemical	2C2
							21.44		124.41		chemical	2C3
							22.26	22.59	123.59	122.92	physical	2P2
3	145.58	123.02	22.36	0.30	19.66	125.62	19.97	20.46	125.61	125.12	physical	3P1
							20.08		125.50		chemical	3C1
							21.01		124.57		chemical	3C2
							22.28		123.20		chemical	3C3
							22.47	22.92	123.11	122.66	physical	3P2
4	136.46	125.40	11.52	NA	NA	NA	1.70	2.03	134.76	134.43	physical	4P1
							8.49	8.76	127.97	127.70	physical	4P2
							11.72		124.74		chemical	4C1
5	131.62	127.04	5.18	NA	NA	NA	4.7		126.92		chemical	5C1
6	133.81	127.04	7.01	NA	NA	NA	0.91	1.46	132.90	132.35	physical	6P1
							1.35		132.46		chemical	6C1
							2.27		131.54		chemical	6C2
							4.40		129.41		chemical	6C3

(continued)

TABLE C-10. (continued)

Boring	Elevation of top of hole (m)	Elevation of water table (m)	Total depth (m)	Thickness of cover (m)	Thickness of refuse (m)	Elevation MW/soil interface (m)	Sampled depth interval (m) From	To	Elevation of sampled intervals (m) From	To	Type of sample	Sample number
							4.57	5.11	129.24	128.70	physical	6P2
							5.93		127.88		chemical	6C4
							7.75		126.06		chemical	6C5
7	125.27	121.71	4.12	NA	NA	NA	0.91	1.58	124.36	123.69	physical	7P1
							3.47		121.80		chemical	7C1
8	132.38	130.50	3.20	NA	NA	NA	2.24		130.14		chemical	8C1
9	145.55	132.0	14.02	NA	NA	NA	2.08		143.47		chemical	9C1
							2.98		142.57		chemical	9C2
							5.11		140.44		chemical	9C3
							7.32	7.88	138.23	137.67	physical	9P1
							9.38		136.17		chemical	9C4
							13.64		131.91		chemical	9C5

NA = not applicable

Note: All elevations are given with reference to mean sea level.

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/2-78-096		

4. TITLE AND SUBTITLE	5. REPORT DATE
Chemical and Physical Effects of Municipal Landfills on Underlying Soils and Groundwater	May 1978 (Issuing Date)
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
U.S. Army Engineer Waterways Experiment Station	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
Environmental Effects Laboratory U.S. Army Engineer Waterways Experiment Station Vicksburg, Mississippi 39180	1DC618
	11. CONTRACT/GRANT NO.
	IAG-D4-0569
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
Municipal Environmental Research Laboratory--Cin.,OH Office of Research and Development U.S. Environmental Protection Agency Cincinnati, Ohio 45268	Final, June 1975-December 1975
	14. SPONSORING AGENCY CODE
	EPA/600/14

15. SUPPLEMENTARY NOTES

Robert E. Landreth, Project Officer, 684-7871

16. ABSTRACT Three municipal landfill sites in the eastern and central United States were studied to determine the effects of the disposal facilities on surrounding soils and groundwater . Borings were made up the groundwater gradient, down the groundwater gradient and through the landfill. Soil and groundwater samples from the test borings were examined. Groundwater samples were analyzed chemically. Soil samples were tested physically and distilled water extracts and nitric acid digests of the soils were analyzed chemically. Groundwater samples from under and downgradient from the landfill showed elevated levels of sulfate in every case. At some sites increased levels of nitrate, total organic carbon and cyanide could be related to the presence of the landfill. No changes in physical characteristics could be related to the presence of the landfill at any site. No evidence was found in this study to indicate that sub-landfill soils seal themselves. Distilled water extracts prepared from soil samples showed consistently low levels for all soluble constituents. Generally, there was more sulfate, chloride, organic carbon, nitrate and high levels of trace metals in extracts of soils from under the landfill than from soils collected at similar depths outside the landfill. Nitric acid digests of soil samples showed great variability in chemical composition. At two of the three sites; iron, manganese, boron, beryllium and zinc were found in higher concentrations in nitric acid digests immediately under the landfill. The results of this investigation indicate that chemical characteristics but, not physical characteristics were altered in sub-landfill soils. Removal of pollutants from leachate through the action of soil was observed for only a very limited number of pollutants.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Chemical Analysis Leaching Soil Chemistry	Solid Waste Pollutant Migration Groundwater Pollution Municipal Landfill	13B

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EXHIBIT 10

Chapter 1 | Solid Waste Management



A brief history of waste and landfills

When the majority of people lived in rural areas, their waste, which consisted almost entirely of organic materials derived from plants, humans, and animals, was burned for fuel, used as crop fertilizers, or fed to livestock. These types of waste management strategies are still practiced in some areas of the world.

As civilization developed and populations concentrated in towns and cities, throwing waste out the door to animals or into the garden posed public health problems.

Some cities, notably in parts of Asia, solved their waste problem by hauling organic waste out to farms and composting it to revitalize crop lands. Another method was to take waste out to the countryside and dump it in piles. Around 500 B.C., Athens issued the first-known law against throwing waste in the streets, requiring it to be dumped no less than one mile outside the city walls. The open dump was born.

Included in this chapter

- Minnesota's waste management hierarchy
- What do we throw away?
- Collection
- Transfer
- Disposal
- Solid waste planning and policy

Minnesota's waste management history

Prior to the 1960s, most waste was disposed of in open or burning dumps located throughout Minnesota. All waste types were allowed at these sites. The Minnesota Department of Health was given legislative authority over dumps located in tourist camps, summer hotels, and resorts. Cities, villages, or townships maintained regulatory control and responsibility over all other dumpsites.

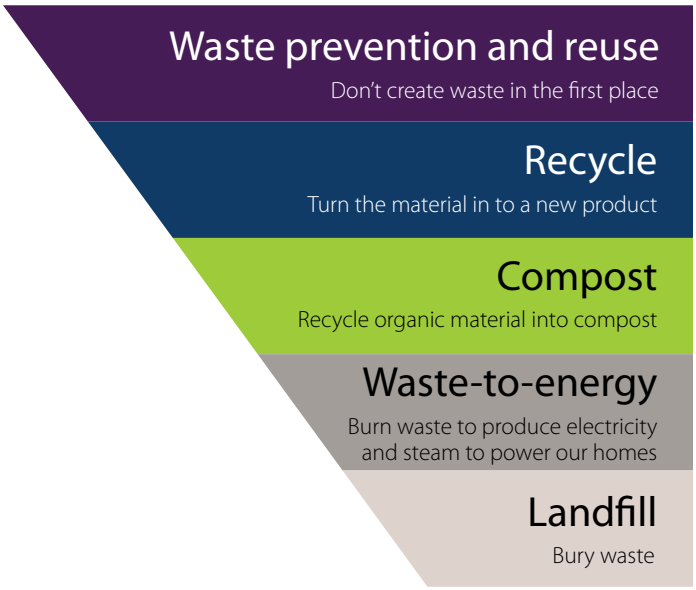
At the time, waste composition was vastly different, and the volume of household wastes was much smaller. Reuse was the norm; containers were made of glass or tin, and food was bought fresh or grown and processed at home. Junk mail and plastic packaging didn't exist. People were, in general, much more frugal. Two world wars and the Great Depression made people more conscious about saving and reusing items as much as they could. Many people went to dumps to scavenge for reusable materials and goods. In northern Minnesota, dumps even served as a social gathering place for activities such as shooting rats and watching bears.

Land use concerns grew as urban areas started to expand. New dumps became harder to site because fewer people were willing to have dumps near their properties. The Legislature passed the Federal Solid Waste Disposal Act in 1965. Two years later, the State of Minnesota created the Minnesota Pollution Control Agency (MPCA) to monitor and regulate air, water, and land pollution. In 1969, the Minnesota Solid Waste Act, which granted oversight of solid waste management to the MPCA, was passed. The act prohibited open burning, established a solid waste permitting process, and emphasized upgrading dumps to sanitary landfills.

During the 1970s, concerns over pollution from landfill sites led to the emergence of regulations for hazardous waste disposal and groundwater protection at landfill sites. These regulations would evolve over the next several decades.

Counties, with oversight from the MPCA, were given responsibility for local solid waste management and were required to submit solid waste management plans to the state. The composition of waste was changing rapidly and now included processed food, plastic packaging, and disposable diapers.

Passed in 1980, the Minnesota Waste Management Act established a waste management hierarchy. The hierarchy prioritizes waste reduction and reuse, recycling, composting, and resource recovery over land disposal. The act also created a landfill siting process and required solid waste abatement planning for metropolitan counties.



The Minnesota Waste Management Act mandates a two-fold strategy:

- Pursue the highest methods of solid waste abatement through source reduction, recycling, organics recovery and resource recovery.
- Minimize the use of landfills and ensure landfills are environmentally sound.

This strategy has helped Hennepin County achieve a recycling rate of approximately 45 percent, supported resource recovery facilities that use solid waste to generate energy, encouraged the implementation of organics recycling programs and the development of composting sites, and introduced source reduction, toxicity reduction, and public awareness activities.

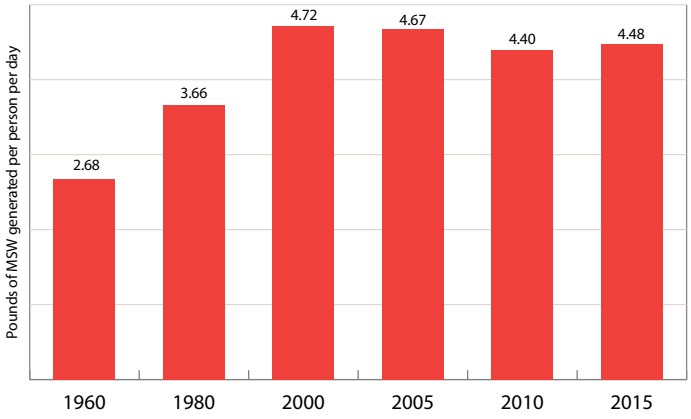
Yet the work is far from over. There is ample opportunity to shift more materials to top of the state's waste management hierarchy by emphasizing waste prevention, recycling and composting.

What do we throw away?

Municipal solid waste (MSW) includes everything we dispose of, including everything we recycle, put in the trash, bring to a household hazardous waste facility, etc. MSW consists of everyday items we use and then throw away. This includes appliances, batteries, bottles, cans, clothing, food scraps, furniture, newspapers, paint, product packaging and much more. MSW is waste that comes from homes, schools, businesses, and public spaces.

In 1960, total MSW generation in the U.S. was 88 million tons. This amount has steadily increased since. In 2018, Americans generated about 294 million tons of MSW, or about 4.9 pounds of waste per person per day.

U.S. MSW generation rate per person

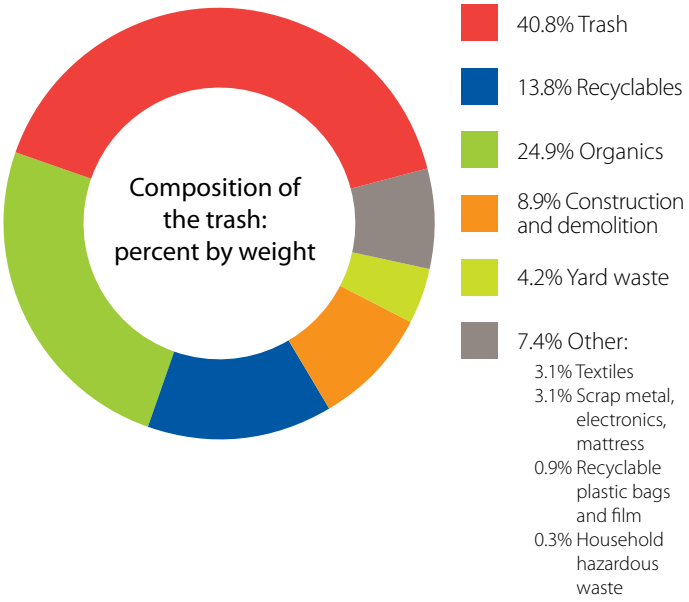


Of those 294 million tons of MSW, more than 94 million tons were recycled or composted. The national recovery rate for recycling, which includes composting, was 32.17 percent.

Hennepin County has a recycling rate that is higher than the national average. In 2024, 42 percent of waste generated in the county was either recycled or composted. Of the trash left, 28 percent was sent to resource recovery/ waste-to-energy facilities, and 29 percent was sent to landfills.

A 2016 waste composition study examined the composition of trash in Hennepin County. This reflects only what has been thrown in the trash; not what has already been diverted for recycling or composting.

Hennepin County MSW Composition in 2016



As shown, there are opportunities to increase both recycling and composting. Especially of food waste and other organic waste, which is the most prevalent material in the trash that could be diverted – representing about 25 percent of the trash by weight.

Collection

The Twin Cities solid waste infrastructure is made up of private and public entities that collect, transport, recycle, recover, and land-dispose of the materials generated at homes, businesses, and institutions. Hennepin County licenses nearly 200 waste-hauling businesses to collect and transport MSW. Waste haulers that collect and transport non-MSW, recycling, or organic waste are not licensed. State law requires waste haulers to provide volume-based service, meaning rates are set based on the amount of waste set out for collection.

Most Twin Cities communities allow residents and businesses to choose their waste hauler. This is referred to as open collection. Some cities, such as Minneapolis, arrange for the service by contract or provide their own service. This is referred to as organized collection. Communities with organized collection represent 48 percent of the households in Hennepin County (although most multifamily residences in these cities are not included in these services). There are no organized collection arrangements for commercial waste, although some communities give small businesses access to organized collection services.

Transfer and disposal

In Hennepin County, waste is either hauled directly to the Hennepin Energy Recovery Center (HERC) or a land disposal facility. Waste may also be taken to a transfer station where waste is loaded into trailer trucks and transported to landfills farther away. In the Twin Cities, there are 19 transfer stations; 14 are licensed to accept MSW and five to accept only construction and demolition (C&D) waste.



The Hennepin Energy Recovery Center (HERC) in downtown Minneapolis.

Only one transfer station is publicly owned – the Hennepin County Transfer Station in Brooklyn Park. The remaining are privately owned. Transfer stations allow waste haulers to spend more time picking up waste rather than traveling long distances to dump their loads at the landfill. Four to five waste truckloads can fit into one transfer trailer, reducing traffic to and from the landfill, saving energy, time, and money.



A transfer trailer at the Hennepin County Transfer Station in Brooklyn Park can haul four to five waste truckloads.

The Hennepin County Transfer Station in Brooklyn Park also accepts household hazardous waste and provides free drop-off facilities for recyclables and residential organics.

Disposal

Resource recovery

The Hennepin Energy Recovery Center (HERC) is a waste-to-energy facility in Minneapolis that uses mass-burn technology to generate energy. At HERC, waste is burned to produce high-pressure steam that turns a turbine to generate electricity. A portion of the steam is diverted to provide steam for heating and hot water to the downtown Minneapolis district energy system and Target Field.

Each year more than 16,000 tons of ferrous metal are recovered from the waste stream at HERC and recycled. This is almost double the 6,500 tons of ferrous metal collected annually in curbside and drop-off recycling programs in Hennepin County.

The state permits HERC to process up to 365,000 tons of waste per year. HERC generates enough electricity to power 25,000 homes each year.

Landfills

In 2024, 29 percent of MSW generated in Hennepin County was land disposed in the eight landfills shown below. Most of the waste was landfilled in the metro area.

Landfill	Tons	Location	Owner
Pine Bend	131,690	Inver Grove Heights, MN	Republic
Spruce Ridge	8,901	Glencoe, MN	Waste Management
Burnsville	84,920	Burnsville, MN	Waste Management
Elk River	146,440	Elk River, MN	Waste Management
Nobles County	406	Rushmore, MN	Nobles County
Superior 7-mile	16,245	Eau Claire, WI	Advanced Disposal
Timberline	476	Weyerhaeuser, WI	Waste Management
Lake Area Landfill	19,545	Sarona, WI	Republic
Total	**323,281**		

Solid waste planning and policy

Solid waste management policy plan

In 2024, the Minnesota Pollution Control Agency (MPCA) approved its new state solid waste management policy plan to set objectives for 2028 and establish a framework for meeting the statutory goal to recycle 75 percent by 2030. State statute requires metropolitan counties to prepare master plans every six years that identify strategies to meet the recycling goals and objectives in the state's Metropolitan Solid Waste Management Policy Plan. The county's plan was adopted by the Hennepin County Board of Commissioners and submitted to the MPCA on October 29, 2024.

Hennepin County developed its 2024 Solid Waste Management Master Plan to reach the goal of recycling 75 percent of waste by 2030. View the Hennepin County Solid Waste Management Plan at **hennepin.us/solidwasteplanning**.

Municipal responsibility

Hennepin County Ordinance 13 requires municipalities to adopt local laws relating to the separation of recyclables from waste. Hennepin County's Residential Recycling Funding Policy facilitates the transfer of Select Committee on Recycling and the Environment (SCORE) funds, which the county receives from the state, to municipalities. These funds support curbside recycling and organics recycling programs.

Private sector responsibility

Individuals and businesses are expected to follow the state, county, and municipal laws and regulations and participate in waste management programs. Generally, the public sector relies on the private waste management industry to provide waste management services, including waste and recycling collection, disposal of ash and residues, and handling of problem materials and hazardous wastes.

Hennepin County solid waste management programs and initiatives

Hennepin County has a growing number of programs and initiatives that help cities, residents, organizations, and businesses reduce waste and increase waste diversion. An overview of these programs and initiatives can be found in the county's annual Recycling Progress Report, available at **hennepin.us/solidwasteplanning**.

Resources

The following resources provide more information about solid waste management in Hennepin County and throughout Minnesota.

- **hennepin.us/solidwasteplanning:** Information about how waste is managed in the county and the solid waste planning process.
- **hennepin.us/HERC:** Information about the Hennepin Energy Recovery Center, the county-owned waste-to-energy facility.
- **revisor.mn.gov/rules/7035/:** The Minnesota Waste Management Act on the Minnesota Office of the Revisor of Statutes website.

EXHIBIT 11

#1149

2024 Annual Water Quality Monitoring Report

Elk River Landfill (SW-74)

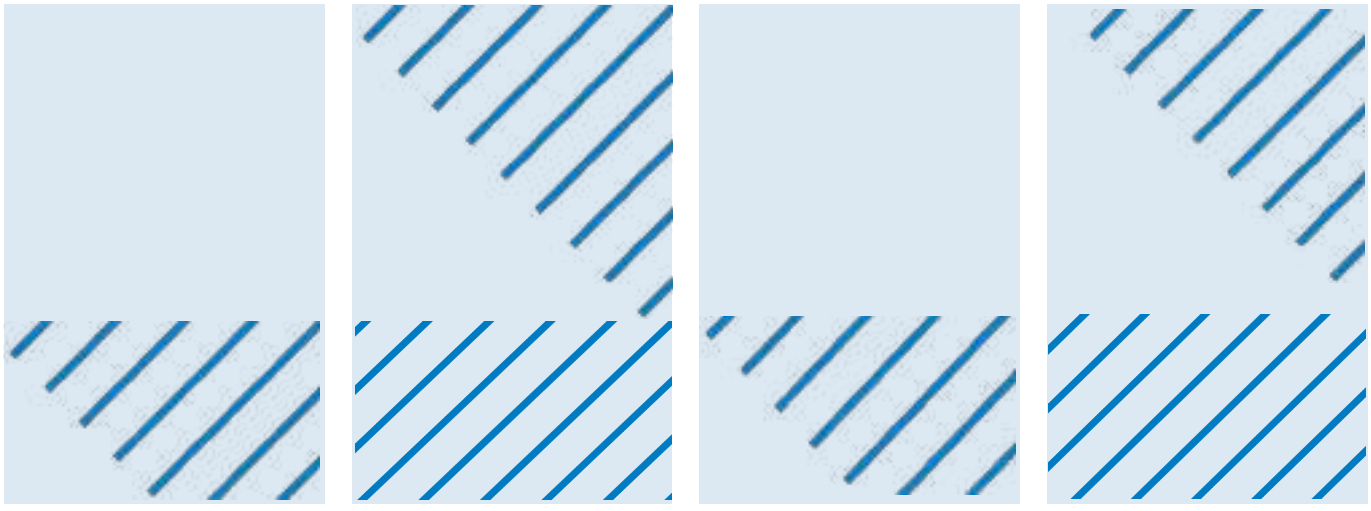
Prepared for
Elk River Landfill, Inc.

Prepared by
Barr Engineering Co.

March 2025

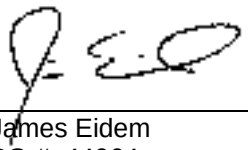
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Certification

I certify under penalty of law that the hydrogeologic portions of this document and all attachments were prepared under my direction or supervision under a system designed to assure that qualified personnel gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. Furthermore, I certify that I am knowledgeable in the field of hydrogeology.



James Eidem
PG #: 44064

February 28, 2025
Date

2024 Annual Water Quality Monitoring Report

March 2024

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1 Introduction

On behalf of Elk River Landfill, Inc., Barr Engineering Co. (Barr) has prepared this report to present the results of the 2024 environmental monitoring activities at the Elk River Landfill (ERL). The ERL is located on the border of the City of Elk River and Livonia Township in Section 3 of Township 33N and Section 34 of Township 34N, Range 26W, of Sherburne County, Minnesota (Figure 1). The ERL is authorized for operation as a solid waste disposal facility with permit/licenses issued by the Minnesota Pollution Control Agency (MCPA), Sherburne County (County), and the City of Elk River (City).

This report is submitted to address the annual environmental monitoring requirements as specified in Minnesota State Rule 7035.2815, Subpart 14 (Q), and the facility-specific permits. Quarterly monitoring data were submitted to the MPCA, County, and City in the 2024 spring, summer, and fall quarterly monitoring reports (Barr, 2024a; 2024b; and 2025a).

This section of the report provides a description of the hydrogeologic conceptual model and an overview of the environmental monitoring system at the ERL. Section 2.0 includes a discussion of the 2024 environmental monitoring results. Section 3.0 provides an overview of the planned 2025 environmental monitoring network. Conclusions and recommendations regarding future environmental monitoring are included in Section 4.0.

1.1 Hydrogeologic Conceptual Model

Detailed hydrogeologic studies have been completed at the ERL (Geomatrix, 1998 and 1999), the North Development Area (NDA), the South Development Area (SDA), and in/near Rice Lake/Tibbits Brook (RL/TB). The investigations involved geologic logging of boreholes, installation of monitoring wells, and collection of hydrogeologic data. The initial hydrogeologic investigation report for the NDA was submitted as part of the facility permitting process (Geomatrix, 2003). The NDA is permitted and partially developed for the disposal of construction and demolition (C&D) waste and approved industrial waste. An additional hydrogeologic investigation report for the revised NDA was submitted in 2023 (Barr, 2023) A revised hydrogeologic investigation report for the SDA was submitted in 2005 (Geomatrix, 2005a). The investigation of groundwater flow and water quality west of the landfill in the vicinity of RL/TB began in 2003 and was completed in 2018 (Geomatrix, 2004a; 2005b; and 2007; Barr, 2016 and 2018). The findings from these investigations were incorporated into site-wide hydrogeologic evaluation reports (Barr, 2015a; 2016; and 2018) and are presented in the hydrogeologic conceptual model below.

The geology at the ERL includes 100 to 200 feet of glacial deposits overlying Paleozoic bedrock. The predominant glacial deposits include two outwash units, referred to as the upper and lower outwash, and sandy-silt textured till that is the result of ice advances from the northeast (i.e., Cromwell and older Pre-Wisconsinan tills). The upper outwash consists primarily of fine-to-medium sand and varies in thickness from 130 feet (the bottom 10 to 40 feet of which is saturated) on the east side of the Site to less than 10 feet on the west side of the Site, where present, before merging into RL/TB. The lower outwash is the uppermost, laterally extensive hydrogeologic unit beneath the Site. This unit is continuous beneath the facility and to the west, beneath and beyond RL/TB, at an approximate elevation of 860 feet MSL (Barr, 2016 and 2018). The lower outwash is recognizable in the field by the heaving sand conditions at the top of the unit and similarities in texture, composition, and stratigraphic position to those observed at the ERL. The grain size of the lower outwash generally coarsens downward from fine-to-medium sand at the top of the unit to medium-to-coarse sand with some gravel at the base of the unit. The till separating the outwash units is present approximately 80 feet below the ground surface (bgs) east of the Site and is present at/near the ground surface to the west, largely due to ground surface elevation changes.

Extensive drilling programs conducted in the NDA and SDA (Geomatrix, 2003 and 2005a; Barr, 2023) detailed the distribution and geometries of till deposits that impede groundwater flow through the upper outwash deposit. Beneath the facility, the till is inferred to be discontinuous near the southern margin of the Pre-Subtitle D area (Barr, 2015b). The Eau Claire Formation, a regional confining unit, is the uppermost continuous bedrock unit at the Site. The Eau Claire Formation forms a local bedrock high in the southwestern portion of the Site and, in places, is capped by clayey, pre-Wisconsinan till and/or a thin mantle of fine sandstone/siltstone from the basal Wonewoc Formation (Barr, 2015a). The Mount Simon Sandstone is the uppermost bedrock aquifer in the area and is underlain by crystalline Pre-Cambrian bedrock.

The lower outwash unit constitutes the uppermost permeable, laterally continuous groundwater flow pathway at the Site and has been the subject of recent water quality investigations and corrective action evaluations. The groundwater flow direction in the lower outwash unit is east to west in the central portion of the Site and transitions to the southwest in the southern portion of the Site. Groundwater at the base of the lower outwash flows to the west-southwest beneath RL/TB and is likely somewhat constrained near the Site by the local bedrock high. Vertical hydraulic gradients are downward between the upper and lower outwash units in the east, central, and southern portions of the Site, indicating the potential for downward flow/recharge in these areas. Upward vertical gradients are present between the lower outwash and RL/TB west of the facility. Based on the magnitude of the upward gradient, the potential for groundwater discharge from the lower outwash through the till to RL/TB exists.

Investigation of groundwater flow and water quality west and southwest of the Site was conducted in 2016 and 2018. The investigations showed that the lower outwash is continuous beneath the RL/TB and that low concentrations of vinyl chloride and other organics are limited to the base of the lower outwash at locations west-southwest of the ERL (Barr, 2018). The ERL completed the delineation of the organics in groundwater, established the groundwater monitoring network west of RL/TB, evaluated groundwater attenuation and corrective actions (Barr, 2019; 2020a; and 2020b), and prepared and began initiating corrective action implementation activities in 2022 (Barr, 2021). The ERL completed an initial corrective action evaluation report (Barr, 2024c) and proposed supplemental groundwater investigation to confirm the previous findings and supplement the groundwater monitoring network west of the facility (Barr, 2024d). The supplemental groundwater investigation was completed in February 2025, and preliminary results were reported to the MPCA (Barr, 2025b).

1.2 Monitoring System Description

The ERL established the current monitoring program in accordance with the requirements of Minnesota State Rules 7035.2815, subpart 14 and Solid Waste Permit SW-74. The MPCA reissued Permit SW-74 in July 2015 (MPCA, 2015). The 2024 monitoring events were based on Permit SW-74 as reflected in the Sampling and Analysis Plan (SAP; Barr, 2024e).

As described in the following subsections, the 2024 environmental monitoring system included groundwater, residential well, leak detection lysimeter, and leachate monitoring points. Monitoring well and lysimeter locations are illustrated on Figure 2. The sampled residential wells are shown on Figure 3.

1.2.1 Groundwater Network

The 2024 groundwater monitoring network included 60 monitoring wells and piezometers (Figure 2). The monitoring network targets the permeable outwash upgradient and downgradient of the ERL to provide early detection of potential releases and/or to provide ongoing monitoring of corrective actions. Monitoring

wells identified with an “OWA” suffix are screened at/near the water table in the upper outwash. Most wells identified with a “C” suffix are screened at the top or middle of the lower outwash, which is confined by till. Most wells identified with an “L” are constructed at the bottom of the lower outwash deposit, just above the bedrock. Monitoring wells P-29D and P-311D are screened in the uppermost bedrock aquifer (i.e., Mount Simon Sandstone) for vertical groundwater compliance monitoring purposes (Barr, 2022). Table 1 identifies the hydrostratigraphic unit in which each well is completed, and well construction details are provided in Table 2.

The following modifications were made to the groundwater monitoring system in 2024:

- Groundwater samples were collected from selected wells and analyzed for natural attenuation monitoring parameters per the Groundwater Corrective Action Report - Initial Performance Review (Barr, 2024c).
- Cis-1,2-dichloroethene was added to the low-level organics reporting list for the natural attenuation monitoring program.
- Monitoring wells P-341L and P-342L were sampled for baseline monitoring parameters for the third time during the spring monitoring event. Both of these monitoring wells were incorporated into the routine sampling program starting in the summer monitoring event, and data are compared to groundwater-based Intervention Limits (ILs).
- Monitoring wells P-29D, P-303C, P-334L, and P-341L were resampled for organics during the summer monitoring event due to laboratory error. Inorganic data were inadvertently omitted from the resampling event.
- A crack in the packer in well P-29D was observed during an inspection in 2024. A new packer will be installed in well P-29D in 2025.
- Water levels were not recorded for wells P-311D (due to wellhead configuration) and wells P-327L, P-333L, and P-342L (due to lack of access by the landowners).

Other minor modifications to the routine monitoring program were detailed in the 2024 quarterly reports (Barr, 2024a; 2024b; and 2025a).

1.2.2 Residential Wells

Fourteen water supply wells, including domestic wells, the ERL Shop well, and one community water supply well (Ridges Development) located near the ERL, were sampled during the fall monitoring event per Permit SW-74. The locations of the residential wells are shown on Figure 3. Modifications to the 2024 residential well monitoring program include:

- Upgradient samples from 22915 Hwy 169 NW and 11661 225th Avenue, which are collected every three years, were collected in 2024 per Permit SW-74.
- Samples were not collected from residential wells at 13175 221st Ave NW and 22248 Elk Lake Rd because access was not approved by the landowner.
- A sample was collected from one residential well not included in Permit SW-74 (12091 221st Ave NW) during the fall monitoring event.

1.2.3 Reporting Limits

As indicated in the quarterly reports, groundwater analyses were conducted by Pace Analytical National Center for Testing and Innovation of Mount Juliet, Tennessee (Pace National). The laboratory reporting limits (RLs) for the groundwater samples collected in 2024 were equal to or lower than the Intervention Limits (ILs) listed in Permit SW-74 with the exception of three compounds (1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, and 1,2-dibromoethane) which have ILs that are not achievable with current technologies (MPCA, 2016).

1.2.4 Lysimeters

The lysimeters installed beneath leachate sumps in municipal solid waste (MSW) disposal cells are monitored per the SAP and Permit SW-74. The lysimeters are purged during each monitoring event and, with the exception of LYS-6N, if more than 15 gallons of liquid are purged, a sample is collected, and the lysimeters are purged dry (as feasible). Lysimeter LYS-6N, which was constructed below the northern portion of Cell 6 prior to the MPCA's promulgation of landfill design standards and the promulgation of Subtitle D of the Resource Conservation and Recovery Act (RCRA) and Minnesota Rule, is the subject of an ongoing automated pumping program. Liquid collected in LYS-6N is discharged to the leachate collection system by an automated pump installed at the base of the lysimeter. The LYS-6N pump, transducer, and flow meter were replaced in July 2023.

- Lysimeters LYS-6S and LYS-10 were not monitored due to accumulated sediment (as reported previously). Lysimeters 6S and 10 were camera'd on September 9, 2022, and December 3, 2022, as part of the implementation of a lysimeter action plan to evaluate downhole conditions (ERL, 2022). A technical memorandum documenting the lysimeter action plan implementation will be submitted under separate cover.
- The first quarter lysimeter sampling event was not conducted due to a scheduling oversight. The spring event results are consistent with past results.
- Lysimeter LYS-6N was sampled at the request of the City of Elk River.

1.2.5 Leachate

Leachate samples were collected on a quarterly basis for parameters that were developed based on Permit SW-74 and Metropolitan Council Environmental Services (MCES) requirements for off-site disposal. Additional leachate sampling was conducted for off-site disposal at the City of Elk River Wastewater Treatment Plant.

2 Results

This section presents an evaluation of 2024 groundwater, lysimeter, and leachate data. Historical groundwater quality data are contained in the following reports:

- Groundwater quality data collected between 1985 and 1994 are included in the 1994 Annual Water Quality Report (Camp Dresser & McKee, Inc., 1995).
- Groundwater data from 1998 through 2011 are included in the 2012 Annual Water Quality Monitoring Report (Barr, 2013).
- Groundwater data from 2012 through 2022 are included in the 2023 Annual Water Quality Monitoring Report (Barr, 2024f).

The 2023 groundwater data and groundwater contour maps are included in Appendix A for reference.

2.1 Groundwater

Groundwater data collection efforts at the ERL include triannual water quality monitoring events referred to as the spring, summer, and fall quarterly monitoring events. Data quality assurance reviews were conducted and summarized in the respective quarterly monitoring reports (Barr, 2024a; 2024b; and 2025a). The 2024 groundwater monitoring data are discussed below.

2.1.1 Flow

Static water levels were measured in the sampled monitoring wells during each monitoring event, and a site-wide water level measurement event was conducted on October 14, 2024. Table 3 includes the annual groundwater elevation data collected at the ERL over the last 10 years. Hydrographs showing groundwater elevations in the monitoring wells since 2015 are included in Appendix B.

2.1.1.1 Lower Outwash

The groundwater flow evaluation focuses on the lower outwash unit as it is the uppermost, permeable, and laterally continuous hydrogeologic unit at the Site and the focus of groundwater corrective actions. Groundwater elevation contours based on hydraulic head in monitoring wells completed at the base of the lower outwash unit for the October 2024 event are shown on Figure 4. The predominant groundwater flow direction in the lower outwash unit is to the west beneath the Pre-Subtitle D portion of the Site and west-southwest beneath RL/TB. The contours west of the facility are consistent with past groundwater investigation results (Barr, 2018; Appendix A).

The horizontal hydraulic gradient in the lower outwash across the ERL and RL/TB is approximately 0.001 feet/foot (ft/ft). Using an average hydraulic gradient of 0.001, an estimated hydraulic conductivity of 1.5 x 10-2 cm/sec, and an effective porosity of 0.27, the estimated average linear groundwater velocity in the lower outwash is 60 feet per year. The groundwater velocity at the lower outwash unit (where organics mass transport predominantly occurs west of ERL) is estimated to be between 60 and 112 feet per year, based on aquifer parameter estimates (Barr, 2020a) and the observed extent of organics downgradient of the landfill.

Using the fall event hydraulic head data, vertical gradients between wells nested in the lower outwash along the west side of the ERL vary from approximately 0.032 ft/ft downward at the P-311C/P-311L nest to 0.006 ft/ft upward at the P-301C/P-301L nest. The vertical gradient between the lower outwash and the

Mt. Simon Aquifer is approximately 0.02 ft/ft downward, which is an order of magnitude lower than the upward gradient that has been estimated between the lower outwash and to RL/TB at wells P-325L and P-326L (Barr, 2015a).

The hydraulic head in wells P-325L and P-326L is about 10 feet above the surface of RL/TB (Geomatrix, 2005b and 2007; Barr, 2015a) and is measured/estimated with pressure gauges at the wellheads[1]. The estimated groundwater elevations in wells P-325L and P-326L in RL/TB, west of the ERL, are included in Table 3 but were not considered in the groundwater flow contours on Figure 4 due to the measurement accuracy limitations and because additional wells located around RL/TB provide sufficient data to evaluate groundwater flow.

2.1.1.2 Upper Outwash

Groundwater flow in the upper outwash is constrained by till along the western edge of the NDA and north of well 315-OWA (Figure 5) (Geomatrix, 2003 and 2005a; Barr, 2015a and 2015b). Groundwater flow in the NDA is to the south-southwest. Elevated groundwater elevations in wells 301-OWA and 302-OWA are likely the result of recharge from the nearby sedimentation pond (located east of the access road) and the presence of a thick till deposit in that area. The upper outwash is interpreted to extend through the thick till but is thin or absent in the areas of local till highs (see gray stipple areas on Figure 5). Groundwater is interpreted to discharge to RL/TB in the vicinity of wells P-303C/P-310C/P-311C, which is consistent with prior interpretations (Appendix A). The area around well P-310C is susceptible to short-term groundwater mounding from standing water. Farther south, near Cell 20, groundwater north of well 336-OWA flows to the northwest and discharges to RL/TB, and groundwater south of well 336-OWA flows to the west/southwest.

2.1.2 Quality

The 2024 groundwater monitoring schedule and parameters were based on the requirements in Permit SW-74 and subsequent modifications in annual reports, SAP updates, and work plans. The compliance monitoring wells completed in the lower outwash and located downgradient of the MSW portion of the ERL are generally sampled for organics during the spring, summer, and fall monitoring events, plus inorganic and general chemistry parameters during the summer monitoring event. The compliance monitoring wells completed in the upper outwash were sampled during the summer monitoring event for organics, inorganics, and general chemistry parameters. The compliance wells located around the C&D debris disposal area were sampled for inorganics and general chemistry parameters during the spring and fall events, plus organics during the spring event. Water quality results from quarterly events are used to confirm the results from the prior monitoring event(s).

The evaluation of groundwater data includes comparing the organic and inorganic compound concentrations to water quality criteria and assessing inorganic leachate indicator trends. Consistent with Permit SW-74, monitoring wells screened in the upper outwash are compared to surface water-based ILs included in Permit SW-74 in Table 4. Data from monitoring wells screened in the lower outwash or bedrock are compared to groundwater-based ILs and the Minnesota Department of Health (MDH) Human Health-Based Water Guidance Table (which include Health Risk Limits (HRLs), EPA Maximum Contaminant Levels [MCLs], Health-Based Values [HBVs], and Risk Assessment Advice [RAAs]) in Table 5.

[1] The ground elevation in RL/TB is approximately 939 feet MSL. Groundwater elevations in wells P-325L and P-326L were originally measured with 11-foot standpipes after installation and pressure gauges were installed to estimate hydraulic head annually.

Inorganic and organic data are discussed on a site-wide basis in the following subsections. The discussion focuses on groundwater quality data collected from network wells located at or beyond the compliance boundary. Only confirmed detections are considered in the evaluation. Confirmed detections are defined as comparable detections for at least two consecutive sampling events that are not attributed to sampling, handling, or laboratory contamination.

2.1.2.1 Inorganics

The following discussion focuses on leachate indicator parameter trends and comparison of inorganic parameter concentrations to ILs and promulgated MDH Human Health Advisory Values (in applicable wells) at points of compliance.

Leachate Indicator Parameter Trends

ERL leachate indicator parameters were selected using a procedure based on ASTM D7045, Standard Guide for Optimization of Groundwater Monitoring Parameters for RCRA Waste Disposal Facilities (Geomatrix, 2002a and 2004b). The indicator parameters include chloride, sodium, potassium, iron, zinc, ammonia, total dissolved solids (TDS), and chromium. Plots showing leachate indicator parameter concentrations from the monitoring wells at the Site are in Appendix C[2]. Observations regarding specific leachate indicator parameter trends from compliance wells are presented below:

- Upgradient monitoring wells include upper outwash wells P-22L, 22-OWA, 312-OWA, 337-OWA, P-337L, and 401-OWA. Chloride concentrations are elevated above natural background concentrations[3] in upgradient monitoring wells P-22L, 22-OWA, 312-OWA, and 401-OWA. The elevated chloride concentrations in these wells are attributed to upgradient groundwater conditions (along Highway 169, described later in this report) and are unrelated to the landfill.

- The P-29C area is located west of the unlined portion (pre-Subtitle D) of the landfill and includes lower outwash wells P-301C, P-301L, P-302C, and P-29C, and nested wells P-320C, P-320C2, and P-320L. Chloride concentrations in the lower outwash in this area are elevated above natural background conditions but have been stable over recent years with the exception of significant decreases at wells P-301C (25 milligrams per liter [mg/L] to 2 mg/L) and P-301L (33 mg/L to 2 mg/L). Both wells will be monitored in 2025.

- The P-17C area is located at the southwest corner of the unlined portion (pre-Subtitle D) of the landfill, near the margin of the lined and unlined portions of the landfill and includes four non-compliance wells located within 200 feet of the landfill (P-17C, P-308C, P-309C, and test well P-308L) and monitoring wells P-305C, P-321L, and P-323L. Non-compliance wells P-17C and P-308C are characterized by elevated but decreasing chloride and iron concentrations with stable to decreasing sodium concentrations. Inorganic indicator parameter concentrations from P-308L are an order of magnitude lower than those in P-308C. Chloride, sodium, potassium, and ammonia concentrations increased at P-309C in 2024. The chloride concentration at P-305C is elevated but is about one-fifth of the chloride concentrations at P-309C and has been relatively stable over recent years.

[2] Chromium not shown on plots due to general absence of detections in groundwater at ERL.
[3] An ambient background level of chloride of 10 mg/L has been used in past reports; however, natural chloride concentrations are generally <5 mg/L in groundwater in deep geologic units (and at isolated locations) that are not influenced by anthropogenic inputs (i.e., road salt, septic tank influent, affected surface water bodies, etc.).

- The P-304C area is located southwest of the unlined portion of the landfill and includes wells P-304C, P-313C, P-314C, P-322L, and P-324L. Chloride and sodium concentrations at well P-304C were relatively stable between 2012 and 2019 and have demonstrated slight decreasing trends over recent years. The chloride concentration in groundwater at well P-313C has been stable and decreasing (but elevated) at P314C in recent years. The chloride concentration in groundwater at wells P-322L and P-324L has increased slightly since 2021, but 2024 concentrations are consistent with 2023 and remain lower than the concentration at P-313C. Wells P-311L and P-315L are located south of the P-304C area. Chloride significantly decreased at well P-311L (from 35 mg/l to 3 mg/L) since 2023.

- Wells P-325L, P-326L, P-334L, P-338L, P-342L, and P694477 are located approximately 1,200 to 4,000 feet west of the facility in the footprint of the vinyl chloride plume. Chloride concentrations are elevated (above natural background) but stable at wells P-325L and P-326L over recent years. Chloride concentrations at well P-325L are nearly twice as high as those at well P-326L. Chloride concentrations at P-334L and P694477 have increased from approximately 5 to 22 mg/L since 2018. Chloride concentration trends at wells P-334L and P694477 are consistent with the interpreted positioning near the leading edge/margin of the organics downgradient from ERL. The chloride concentration at well P-342L (1 mg/L), which is located approximately 1,000 feet downgradient of P-334L, is consistent with background.

- Sentinel wells P-327L, P-328L, P-329L, P-333L, P-335L, and P-340L are located approximately 2,500 to 4,800± feet west of the facility. Chloride concentrations in groundwater at these wells (~ ≤10mg/L) are consistent with ambient background.

- Indicator parameter trends are stable or decreasing in upper outwash wells downgradient of the facility. Chloride concentrations at well P-303C are stable but slightly above natural background concentrations. Well P-303C is located near an area where the upper and lower outwash units merge (Barr, 2015a). The upper outwash wells are more susceptible to shifts in redox conditions from precipitation events or infiltration from stormwater.

- Indicator parameter trends are stable or decreasing in wells 408-OWA and P-403C, which are located downgradient of the NDA. Leachate indicator parameter concentrations in bedrock wells P-29D and P-311D are generally stable.

Comparison to Intervention Limits

Tables 6 and 7 summarize groundwater results above screening criteria for upper and lower and outwash wells, respectively. Inorganic groundwater monitoring results are generally consistent with prior results. Inorganic parameter exceedances are discussed below.

- Chloride concentrations in upgradient wells 22-OWA, 312-OWA, and 401-OWA, which are completed in the upper outwash, were above the surface-water based IL (57.5 mg/L) (Table 6). As documented in previous reports, chloride concentrations in groundwater upgradient of the landfill have been detected at concentrations an order of magnitude greater than typical natural background concentrations (≤10 mg/L) and are attributed to the application and infiltration of deicing agents along Highway 169 (Barr, 2015a). A HRL has not been established for chloride.

- Boron was detected in groundwater above the groundwater-based IL (250 µg/L) in samples from lower outwash wells P-302C, P-304C, P-305C, P-323L, and P-325L (Table 7). A HRL has not been established for boron. Concentrations generally decrease with distance from the landfill.

- Arsenic was detected above the groundwater-based IL (2.5 µg/L) but below the EPA MCL of 10 µg/L in samples from lower outwash wells P-302C, P-304C, P-305C, P-311L, P-313C, P-315L, P-320C, and P-327L (Table 7). A HRL has not been established for arsenic. Arsenic is detected in leachate and is also a naturally occurring element that can become mobile in groundwater under certain geochemical conditions. Arsenic concentrations in groundwater above the MCL are common in glacial aquifers in the midwestern United States (Root et al., 2010; MDH, 2014; Erickson and Barnes, 2005). The source of arsenic in groundwater at concentrations above the IL in wells located along the west side of the ERL has not been determined; however, it may be related to redox conditions mobilizing natural arsenic near the unlined portion of the landfill or under natural conditions in confined outwash units. The extent of arsenic in groundwater at the ERL is limited, as evidenced by concentrations below the IL (or method reporting limits) in samples from the majority of monitoring wells 300+ feet from the landfill footprint. The arsenic concentration at P-327L was slightly above the IL of 2.5 µg/L and below the MCL. Based on the position relative to the landfill and the absence of organic compounds in groundwater at this well, arsenic at P-327L is attributed to natural conditions.

- Chloride concentration trends are shown on plots in Appendix C (and are discussed in the subsection above), and boron and arsenic concentrations trend plots are in Appendix D. Boron and arsenic concentrations have remained largely stable over recent years in groundwater at monitoring wells located at or beyond the compliance boundary.

- Manganese was detected in groundwater at concentrations above the HRL (100 µg/L) in the baseline groundwater sample from well P-342L (Table 7). As described in Section 2.1.2.3 below, the manganese concentration is unrelated to the landfill.

The inorganics detected in groundwater at concentrations above ILs are limited in extent at ERL.

2.1.2.2 Organics

Table 7 summarizes groundwater results above screening criteria for lower outwash wells. Groundwater monitoring results are consistent with prior results. Two organic compounds, vinyl chloride and trichloroethylene (TCE), were detected above their respective HRL in samples from one or more lower outwash monitoring wells located at/beyond the groundwater compliance boundary. The following observations were made from a review of the 2024 point-of-compliance organics groundwater data:

- Vinyl chloride concentrations were above the HRL (0.2 µg/L) in one or more groundwater samples from 14 wells located downgradient of the unlined (pre-Subtitle D) portion of the landfill, and above the IL (0.05 µg/L) but below the HRL in four other wells located downgradient of the unlined (pre-Subtitle D) portion of the landfill (Table 7). The highest vinyl chloride concentration in a 2024 groundwater sample from a well located at/beyond a point of compliance was 1.05 µg/L (P-338L). The extent of vinyl chloride in groundwater above the HRL is shown on Figure 6. Vinyl chloride is the subject of ongoing groundwater corrective action and is evaluated in Appendix E.

- TCE was detected above the HRL (0.4 µg/L) in groundwater at well P-323L and above the IL (0.1 µg/L) but below the HRL in groundwater at wells P-304C and P-326L (Table 7). The highest TCE concentration in a 2024 groundwater sample was 0.927 µg/L (P-323L). All three wells are located downgradient of the unlined (pre-Subtitle D) portion of the landfill and are evaluated in Appendix E.

- 1,2-DCA was detected in groundwater at concentrations above the IL (0.25 µg/L) but below the HRL (1 µg/L) in samples from wells P-302C and P-323L.

- Dichlorofluoromethane (DCFM) was detected in one groundwater at a concentration above the RAA (20 µg/L) from P-334L. A HRL has not been established for DCFM.

- No organics were detected in groundwater samples collected from upper outwash wells (Table 4), sentinel wells P-327L, P-328L, P-329L, P-333L, P-335L, P-340L, and P-341L; bedrock monitoring wells P-29D and P-311D; or monitoring well P-342L which is located approximately 1,000 feet downgradient of well P-334L (Table 5). The non-detect results are consistent with historical results from these wells and indicate that water quality at these locations is not affected by the facility.

- Concentration trends for vinyl chloride, 1,2-DCA, cis-1,2-DCE, TCE (i.e., organics detected above ILs in one or more wells), and DCFM are shown on plots in Appendix D. The 1,2-DCA, cis-1,2-DCE, TCE and DCFM trends are consistent with vinyl chloride trends (and the statistical evaluation presented in Appendix E). The following observations are made based on the trend plots and the monitored natural attenuation summary presented in Appendix E.

    - Vinyl chloride concentrations at the majority of the wells near the pre-Subtitle D portion of the landfill are decreasing or stable, suggesting either a diminishing source of organics in the groundwater system (as a result of past cover placement and landfill gas extraction) and/or increased attenuation capacity in the lower outwash.

    - Vinyl chloride concentrations in groundwater in the middle to outer portion of the plume are exhibiting minor increases, which is consistent the anticipated migration of peak vinyl chloride concentrations previously identified at the facility (Barr, 2020b and 2024c)

    - The organics data are reflective of sequential dechlorination near the landfill while other attenuation processes, including anaerobic and aerobic oxidation and abiotic reactions, as discussed in previous reports (Barr, 2020a, 2020b, 2021, and 2024c) and briefly in Appendix E.

    - The plume is fully delineated as demonstrated by the non-detections in sentinel wells P-327L, P-328L, P-329L, P-333L, P-335L, P-340L, and P-341L, monitoring well P-342L, and vertical profile borings recently collected adjacent to P-342L (Barr, 2025b).

2.1.2.3 Baseline Monitoring

The final round of baseline groundwater data from monitoring wells P-341L and P-342L are tabulated in Table 8 and are discussed below.

- Manganese was detected in groundwater at concentrations above the HRL (100 µg/L) in the baseline groundwater sample from well P-342L (Table 8). Manganese is a naturally occurring mineral that can be mobilized in groundwater under mildly reducing geochemical conditions. Manganese is not a routine monitoring parameter at the ERL because high natural background manganese concentrations are prevalent in the groundwater in the regional area around the ERL, as evidenced by previous monitoring results from upgradient wells (P-22L, P-337L, and 401-OWA), far-flung side-gradient wells (P-318C, P-327L, 405-OWA, 406-OWA, and 407-OWA),

and far-flung downgradient wells (P-328L, P-329L, P-333L, P-335L, and P-340L) where landfill influences (as determined by lack of detection of organics) have not been detected and/or are not expected based on well locations relative to the landfill and well-established groundwater flow directions (Barr, 2022; 2015a; and 2012; Geomatrix, 2005c). The manganese result from well P-342L is attributed to natural conditions and is unrelated to the landfill.

- No organics were detected in the groundwater samples collected from wells P-341L and P-342L.

2.1.2.4 Residential Well Sampling Results

Residential well sampling results are included in Table 9. Organic compounds were not detected in samples from the residential water supply wells. Chloride was not detected (i.e., <1 mg/L) in the ERL Shop well (unique ID #420558), the Ridges of Rice Lake community water supply well (unique ID #646766), or the wells replaced per the Groundwater Correction Action Work Plan (Barr, 2021).

2.2 Active Gas Collection System Evaluation

Methane was not detected in the gas monitoring probes in 2024. The gas probe monitoring results suggest that the operation of the active gas collection system is preventing landfill gas migration in the vadose zone at the ERL. Past ERL gas collection system enhancements have resulted in groundwater quality improvements in unconfined outwash at 22-OWA (Geomatrix, 2002b) and are credited, along with the placement of final cover, for the reduction of organics concentrations in groundwater inside the compliance boundary in the P-17C area. Twelve additional gas extraction wells were installed at the ERL in 2024.

The influence of the gas collection system on organics concentrations in groundwater in the confined outwash west of the ERL is likely limited to the reduction of organics transfer from gas in the vadose zone beneath the unlined portion of the landfill to groundwater where the outwash is unconfined. Groundwater data suggest that existing impacts downgradient of the facility are likely the result of a combination of leachate and landfill gas (Geomatrix, 1998).

2.3 Lysimeters

Lysimeter purge volumes are summarized in Table 10. The quarterly lysimeter purge volumes were below the nominal Action Leakage Rate (ALR)-based nominal Lysimeter Threshold Values (266 gallons) (LTVs; Geomatrix, 2002a).

Greater than 15 gallons of liquid was purged from lysimeters LYS-11, LYS-13, LYS-17, and LYS-19 during one or more events in 2024, so samples were collected and submitted for laboratory analysis (Table 11). The inorganic signature of the lysimeter samples is inconsistent with leachate (Barr, 2024a; 2024b), and the total organics concentrations are considerably lower in the lysimeter samples than in the concentrations in leachate samples (Table 12). The leachate sample analyses show higher concentrations of multiple organic compounds (e.g., acetone, ethyl ether, tetrahydrofuran, xylenes). Lysimeters differ in function and construction from monitoring wells (e.g., lysimeters are not constructed in a “clean glove” setting), and detections of a few organics at concentrations at relatively low concentrations (compared to leachate) do not indicate a release from the overlying cell.

A total of 469 gallons of liquid was produced by the automated pump in LYS-6N in 2024. The functionality of the automated pump and transducer in LYS-6N was confirmed in February 2024. A sample was also collected from LYS-6N in 2024 at the request of the City, and data are included in Table 11.

2.4 Leachate

Quarterly leachate samples were collected from the aboveground leachate storage tank (Tank #4). Leachate data from Tank #4 are included in this report (Table 12) for completeness purposes.

3 2025 Environmental Monitoring

The 2025 environmental monitoring system will include groundwater, lysimeter, and leachate monitoring in accordance with the facility permits and SAP, as modified by Table 13. Additional monitoring may also be conducted per the recommendations from the ongoing groundwater corrective action activities.

The following bullets summarize the primary changes to the monitoring network and/or anticipated changes in 2025:

- Baseline monitoring at wells P-341L and P-342L was completed in 2024. Both wells will be incorporated into the routine monitoring network (see Table 13 for anticipated future monitoring). Groundwater data from both wells will continue to be compared to groundwater-based criteria. Similar to monitoring well P-333L, well P-342L will not be sampled during fall monitoring events due to landowner access restrictions.

- One new monitoring well, P-342C, was installed as a nested well to P-342L in early 2025 as part of supplemental groundwater corrective action activities (Barr, 2024d). Preliminary results of vertical groundwater profile water quality sample results were reported in February 2025 (Barr, 2025b), and further documentation will be provided later in 2025. Well P-342C will undergo baseline groundwater monitoring during the 2025 spring and summer monitoring events but will not be sampled during the fall monitoring event due to landowner access restrictions.

- Monitoring wells 317-OWA and P-317L, located on property owned by others (i.e., Martin Marietta) south of Cell 20, will be sealed by a licensed well contractor in 2025 if gravel mining operations encroach on the well nest.

- The replacement residential wells at 22130 Quinn St. will be connected and monitored in 2025 if the owner provides access to the property.

4 Conclusions and Recommendations

Based on the 2024 ERL environmental monitoring data, the following conclusions and recommendations are made:

- Groundwater data are generally consistent with previous results. Vinyl chloride is present at low concentrations in groundwater in the lower outwash, west-southwest of the unlined (pre-Subtitle D) portion of the ERL. The vinyl chloride trends are consistent with the anticipated conditions as previously described (Barr, 2020b and 2024c), with decreasing trend near the landfill indicating a either a diminishing source of organics in the groundwater system (as a result of past cover placement and landfill gas extraction) and/or increased attenuation capacity. ERL is continuing to implement the work described in the Groundwater Corrective Action Work Plan (Barr, 2021) to address vinyl chloride and other organics in groundwater. Groundwater corrective action results are discussed in Appendix E.

- Based on 2024 (and previous) monitoring data, groundwater quality at the residential wells and in the Mt. Simon aquifer is not affected by the landfill.

- No contingency actions listed in the Groundwater Corrective Action Work Plan (Barr, 2021) were triggered in 2024.

- Lysimeter purge volumes were below the nominal threshold volumes, and the nature of the purged liquid was inconsistent with leachate.

- The 2025 environmental monitoring system will include groundwater, lysimeter, and leachate monitoring in accordance with the facility permits, as updated by Table 13. Additional monitoring may also be conducted per the recommendations from the ongoing groundwater corrective action activities.

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Tables

Table 1
2024 Groundwater Monitoring Summary
Elk River Landfill
Elk River, Minnesota

Monitoring Point	Unique Well ID[1]	Annual Sampling Frequency in SAP[2]	2024 Sampling and Analysis Summary[3]	2024 Well Status	Unit Monitored	Well Screen Placement
Monitoring Wells						
P-17C	496278	1x	VOCs (1), Inorganics (1)	In Network (NC), GWCAM	Till/Lower outwash	S
22-OWA	420729	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-22L	801470	1x	VOCs (1), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-29C	496289	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-29D	496294	3x	VOCs (3), Inorganics (0)[10]	In Network	Bedrock	S
36-OWA	498324	--	Depth to water	WL only	Upper outwash	WT
301-OWA	598567	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-301C	598562	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-301L	767989	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
302-OWA	598568	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-302C	598563	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash	S
P-303C	598532	1x	VOCs (2), Inorganics (0)[10]	In Network	Upper outwash	S
P-304C	598565	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash	S
P-305C	598566	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-308C	621858	1x	VOCs (1), Inorganics (1)	In Network (NC)	Lower outwash	S
P-308L	836661	1x	VOCs (1), Inorganics (1)	GWCAM (NC)	Lower outwash	S
P-309C	635420	1x	VOCs (1), Inorganics (1)	In Network (NC)	Lower outwash	S
P-310C	646855	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	S
P-311C	646854	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	S
P-311L	801471	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-311D	650145	3x	VOCs (3), Inorganics (1)	In Network	Bedrock	S
312-OWA	646853	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-313C	969668	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash	S
P-314C	969669	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
315-OWA	696663	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-315L	722063	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
317-OWA	696666	--	Depth to water	WL only	Upper outwash	WT
P-317L	722092	--	Depth to water	WL only	Lower outwash	S
P-320C	737638	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-320C2	756593	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-320L	737637	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-321L	767990	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-322L	767991	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-323L	786203	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-324L	786202	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-325L	804281	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-326L	804282	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-327L	812996	1x	VOCs (1), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S

Table 1
2024 Groundwater Monitoring Summary
Elk River Landfill
Elk River, Minnesota

Monitoring Point	Unique Well ID[1]	Annual Sampling Frequency in SAP[2]	2024 Sampling and Analysis Summary[3]	2024 Well Status	Unit Monitored	Well Screen Placement
P-328L	812994	1x	VOCs (1), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-329L	812995	3x	VOCs (3), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-333L	828060	2x	VOCs (2), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-334L	828061	3x	VOCs (3), Inorganics (0)[10]	In Network, GWCAM	Lower outwash (bottom)	S
P-335L	828062	3x	VOCs (3), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
336-OWA	853108	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
337-OWA	853109	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-337L	853110	1x	VOCs (1), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-338L	853139	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-340L	953140	1x	VOCs (1), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-341L[4]	877298	1x	VOCs (2), Inorganics (1)[10]	Baseline, GWCAS	Lower outwash (bottom)	S
P-342L[4]	871179	2x	VOCs (2), Inorganics (2)	Baseline, GWCAM	Lower outwash (bottom)	S
401-OWA	683321	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
402-OWA	683320	--	Depth to water	WL only	Upper outwash	WT
P-403C	683318	2x	VOCs (1), Inorganics (2)	In Network	Upper outwash	S
405-OWA	683316	--	Depth to water	WL only	Upper outwash	WT
406-OWA	683317	--	Depth to water	WL only	Surficial outwash	WT
407-OWA	683315	--	Depth to water	WL only	Surficial outwash	WT
408-OWA	717920	2x	VOCs (1), Inorganics (2)	In Network	Upper outwash	WT
P-694477[5]	694477	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
Residential Wells						
22447 Tipton St	813437	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12163 223rd Ave	876409	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12269 223rd St	876410	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12265 223rd Ave[6]	876411	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12183 223rd Ave	846412	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
11661 225th[7]	ZW00217	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
22272 Quinn St	876413	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
22130 Quinn St[8]	638355	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
ERL Shop Well	420558	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
Ridges Develop.	626766	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
22915 Hwy 169	545375	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
22205 Elk Lake Rd	625475	--	VOCs (1), inorganics (1)	GWCAWP	--	--
22275 Elk Lake Rd	720300	--	VOCs (1), inorganics (1)	GWCAWP	--	--
12901 221st Ave NW	535970	1x	VOCs (1), inorganics (1)	per Permit SW-74		
13175 221st Ave NW[9]	1000022317	--	VOCs (0), inorganics (0)	GWCAWP		
22248 Elk Lake Rd[9]	608116	--	VOCs (0), inorganics (0)	GWCAWP	--	--

Table 2
Well Information Index
Elk River Landfill
Elk River, Minnesota

Well I.D.	MN Unique Number	Year Installed	Altered or Sealed	Approx. Depth [1]	Screen Interval (ft MSL)	Top of Casing Elevation (ft MSL)	Const Material
1 OW		1979	S/1988	44		974.32	St
1 OWR	443420	1988	S/1999	33	943 - 953	976.69	St
2 OW		1979	S/1988	30		969.80	St
4 OW	420714	1983	S/1999	35	951 - 956	986.40	PVC
5 OW	420715	1983	S/1987	44		984.50	PVC
5 OWA	420721	1985	S/1987	35		984.20	PVC
5 OWR	443421	1988	S/1996	36	948 - 958	983.85	St
6 OW	420716	1983	S/1988	64		1016.15	PVC
7 OW	420717	1983	S/1985	50		988.60	PVC
8 OW	420718	1983	S/1985	45		985.60	PVC
9 OW	420719	1983	S/1985	30		978.00	PVC
10 OW	420720	1984	S/1999	60	922 - 932	981.99	PVC
11 OWA	420722	1985	S/1997	58	951 - 961	1008.64	PVC
12 OWA	420723	1985	S/1996	41	958 - 968	998.50	PVC
P 12A	420724	1985	S/1996	61	937 - 947	997.94	PVC
13 OWA	420725	1985	S/1999	20	952 - 962	971.82	PVC
15 OWA	420726	1985	S/2012	32	961 - 971	993.08	PVC
16 OWA	420728	1985	S/1999	14	944 - 954	958.31	PVC
P 16A	420727	1985	S/1999	31	927 - 937	958.01	PVC
17 OWA	420730	1985	S/2001	32	950 - 960	982.43	PVC
P 17C	496278	1991	Altered: '01, '08; resurveyed	66	917 - 922	982.62	St
18 OWA	420731	1985	S/1997	32	951 - 961	982.50	PVC
19 OWA	420732	1985	S/1997	33	946 - 956	978.70	PVC
P 19A	420733	1985	S/1997	57	922 - 927	978.63	PVC
20 OWA	420734	1985	S/1991	57	994 - 1004	1051.46	PVC
21 OWA	420735	1985	S/1999	16	937 - 947	952.47	PVC
22 OWA	420729	1985		91	949 - 959	1039.68	PVC
P 22L	801470	2013		197	846 - 856	1043.45	St
23 OWA	433112	1987	S/2001	49	938 - 948	987.02	St
24 OWA	433159	1987	S/1997	26	949 - 959	975.24	St
25 OWA	420741	1987	S/1997	23	948 - 958	970.53	St
26 OWA	420743	1987	S/2007	20	946 - 956	966.16	St
P 26A	420742	1987	S/2007	27	940 - 945	967.01	St
27 OWA	420745	1987	S/1999	18	941 - 951	959.04	St
P 27A	420744	1987	S/1999	33	927 - 932	960.08	St
28 OWA	420746	1987	S/2001	36	949 - 959	985.04	St
29 OWA	420747	1987	S/1999	18	941 - 951	959.03	St
P 29A	420748	1987	S/1999	33	925 - 930	958.34	St
P 29C	496289	1991		108	849 - 854	957.16	St
P 29D	496294	1991		265	692 - 702	957.35	St
30 OWA	433149	1987	S/1999	23	933 - 943	956.05	St
P 30C	496291	1991	S/1999	74	882 - 887	955.04	St
31 OWA	433150	1987	S/1992	50	949 - 959	999.31	St
32 OWA	433147	1987	S/1998	47	944 - 954	991.29	St
33 OWA	433151	1987	S/1998	52	951 - 961	1003.08	St
34 OWA	443422	1988	S/1989	984		983.74	PVC
35 OWA	443424	1988	S/1993	37	945 - 955	982.88	PVC
P 35B	443423	1988	S/1993	51	932 - 937	983.75	PVC
36 OWA	498324	1991		75	946 - 956	1021.61	St
37 OWA	496290	1991	S/2003	58	949 - 959	1007.44	St
38 OWA	496295	1991	S/2003	40	951 - 961	990.61	St
39 OWA	496283	1991	S/2004	26	960 - 970	985.65	St
40 OWA	496282	1991	S/1999	28	927 - 937	955.07	St
P 40B	496292	1991	S/1999	58	898 - 904	956.27	St
41 OWA	496280	1991	S/1999	36	937 - 947	972.95	St
P 41B	496293	1991	S/2001	60	912 - 917	971.69	St
42 OWA	496296	1991	S/1996	89	954 - 964	1043.24	St

Table 2
Well Information Index
Elk River Landfill
Elk River, Minnesota

Well I.D.	MN Unique Number	Year Installed	Altered or Sealed	Approx. Depth [1]	Screen Interval (ft MSL)	Top of Casing Elevation (ft MSL)	Const Material
43 OWA	496279	1991	S/1999	30	944 - 954	973.41	
P 43B	496277	1991	S/1999	72	902 - 907	973.55	St
P 43C	496281	1991	S/1999	287	686 - 696	973.38	St
101 OWA	433160	1987	S/1997	33	944 - 949	977.43	St
102 OWA	433165	1987	S/1997	30	946 - 951	975.73	St
103 OWA	433161	1987	S/1997	58	950 - 955	1008.26	St
104 OWA	433162	1987	S/1996	28	943 - 948	970.74	St
105 OWA	433163	1987	S/1997	58	945 - 950	1002.32	St
106 OWA	433164	1987	S/1997	83	918 - 923	1000.88	St
108 OWA	433166	1987	S/1996	57	946 - 951	1002.72	St
110 OWA	433167	1987	S/1996	88	951 - 956	1038.84	St
201 OWA	443223	1988	S/1999	26	946 - 956	972.27	St
P 201B	443224	1988	S/1999	46	926 - 931	971.96	St
202 OWA	443219	1988	S/1992	86	946 - 956	1031.62	St
203 OWA	443218	1988	S/1992	103	945 - 955	1047.65	St
204 OWA	443221	1988	S/1995	53	945 - 955	998.26	St
205 OWA	443220	1988	S/1994	87	947 - 957	1033.51	St
206 OWA	443217	1988	S/1997	48	947 - 957	994.01	St
207 OWA	443216	1988	S/1999	104	947 - 957	1050.99	St
208 OWA	443215	1988	S/1997	43	953 - 963	996.86	St
209 OWA	443214	1988	S/2012	57	946 - 956	1002.50	St
210 OWA	443211	1988	S/2007	38	943 - 953	981.19	St
P 210B	443212	1988	S/2012	58	923 - 928	981.25	St
211 OWA	443222	1988	S/1999	36	943 - 953	979.03	St
212 OWA	443213	1988	S/1997	70	945 - 955	1014.64	St
213 OWA	443209	1988	S/2012	47	946 - 956	993.35	St
P 213A	443210	1988	S/2007	67	926 - 931	992.20	St
301 OWA	598567	1997		17	950 - 960	966.54	PVC
P 301C	598562	1997		73	895 - 905	967.50	St
P301L	767989	2009		123	847 - 857	970.11	St
302 OWA	598568	1997		17	953 - 963	970.47	PVC
P 302C	598563	1997		72	898 - 908	970.63	St.
303 OWA	598569	1997	S/2012	17	946 - 956	963.71	PVC
P 303C	598532	1997		53	911 - 921	963.77	St.
P 304C	598565	1997		62	898 - 908	959.89	St.
P 305C	598566	1997		80	884 - 894	963.26	St.
306 OWA	621863	1998	S/2004	40	951 - 961	990.88	St.
307 OWA	621862	1998	S/2003	55	951 - 961	1005.59	St.
P 308C	621858	1998	Altered: 2008; resurveyed	77	903 - 913	979.83	St.
P 308L	836661	2019		130	848 - 863	979.94	St.
P 309C	635420	1999		85	883 - 893	967.71	St.
P 310C	646855	2000		42	933 - 948	975.33	St.
P 311C	646854	2000		33	933 - 943	965.54	St.
P 311L	801471	2013		114	852 - 862	965.76	St.
P 311D	650145	2000		253	711 - 779	963.80	St.
312 OWA	646853	2000		70	946 - 956	1016.20	St.
P 313C	969668	2003	reduced: 2004; resurveyed	68	880 - 895	948.15	St.
P 314C	969669	2003		75	877 - 892	952.02	St.
315 OWA	696663	2003		35	937 - 952	972.41	St.
P 315L	722063	2005		100	872 - 882	972.27	St.
316 OWA	696664	2003	S/2015	107	939 - 954	1046.43	St.
P 316L	722093	2005	S/2015	163	884 - 894	1046.82	St.
317 OWA	696666	2003	to be sealed in 2024	73	937 - 952	1009.73	St.
P 317L	722092	2005	to be sealed in 2024	157	852 - 862	1008.65	St.
P 318C	696665	2003	S/2012	57	936 - 946	993.41	St.
P 318L	722091	2005	S/2012	139	853 - 863	991.06	St.
319 OWA	696667	2003	S/2012	72	943 - 953	1014.59	St.

Table 2
Well Information Index
Elk River Landfill
Elk River, Minnesota

Well I.D.	MN Unique Number	Year Installed	Altered or Sealed	Approx. Depth [1]	Screen Interval (ft MSL)	Top of Casing Elevation (ft MSL)	Const Material
P 320C	737638	2006		63	888 - 898	951.19	St.
P 320C2	756593	2007		90	862 - 872	951.21	St.
P 320L	737637	2006		110	851 - 856	951.37	St.
P 321L	767990	2009		118	855 - 865	972.56	St.
P 322L	767991	2009		87	862 - 872	948.75	St.
P 323L	786203	2011		96	872 - 883	967.20	St.
P 324L	786202	2011		103	857 - 865	960.40	St.
P 325L	804281	2014		82	856 - 866	942.11	St.
P 326L	804282	2014		85	854 - 864	942.62	St.
P 327L	812996	2016		119	833 - 848	952.35	St.
P 328L	812994	2016		112	836 - 851	948.20	St.
P 329L	812995	2016		98	850 - 865	947.99	St.
P 333L	828060	2018		116	828 - 843	943.72	St.
P 334L	828061	2018		143	829 - 844	972.22	St.
P 335L	828062	2018		148	848 - 863	995.98	St.
336-OWA	853108	2020	extended 2022; resurveyed	22	942 - 957	969.45	St.
337-OWA	853109	2020		99	932 - 947	1031.70	St.
P-337L	853110	2020		186	846 - 856	1031.68	St.
P-338L	853139	2021		115	846 - 861	961.13	St.
P-340L	953140	2021		105	841 - 856	946.43	St.
P-341L	877298	2023		143	846 - 861	988.58	St.
P-342L	871179	2023		100	847 - 862	947.27	St.
401 OWA	683321	2002		66	945 - 955	1010.97	St.
402 OWA	683320	2002		79	945 - 960	1023.56	St.
P 403C	683318	2002		60	938 - 948	998.46	St.
404 OWA	683319	2002	S/2006	57	944 - 954	1001.12	St.
405 OWA	683316	2002	extended: 2004; resurveyed	41	947 - 957	987.17	St.
406 OWA	683317	2002		15	939 - 944	953.71	St.
407 OWA	683315	2002		40	934 - 944	973.87	St.
408 OWA	717920	2004		42	947 - 957	986.55	PVC
P-694477	694477	2003	Surveyed 2015	145	842 - 846	987.86	St.
T1	643948	2002	extended: 2008; resurveyed	85	896 - 911	980.85	St.
T2	643949	2002	extended: 2008; resurveyed	88	892 - 907	979.85	St.
T3	643950	2002	extended: 2008; resurveyed	91	889 - 904	980.39	St.
T4	673801	2002	extended: 2008; resurveyed	93	887 - 902	980.47	St.
T5	733223	2006		83	883 - 898	965.11	St.
T6	733222	2006		84	882 - 897	964.77	St.

Notes:

PVC - polyvinyl chloride

St - stainless steel & low carbon steel

S - sealed/date of well sealing

MSL - Mean Sea Level

[1] Approx. depth in feet from top of riser to bottom of screen

Table 3
Groundwater Elevations
Elk River Landfill
Elk River, Minnesota

Well Number	Elevation of Top of Casing	Water Elevation Oct 20, 2014[1]	Water Elevation Oct 20, 2015	Water Elevation Oct 18, 2016	Water Elevation Oct 16, 2017	Water Elevation Oct 17, 2018[1]	Water Elevation Oct 22, 2019[1]	Water Elevation Oct 11, 2020[1]	Water Elevation Oct 18, 2021	Water Elevation Oct 26, 2022[1]	Water Elevation Oct 16, 2023[1]	Water Elevation Apr 15, 2024[1]	Water Elevation July 23, 2024[1]	Water Elevation Oct 14, 2024
P-17C	982.62	956.04	954.96	956.15	956.38	955.19	955.84	955.30	953.17	952.74	953.52		955.53	954.10
22-OWA	1039.68	957.96	956.79	957.00	957.56	956.79	958.53	957.90	955.97	955.14	955.68		955.96	956.43
P-22L	1043.45	952.82	951.93	952.56	952.97	952.16	953.96	952.60	949.75	950.12	950.28	951.72	951.33	951.20
P-29C	957.16	951.26	950.35	950.94	951.35	950.70	952.24	950.98	949.21	948.85	948.98	949.58	949.69	949.73
P-29D	957.35	948.55	947.62	948.26	948.76	948.14	949.93	948.54	944.65**	946.03	946.20	946.76	949.38	946.98
36-OWA	1021.61	958.71	957.49	957.78	958.27	957.41	959.33	958.49	956.51	956.03	956.31	1021.61		957.31
301-OWA	966.54	961.77	960.10	962.27	962.38	962.72	962.34	956.50	955.94	956.23	964.43	963.89	957.99	957.46
P-301C	967.50	951.19	950.31	950.85	951.22	950.54	948.96**	950.79	949.16	948.78	948.98	949.48	958.63**	949.55
P-301L	970.11	951.35	950.56	951.07	951.55	950.86	951.79	951.07	949.39	949.06	949.16	949.83	961.79**	949.83
302-OWA	970.47	960.64	961.18	964.20	961.89	965.26	966.90	958.65	959.45	957.88	964.32		962.77	958.32
P-302C	970.63	951.27	950.27	950.81	951.31	950.67	955.20**	950.91	949.14	948.98	948.92	948.63	949.82	949.55
P-303C	963.77	953.24	952.75	953.70	954.14	953.18	955.48	952.61	950.63	950.47	951.52		955.93**	951.46
P-304C	959.89	954.02	953.22	954.72	955.03	953.93	956.38	953.12	951.21	951.04	952.49	954.09	952.39	952.00
P-305C	963.26	951.03	950.16	950.78	951.20	950.58	952.04	950.92	949.03	948.60	948.84	949.33	955.54**	949.77
P-308C	979.83	957.17	952.24	953.04	953.31	952.45	953.58	952.28	950.40	949.96	950.29		947.21**	950.86
P-308L	979.94						952.58	951.26	949.52	949.15	949.25		950.17	949.97
P-309C	967.71	951.17	950.30	950.98	951.36	950.60	952.20	950.89	949.19	948.77	948.97		959.5**	949.66
P-310C	975.33	954.99	955.61	956.25	956.66	955.96	957.06	953.85	950.13	952.51	952.61		955.33	952.23
P-311C	965.54	953.27	953.18	953.48	953.84	952.93	954.83	953.23	950.96	950.77	950.97		952.34	951.62
P-311L	965.76	950.32		950.21	950.76	950.04	951.60	950.64	948.30	948.06	948.22	948.59	948.36	949.01
P-311D	963.80	947.28	NM	947.38	947.82	947.09	947.39	947.32	946.94	944.91	945.00			
312-OWA	1016.20	956.88	955.73	956.17	956.71	955.85	957.74	956.95	954.55	953.92	954.31		949.74	955.19
P-313C	948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15
P-314C	952.02	950.51	950.29	950.74	951.05	950.35	951.63	950.80	948.93	948.27	948.53	948.93	949.72	949.11
315-OWA	972.41		953.27	954.07	954.54	953.36	955.64	954.21	951.70	951.51	952.16		952.91	953.21
P-315L	972.27		949.07	949.81	950.25	949.32	951.17	950.05	947.98	947.44	947.58	948.07	948.47	948.47
317-OWA	1009.73		954.31	955.00	956.42	955.37	957.38	956.17	953.62	953.26	954.07		954.68	954.18
P-317L	1008.65		949.54	950.27	950.95	949.92	951.90	950.75	948.57	947.78	947.96		949.26	949.03
P-320C	951.19	950.88	950.32	950.98	>951.19	950.60	>951.19	951.00	949.19	948.84	949.01	949.49	949.77	949.62
P320C2	951.21	950.91	950.32	951.02	951.08	950.70	>951.21	950.92	949.12	948.87	949.02	949.49	949.81	949.64
P-320L	951.37	950.87	950.30	950.90	951.33	950.62	>951.37	950.97	949.16	948.77	949.01	949.70	949.82	949.57
P-321L	972.56	950.99	950.18	950.73	951.19	950.53	951.99	950.86	949.09	948.71	948.87	949.38	949.68	949.52
P-322L	948.75	>948.75	948.75	>948.75	>948.75	>948.75	>948.75	>948.75	947.64	947.85	947.35	947.71	948.15	948.05
P-323L	967.20	950.68	949.88	950.38	950.87	950.22	951.68	950.52	948.59	948.37	948.53	949.06	949.35	949.18
P-324L	960.40	950.33	949.59	950.11	950.64	949.99	951.57	950.21	948.40	948.04	948.15	948.68	949.28	948.92
P-325L	942.11	>942.11	~ 950.31		~ 952.5 **	~ 950.7	~ 952.8**	~ 949.3**	~ 947.8**	~946.9	~ 947.0	>942.11	>942.11	~947.7**
P-326L	942.62	>942.62	~ 950.37		~ 951.9 **	~ 950.3	~ 952.4**	~ 944.5**	~ 947.5**	~947.0	~ 947.0	>942.62	>942.62	~947.5**
P-327L	952.35			950.37 **	948.75	948.28	949.59	948.16	946.86	946.83		947.59	947.65	
P-328L	948.20			946.13	946.40	945.81	947.13	945.76	944.29	944.40	944.52	945.09	944.98	944.73
P-329L	947.99			944.04 **	945.71	945.72	946.87	945.52	944.11	944.27	944.29	944.90	944.79	944.55
P-333L	943.72											>943.72	>943.72	
P-334L	972.22					946.44	947.79	946.27	944.99	944.90	944.95	945.40	945.40	945.42
P-335L	995.98					946.97	948.25	947.11	944.90	945.28	945.39	945.69	945.85	945.93

Table 3
Groundwater Elevations
Elk River Landfill
Elk River, Minnesota

Well Number	Elevation of Top of Casing	Water Elevation Oct 20, 2014[!]	Water Elevation Oct 20, 2015	Water Elevation Oct 18, 2016	Water Elevation Oct 16, 2017	Water Elevation Oct 17, 2018[!]	Water Elevation Oct 22, 2019[!]	Water Elevation Oct 11, 2020[!]	Water Elevation Oct 18, 2021	Water Elevation Oct 26, 2022[!]	Water Elevation Oct 16, 2023[!]	Water Elevation Apr 15, 2024[!]	Water Elevation July 23, 2024[!]	Water Elevation Oct 14, 2024
336-OWA	969.45							956.28	953.71	953.27	954.45		954.45	954.16
337-OWA	1031.70							956.36	954.37	953.18	953.66		954.61	954.61
P-337L	1031.68							951.58	949.58	948.86	948.88		944.43**	950.05
P-338L	961.13								945.76	945.63	945.72	946.38	946.29	946.21
P-340L	946.43								944.83	944.83	944.98		945.43	945.10
P-341L	988.58										946.58	946.93	947.43	947.37
P-342L	947.27											945.27	945.07	
401-OWA	1010.97		958.62	959.20	959.70	958.85	960.61	959.44	957.50	957.11	957.77	957.30	958.67	958.53
402-OWA	1023.56	960.13	959.02	959.53	960.06	959.27	960.96	959.94	958.11	957.56	958.25	958.18	959.03	958.92
P-403C	998.46	959.81	958.82	960.06	960.41	959.15	961.50	958.91	956.57	956.14	956.78	957.56	958.24	957.59
405-OWA	987.17	960.04	959.12	959.57	959.86	958.85	960.92	959.10	957.04	956.67	956.57	956.60	958.12	957.74
P-405L	987.97												951.47	951.05
406-OWA	953.71	942.29	941.71	942.49	942.68	942.39	943.16	941.45	940.43	940.26	940.41	941.29	941.33	940.41
407-OWA	973.87	944.93	944.37	945.24	945.30	944.67	945.82	943.65	942.35	942.78	942.77	943.67	944.74	943.28
408-OWA	986.55	958.86	957.92	959.02	959.57	958.30	960.18	957.86	955.87	955.26	955.87	955.77	956.84	956.50
409-OWA	1044.39										965.57	965.62	965.60	965.80
P-410L	994.56										949.47	949.99	950.36	949.99
411-OWA	1007.34									959.84	960.15	959.96	960.88	960.87
412-OWA	1028.56									961.36	961.91	962.44	962.07	962.54
413-OWA	990.97									958.19	959.20	958.72	960.19	960.12
P-694477	987.86			947.59	948.00	947.32	949.60	947.45	945.93	945.65	945.75	946.42	946.31	946.28

Table 2
Groundwater Elevations
Elk River Landfill
Elk River, Minnesota

Water level elevations in feet, Mean Sea Level (MSL)

Blank indicates no water level collected

S: Well has been sealed

BP: Below top of dedicated pump

**: Unusable/rejected measurement based on hydrograph evaluation

>: groundwater elevation is greater than elevation listed; formerly reported as "Flowing"

~: approximate elevation based on pressure gauge reading

[!] indicates reported water levels were measured during a routine monitoring event and not necessarily on the listed day

Table 4
Groundwater Data Compared to Surface Water-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

		Location	22-OWA	301-OWA	302-OWA	P-303C	P-303C	P-310C	P-311C	312-OWA	336-OWA	337-OWA	P-403C	408-OWA
		Date	7/26/2024	7/26/2024	7/26/2024	9/19/2024	10/16/2024	7/26/2024	7/25/2024	7/25/2024	7/26/2024	7/25/2024	10/16/2024	10/16/2024
Parameter	Units	Elk River Surface Water Limits Table - SW-74												
Last Updated		09/28/2010												
Exceedance Key		**Bold**												
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,1,1-Trichloroethane	ug/l	82.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,1,2,2-Tetrachloroethane	ug/l	3.25	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	--
1,1,2-Trichloroethane	ug/l	11.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	--	--
1,1-Dichloroethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,1-Dichloroethylene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,1-Dichloropropene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,2,3-Trichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,2,3-Trichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,2,4-Trichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,2,4-Trimethylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,2-Dibromoethane (EDB)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,2-Dichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,2-Dichloroethane	ug/l	47.5	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	--
1,2-Dichloroethylene, cis	ug/l	132.25	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--	--
1,2-Dichloroethylene, trans	ug/l	132.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,2-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,3,5-Trimethylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,3-Dichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,3-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,3-Dichloropropene, cis	ug/l		< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	--
1,3-Dichloropropene, trans	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
1,4-Dichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
2,2-Dichloropropane	ug/l		< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	--	--
Acetone	ug/l		< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--	--
Allyl chloride	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Benzene	ug/l	28.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	--
Bromobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Bromochloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Bromodichloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Bromoform	ug/l	116.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Bromomethane	ug/l		< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	--	--
Butylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Butylbenzene, sec	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Butylbenzene, tert	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Carbon tetrachloride	ug/l	1.475	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	--
Chlorobenzene	ug/l	5.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Chlorodibromomethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Chloroethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Chloroform	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Chloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Chlorotoluene, o	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Chlorotoluene, p	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Cumene (isopropyl benzene)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Dibromomethane (methylene bromide)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Dichlorodifluoromethane (Freon-12)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Dichlorofluoromethane (Freon-21)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Ethyl benzene	ug/l	17.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Ethyl ether	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Hexachlorobutadiene	ug/l		< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	--
Methyl ethyl ketone (2-butanone)	ug/l		< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J3	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--	--

Table 4
Groundwater Data Compared to Surface Water-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

		Location	**22-OWA**	**301-OWA**	**302-OWA**	**P-303C**	**P-303C**	**P-310C**	**P-311C**	**312-OWA**	**336-OWA**	**337-OWA**	**P-403C**	**408-OWA**
		Date	**7/26/2024**	**7/26/2024**	**7/26/2024**	**9/19/2024**	**10/16/2024**	**7/26/2024**	**7/25/2024**	**7/25/2024**	**7/26/2024**	**7/25/2024**	**10/16/2024**	**10/16/2024**
Parameter	Units	Elk River Surface Water Limits Table - SW-74												
Last Updated		09/28/2010												
Exceedance Key		**Bold**												
Methyl isobutyl ketone (MIBK)	ug/l		< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	--	--
Methyl tertiary butyl ether (MTBE)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Methylene chloride	ug/l	485.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Naphthalene	ug/l	20.25	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	--	--
Propylbenzene	ug/l		< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	--	--
Styrene	ug/l	5.3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Tetrachloroethylene	ug/l	2.225	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Tetrahydrofuran	ug/l		< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3 J3	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	--	--
Toluene	ug/l	63.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Trichloroethylene (TCE)	ug/l	30.0	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--	--
Trichlorofluoromethane (Freon-11)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Trichlorotrifluoroethane (Freon 113)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	--
Vinyl chloride	ug/l	2.3	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U J4	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	--	--
Xylene, total	ug/l	41.5	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	--
General Parameters														
Alkalinity, total, as CaCO3	mg/l		361	325	284	--	--	691	285	245	195	621	323	297
Anions	meq/l		11.9	6.96	5.83	--	--	14.1	6.40	13.0	4.64	13.6	7.37	6.19
Cation-Anion balance	%		4.86	1.83	0.200	--	--	1.00	1.72	3.85	5.52	3.93	1.78	-1.05
Cations	meq/l		13.1	7.22	5.86	--	--	14.4	6.63	14.0	5.18	14.9	7.64	6.06
Chloride	mg/l	**57.5**	**138**	2.40	1.15	--	--	4.45	2.63	**273**	12.7	14.6	2.52	1.19
Nitrogen, ammonia, as N	mg/l		< 0.100 U	< 0.100 U	< 0.100 U	--	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Solids, total dissolved	mg/l		677	372	303	--	--	704	339	882	283	720	379	298
Sulfate, as SO4	mg/l	136.75	38.3	19.1	5.96	--	--	8.29	30.2	19.4	18.5	36.1	44.3	12.1
Dissolved oxygen, field	mg/l		5.2	0	0	0.4	0	0.8	0	6.6	7.7	0.1	1.6	2.4
pH, field	pH units		7.29	7.18	7.28	8.22	6.94	7.37	7.96	7.42	7.74	6.91	7.05	7.19
Redox (oxidation potential), field	mV		58	22.4	-28.3	-187	-81.7	-132	-146.6	12.8	95	-35.1	100	150
Specific conductance @ 25 deg C, field	umhos/cm		864	441	359	368	884	1232	387	1035	480	838	702	520
Temperature, field	deg C		10.6	11.6	10.7	12.9	10.8	11.3	9.4	12.2	12.4	10.1	9	11.4
Turbidity, field	NTU		5.4	6.4	--	2	4.9	24	14.4	21.7	6	6.9	34	1
Dissolved Metals														
Arsenic	ug/l	13.25	< 2.00 U	< 2.00 U	< 2.00 U	--	--	< 2.00 U	2.99	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U
Boron	ug/l	125.0	< 200 U	< 200 U	< 200 U	--	--	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U
Calcium	mg/l		151 V	92.0	76.9	--	--	196	80.7	142	63.7	184	81.7	75.7
Chromium	ug/l	80.25	5.22	< 4.00 U	< 4.00 U	--	--	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U
Iron	ug/l	311.25	< 100 U	< 100 U	< 100 U	--	--	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U
Magnesium	mg/l		44.3	28.8	22.7	--	--	50.9	28.7	36.2	18.8	60.4	39.3	24.6
Potassium	mg/l		1.95	2.1	1.74	--	--	2.49	1.22	3.51	1.72	1.8	1.36	< 1 U
Sodium	mg/l		43.2	4.55	2.6	--	--	8.56	4.74	89.6	9.49	11.1	6.87	5.44
Zinc	ug/l	41.75	23.2	12.6	12.8	--	--	24.0	< 10.0 U	11.4	26.1	14.0	< 10.0 U	< 10.0 U

B The analyte was detected in the associated laboratory blank sample(s).

C3 The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

FD Sample Type: Field Duplicate

J3 The associated batch QC was outside the established quality control range for precision.

J4 The associated batch QC was outside the established quality control range for accuracy.

N Sample Type: Normal

U The analyte was analyzed for, but was not detected.

Table 4
Groundwater Data Compared to Surface Water-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

Location			22-OWA	301-OWA	302-OWA	P-303C	P-303C	P-310C	P-311C	312-OWA	336-OWA	337-OWA	P-403C	408-OWA
Date			**7/26/2024**	**7/26/2024**	**7/26/2024**	**9/19/2024**	**10/16/2024**	**7/26/2024**	**7/25/2024**	**7/25/2024**	**7/26/2024**	**7/25/2024**	**10/16/2024**	**10/16/2024**
Parameter	Units	Elk River Surface Water Limits Table - SW-74												
Last Updated		09/28/2010												
Exceedance Key		**Bold**												

UB The analyte was detected in one of the associated laboratory, equipment, field or trip blank samples and is considered non-detect at the concentration reported by the laboratory.

V The sample concentration is too high to evaluate accurate spike recoveries.

Table 5
Groundwater Data Compared to Groundwater-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

			Location	P-326L	P-327L	P-327L	P-328L	P-329L	P-329L	P-329L	P-333L	P-333L	P-334L	P-334L	P-334L	P-334L	P-335L	P-335L	P-335L
			Date	10/17/2024	4/15/2024	7/25/2024	7/25/2024	4/15/2024	7/25/2024	10/16/2024	4/15/2024	7/25/2024	5/15/2024	7/22/2024	9/19/2024	10/17/2024	4/15/2024	7/25/2024	10/16/2024
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																
Last Updated		01/16/2024	07/23/2015																
Exceedance Key		**Bold**	Underline																
Volatile Organic Compounds																			
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75	< 0.750 U	--	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	--	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0	4.40	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	4.20	--	4.86	3.89	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	50.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	25.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	12.5	1.39	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	10.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	1.25	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	25.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94		< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	2.5	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U
Acetone	ug/l	3000 HRL23 (1)	1000	< 10.0 U J3 J4	--	< 10.0 U C3	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	--	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U	< 10.0 U	< 10.0 U C3 J3
Allyl chloride	ug/l	30 HRL94	7.5	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	0.5	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	1.5	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	40 HRL93	10.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Bromomethane	ug/l	10 HRL93	2.5	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Butylbenzene	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U
Butylbenzene, tert	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	25.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	2.5	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	ND RAA16		< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Chloroform	ug/l	20 HRL18	7.5	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l			< 1.00 U	--	< 1.00 U J3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	175.0	< 1.00 U C5	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5 J4	< 1.00 U	< 1.00 U	7.27	--	12.7	6.90 C5	< 1.00 U	< 1.00 U	< 1.00 U J4
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**		3.92	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	19.1	--	**25.4**	16.7	< 1.00 U	< 1.00 U	< 1.00 U
Ethane	ug/l			< 1.20 U	--	--	--	--	--	--	--	--	--	< 1.29 U	--	< 1.20 U	--	--	--
Ethyl benzene	ug/l	40 HRL23	12.5	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	50.0	14.1	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	20.8	--	20.5	17.9	< 1.00 U	< 1.00 U	< 1.00 U
Ethylene	ug/l			< 1.20 U	--	--	--	--	--	--	--	--	--	< 1.27 U	--	< 1.20 U	--	--	--
Hexachlorobutadiene	ug/l	1 HRL93	0.25	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methane	ug/l			299	--	--	--	--	--	--	--	--	--	2110	--	2020	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0	< 10.0 U	--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	--	< 10.0 U J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0	< 5.00 U	--	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	--	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	1.25	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4
Naphthalene	ug/l	70 HRL13	17.5	< 1.00 U J3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	--	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U C3	< 1.00 U

Table 5
Groundwater Data Compared to Groundwater-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

			Location	P-326L	P-327L	P-327L	P-328L	P-329L	P-329L	P-329L	P-333L	P-333L	P-334L	P-334L	P-334L	P-334L	P-335L	P-335L	P-335L
			Date	10/17/2024	4/15/2024	7/25/2024	7/25/2024	4/15/2024	7/25/2024	10/16/2024	4/15/2024	7/25/2024	5/15/2024	7/22/2024	9/19/2024	10/17/2024	4/15/2024	7/25/2024	10/16/2024
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																
Last Updated		01/16/2024	07/23/2015																
Exceedance Key		**Bold**	Underline																
Propylbenzene	ug/l			< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l		25.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	4 HRL23 (1)	1.25	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18		9.67	--	< 5.00 U C3	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U C5	7.47	--	9.04 C3 J3	7.81	< 5.00 U	< 5.00 U	< 5.00 U C3
Toluene	ug/l	70 HRL23	50.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1	0.120	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05	0.176	--	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 0.0500 U	< 0.0500 U J4	< 0.0500 U C3	< 0.0500 U	**0.584**	--	**0.690**	**0.545**	< 0.0500 U C3	< 0.0500 U	< 0.0500 U J4
Xylene, total	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U
General Parameters																			
Alkalinity, total, as CaCO3	mg/l			633	208	197	205	210	206	--	205	198	--	308	--	300	202	197	--
Anions	meq/l			--	--	4.36	4.60	--	4.50	--	--	4.39	--	--	--	--	--	4.42	--
Carbon, total organic	mg/l			2.84	--	--	--	--	--	--	--	--	--	< 1.40 UB	--	1.16	--	--	--
Cation-Anion balance	%			--	--	3.23	3.11	--	-1.26	--	--	-0.687	--	--	--	--	--	-1.01	--
Cations	meq/l			--	--	4.51	4.54	--	4.38	--	--	4.33	--	--	--	--	--	4.33	--
Chloride	mg/l			67.0	11.2	10.6 J6	6.09	3.04	3.45	--	3.94	3.43	--	21.6	--	23.6	4.04	4.10	--
Nitrogen, ammonia, as N	mg/l			--	--	0.214	0.225	--	< 0.100 U	--	--	< 0.100 U	--	--	--	--	--	< 0.100 U	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL		< 1.00 U	--	--	--	--	--	--	--	--	--	< 1.00 U T8	--	< 1.00 U	--	--	--
Solids, total dissolved	mg/l			--	--	224	229	--	224	--	--	228	--	--	--	--	--	229	--
Sulfate, as SO4	mg/l			17.7	5.85	6.28	15.9	13.4	13.8	--	16.5	16.5	--	18.6	--	18.7	15.1	17.6	--
Dissolved oxygen, field	mg/l			0.8	0.2	0.8	0.9	0.5	0.5	0.4	0.4	0.6	1	--	0.8	0.7	1.1	0.8	1.8
pH, field	pH units			7.21	8.37	8.18	7.96	7.98	7.9	7.74	7.94	7.85	7.48	--	7.23	7.27	7.62	8.12	7.87
Redox (oxidation potential), field	mV			-85	-230	-201	-147	-140	-125	-137	-139	-139	-12	--	-86	-36	-138	-135	-114
Specific conductance @ 25 deg C, field	umhos/cm			1373	409	418	436	395	413	392	400	403	613	--	644	630	398	407	408
Temperature, field	deg C			10.3	8	9	9.7	9.2	9.9	9.2	7.9	9.9	10.5	--	10	9.7	11	11.1	11.4
Turbidity, field	NTU			9.3	9.1	1	13	9.5	2	9	2.3	2	3.8	--	5	13	8.1	28	12
Dissolved Metals																			
Arsenic	ug/l		2.5	--	--	3.62	< 2.00 U	--	< 2.00 U	--	--	< 2.00 U	--	--	--	--	--	< 2.00 U	--
Boron	ug/l	**500 RAA17**	250.0	--	--	< 200 U	< 200 U	--	< 200 U	--	--	< 200 U	--	--	--	--	--	< 200 U	--
Calcium	mg/l			--	58.9 F1	51.5	54.8	59.5 F1	51.1	--	62.6 F1	53.0	--	--	--	--	60.0 F1	52.3	--
Chromium	ug/l	100 CR HRL93	25.0	--	--	< 4.00 U	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	--	--	--	--	< 4.00 U	--
Iron	ug/l			--	--	2320	810	--	1080	--	--	1310	--	--	--	--	--	879	--
Magnesium	mg/l			--	19.1 F1	18.5	18.2	18.1 F1	18	--	19.3 F1	17.7	--	--	--	--	19.6 F1	17.8	--
Potassium	mg/l			--	1.85 F1	1.61	1.42	1.66 F1	1.77	--	1.29 F1	1.3	--	--	--	--	1.34 F1	1.42	--
Sodium	mg/l			--	6.64 F1	6.8	5.8	5.77 F1	6.07	--	3.33 F1	3.51	--	--	--	--	4.07 F1	4.35	--
Zinc	ug/l	2000 HRL94	500.0	--	--	< 10.0 U	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	--	--	--	--	< 10.0 U	--

Table 5
Groundwater Data Compared to Groundwater-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

			Location	P-337L	P-338L	P-338L	P-338L	P-340L	P-341L	P-341L	P-342L	P694477	P694477	P694477
			Date	7/25/2024	4/18/2024	7/22/2024	10/17/2024	7/22/2024	7/23/2024	9/19/2024	7/24/2024	4/18/2024	7/26/2024	10/16/2024
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74											
Last Updated		01/16/2024	07/23/2015											
Exceedance Key		**Bold**	Underline											
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	--	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0	< 1.00 U	3.77	10.5	10.0	< 1.00 U	--	< 1.00 U	< 1.00 U	9.48	3.51	2.61
1,1-Dichloroethylene	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	12.5	< 0.100 U	< 0.100 U	0.981	0.918	< 0.100 U	--	< 0.100 U	< 0.100 U	0.860	0.103	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U
Acetone	ug/l	3000 HRL23 (1)	1000	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U	--	< 10.0 U J3 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3
Allyl chloride	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Bromomethane	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U
Butylbenzene	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U
Butylbenzene, tert	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	ND RAA16		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l			< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l			< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	175.0	< 1.00 U	7.52	5.21	4.42 C5	< 1.00 U	--	< 1.00 U	< 1.00 U	4.63	2.78	3.00 C5 J4
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**		< 1.00 U	15.9	15.9	15.1	< 1.00 U	--	< 1.00 U	< 1.00 U J3	13.8	4.98	5.44
Ethane	ug/l			--	--	9.15	1.78	< 1.29 U	< 1.29 U	--	< 1.29 U	--	--	--
Ethyl benzene	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	50.0	< 1.00 U	17.6	30.0	30.3	< 1.00 U	--	< 1.00 U	< 1.00 U J3	30.5	13.5	10.1
Ethylene	ug/l			--	--	< 1.27 U	< 1.20 U	< 1.27 U	< 1.27 U	--	< 1.27 U	--	--	--
Hexachlorobutadiene	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methane	ug/l			--	--	2880	2630	24.9	< 0.678 U	--	42.9	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--	< 10.0 U J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	--	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4
Naphthalene	ug/l	70 HRL13	17.5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	--	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U C3	< 1.00 U

Table 5
Groundwater Data Compared to Groundwater-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

				Location	P-337L	P-338L	P-338L	P-338L	P-340L	P-341L	P-341L	P-342L	P694477	P694477	P694477
				Date	7/25/2024	4/18/2024	7/22/2024	10/17/2024	7/22/2024	7/23/2024	9/19/2024	7/24/2024	4/18/2024	7/26/2024	10/16/2024
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74												
Last Updated		01/16/2024	07/23/2015												
Exceedance Key		**Bold**	Underline												
Propylbenzene	ug/l				< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l		25.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	4 HRL23 (1)	1.25		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18			< 5.00 U C3	8.38	16.2 B	7.52	< 5.00 U	--	< 5.00 U C3 J3	< 5.00 U	20.8	< 5.00 U	< 5.00 U C3
Toluene	ug/l	70 HRL23	50.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1		< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05		< 0.0500 U	**0.442**	**1.05**	**0.984**	< 0.0500 U	--	< 0.0500 U	< 0.0500 U	**0.795**	**0.489**	**0.474 J4**
Xylene, total	ug/l	300 XYL HRL23 (1)	75		< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U
General Parameters															
Alkalinity, total, as CaCO3	mg/l				193	--	449	448	179	272	--	203	--	436	--
Anions	meq/l				4.98	--	10.6	--	3.98	--	--	4.22	--	9.74	--
Carbon, total organic	mg/l				--	--	2.63	2.21	< 1.00 U	< 1.00 U	--	1.03	--	--	--
Cation-Anion balance	%				1.06	--	1.27	--	6.85	--	--	0.387	--	0.477	--
Cations	meq/l				5.08	--	10.9	--	4.56	--	--	4.25	--	9.69	--
Chloride	mg/l				9.34	--	43.6	45.1	4.72	24.5	--	1.20	--	21.3 J6	--
Nitrogen, ammonia, as N	mg/l				< 0.100 U	--	< 0.100 U	--	< 0.100 U	--	--	< 0.100 U	--	< 0.100 U J3	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL			--	--	< 1.00 U T8	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	--	--	--
Solids, total dissolved	mg/l				272	--	545	--	207	--	--	210	--	460	--
Sulfate, as SO4	mg/l				41.6	--	18.8	18.0	12.5	23.7	--	9.38	--	20.4 J6	--
Dissolved oxygen, field	mg/l				0	0.5	0.4	0.7	10.7	--	0.5	0.9	0.1	0.1	0.2
pH, field	pH units				7.47	7.63	7.74	7.49	8.45	--	7.55	8.06	7.4	7.72	7.45
Redox (oxidation potential), field	mV				-221.9	-161	-176	-166	72	--	-172	-43	-98	-210	192
Specific conductance @ 25 deg C, field	umhos/cm				316	895	953	910	404	--	685	411	653	822	786
Temperature, field	deg C				10	9.2	10.1	9.6	11.5	--	10.6	12.1	9.7	9.6	9.6
Turbidity, field	NTU				9.4	2	1	0.8	8	--	60.3	19	2.3	1.3	0.8
Dissolved Metals															
Arsenic	ug/l		2.5		< 2.00 U	--	< 2.00 U	--	< 2.00 U	--	--	< 2.00 U	--	< 2.00 U	--
Boron	ug/l	**500 RAA17**	250.0		< 200 U	--	< 200 U	--	< 200 U	--	--	< 200 U	--	< 200 U	--
Calcium	mg/l				60.8	--	128	--	51.6	--	--	49.7	--	120 V	--
Chromium	ug/l	100 CR HRL93	25.0		< 4.00 U	--	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	< 4.00 U	--
Iron	ug/l				604	--	2360	--	400	--	--	1410	--	1370	--
Magnesium	mg/l				22.4	--	50.1	--	21	--	--	19.1	--	40.8	--
Potassium	mg/l				1.45	--	2.14	--	1.39	--	--	1.36	--	1.97	--
Sodium	mg/l				3.32	--	4.54	--	4.79	--	--	2.58	--	5.3	--
Zinc	ug/l	2000 HRL94	500.0		< 10.0 U	--	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	< 10.0 U	--

Table 6
Groundwater Concentrations Exceeding Surface Water-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

		Location	22-OWA	312-OWA	401-OWA
		Date	7/26/2024	7/25/2024	4/16/2014
Parameter	Units	Elk River Surface Water Limits Table - SW-74			
Last Updated		09/28/2010			
Exceedance Key		**Bold**			
General Parameters					
Chloride	mg/l	**57.5**	**138**	**273**	**296**

2/24/2025
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Table 7
Groundwater Concentrations Exceeding Groundwater-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

				Compliance Wells														
			Location	P-29C	P-29C	P-29C	P-301C	P-301L	P-302C	P-302C	P-302C	P-304C	P-304C	P-304C	P-305C	P-305C	P-311L	P-313C
			Date	4/16/2024	7/24/2024	10/15/2024	4/19/2024	10/16/2024	4/19/2024	7/24/2024	10/17/2024	4/18/2024	7/24/2024	10/17/2024	7/26/2024	10/15/2024	7/25/2024	4/16/2024
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74															
Last Updated		01/16/2024	07/23/2015															
Exceedance Key		**Bold**	Underline															
Volatile Organic Compounds																		
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25	--	--	--	--	--	0.392	0.416	0.461	--	--	--	--	--	--	--
Benzene	ug/l	2 HRL09 (1)	0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1	--	--	--	--	--	--	--	--	0.161	0.215	0.214	--	--	--	--
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05	**0.412 C3**	**0.396**	**0.654 J4**	0.109 C3	0.106 J4	**0.538 C3**	**0.680**	**0.745**	--	**0.383**	**0.286**	--	0.113 J4	--	0.133 C3
Dissolved Metals																		
Arsenic	ug/l		2.5	--	--	--	--	--	--	9.99	--	--	3.34	--	5.91	--	4.08	--
Boron	ug/l	**500 RAA17**	250.0	--	--	--	--	--	--	**559**	--	--	309	--	310	--	--	--
Manganese	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

-- No exceedance/not analyzed.

(1) Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.

C3 The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

F1 MS and/or MSD Recovery exceeds the control limits

HRL09 Health Risk Limit 2009.

HRL15 Health Risk Limit 2015.

HRL18 Health Risk Limit 2018.

HRL23 Health Risk Limit 2023.

J4 The associated batch QC was outside the established quality control range for accuracy.

RAA16 Risk Assessment Advice 2016.

RAA17 Risk Assessment Advice 2017.

Table 7
Groundwater Concentrations Exceeding Groundwater-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

				Compliance Wells															
			Location	P-313C	P-313C	P-314C	P-314C	P-315L	P-320C	P-320C2	P-320C2	P-320L	P-320L	P-320L	P-321L	P-321L	P-323L	P-323L	P-323L
			Date	7/24/2024	10/17/2024	7/24/2024	10/16/2024	7/26/2024	7/24/2024	4/16/2024	10/15/2024	4/16/2024	7/24/2024	10/15/2024	7/23/2024	10/17/2024	4/18/2024	7/23/2024	10/17/2024
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																
Last Updated		01/16/2024	07/23/2015																
Exceedance Key		**Bold**	Underline																
Volatile Organic Compounds																			
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.335	0.313
Benzene	ug/l	2 HRL09 (1)	0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.927**	**0.740**
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05	**1.30**	0.154	**0.256**	0.115 J4	--	**0.392**	**0.214 C3**	**0.301 J4**	**0.228 C3**	**0.296**	**0.221 J4**	**0.285**	**0.366**	**0.223**	**0.222**	**0.236**
Dissolved Metals																			
Arsenic	ug/l		2.5	2.73	--	--	--	2.90	7.23	--	--	--	--	--	--	--	--	--	--
Boron	ug/l	**500 RAA17**	250.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	319	--
Manganese	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

-- No exceedance/not analyzed.

(1) Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.

C3 The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

F1 MS and/or MSD Recovery exceeds the control limits

HRL09 Health Risk Limit 2009.

HRL15 Health Risk Limit 2015.

HRL18 Health Risk Limit 2018.

HRL23 Health Risk Limit 2023.

J4 The associated batch QC was outside the established quality control range for accuracy.

RAA16 Risk Assessment Advice 2016.

RAA17 Risk Assessment Advice 2017.

Table 7
Groundwater Concentrations Exceeding Groundwater-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

				Compliance Wells																Non-Compliance Wells			
Location				P-325L	P-325L	P-325L	P-326L	P-326L	P-326L	P-327L	P-334L	P-334L	P-334L	P-338L	P-338L	P-338L	P-342L	P694477	P694477	P694477	P-17C	P-308C	P-308L	P-309C
Date				4/16/2024	7/23/2024	10/17/2024	4/16/2024	7/23/2024	10/17/2024	7/25/2024	5/15/2024	9/19/2024	10/17/2024	4/18/2024	7/22/2024	10/17/2024	4/15/2024	4/18/2024	7/26/2024	10/16/2024	7/24/2024	7/26/2024	7/24/2024	7/26/2024
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																					
Last Updated		01/16/2024	07/23/2015																					
Exceedance Key		**Bold**	Underline																					
Volatile Organic Compounds																								
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	ug/l	2 HRL09 (1)	0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.952	0.935	--	0.862
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**		--	--	--	--	--	--	--	--	**25.4**	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1	--	--	--	--	0.154	0.120	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05	**0.533 C3**	**0.556**	**0.643**	0.156 C3	0.160	0.176	--	**0.584**	**0.690**	**0.545**	**0.442**	**1.05**	**0.984**	--	**0.795**	**0.489**	**0.474 J4**	**0.289**	--	**1.74**	0.111
Dissolved Metals																								
Arsenic	ug/l		2.5	--	--	--	--	--	--	3.62	--	--	--	--	--	--	--	--	--	--	22.3	35.0	--	35.2
Boron	ug/l	**500 RAA17**	250.0	--	251	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**4330**	**3170**	--	**3150**
Manganese	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--	--	--	**114 F1**	--	--	--	--	--	--	--

-- No exceedance/not analyzed.

(1) Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.

C3 The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

F1 MS and/or MSD Recovery exceeds the control limits

HRL09 Health Risk Limit 2009.

HRL15 Health Risk Limit 2015.

HRL18 Health Risk Limit 2018.

HRL23 Health Risk Limit 2023.

J4 The associated batch QC was outside the established quality control range for accuracy.

RAA16 Risk Assessment Advice 2016.

RAA17 Risk Assessment Advice 2017.

Table 8
Baseline Groundwater Data
Elk River Landfill
Elk River, Minnesota

			Location	P-341L	P-342L
			Date	4/15/2024	4/15/2024
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74		
Last Updated		01/16/2024	07/23/2015		
Exceedance Key		**Bold**	No Exceedances		
Volatile Organic Compounds					
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	50.0	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l			< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l			< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	25.0	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	0.001	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	12.5	< 0.100 U	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	10.0	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	1.25	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	25.0	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l			< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l			< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94		< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	2.5	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l			< 1.00 U C3	< 1.00 U C3
Acetone	ug/l	3000 HRL23 (1)	1000	< 10.0 U	< 10.0 U
Allyl chloride	ug/l	30 HRL94	7.5	< 1.00 U	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	0.5	< 0.500 U	< 0.500 U
Bromobenzene	ug/l			< 1.00 U	< 1.00 U
Bromochloromethane	ug/l			< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	1.5	< 1.00 U	< 1.00 U
Bromoform	ug/l	40 HRL93	10.0	< 1.00 U	< 1.00 U
Bromomethane	ug/l	10 HRL93	2.5	< 1.00 U C3	< 1.00 U C3
Butylbenzene	ug/l			< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l			< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l			< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	25.0	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	2.5	< 1.00 U	< 1.00 U
Chloroethane	ug/l	ND RAA16		< 1.00 U C3	< 1.00 U C3
Chloroform	ug/l	20 HRL18	7.5	< 1.00 U	< 1.00 U
Chloromethane	ug/l			< 1.00 U C3	< 1.00 U C3
Chlorotoluene, o	ug/l			< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l			< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l			< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l			< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	175.0	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17		< 1.00 U	< 1.00 U
Ethyl benzene	ug/l	40 HRL23	12.5	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	50.0	< 1.00 U	< 1.00 U
Hexachlorobutadiene	ug/l	1 HRL93	0.25	< 0.250 U	< 0.250 U

Table 8
Baseline Groundwater Data
Elk River Landfill
Elk River, Minnesota

			Location	P-341L	P-342L
			Date	4/15/2024	4/15/2024
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74		
Last Updated		01/16/2024	07/23/2015		
Exceedance Key		**Bold**	No Exceedances		
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	1.25	< 1.00 U	< 1.00 U
Naphthalene	ug/l	70 HRL13	17.5	< 1.00 U	< 1.00 U
Propylbenzene	ug/l			< 1.00 U	< 1.00 U
Styrene	ug/l		25.0	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	4 HRL23 (1)	1.25	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18		< 5.00 U	< 5.00 U
Toluene	ug/l	70 HRL23	50.0	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	0.1	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	0.2 HRL18 (1)	0.05	< 0.0500 U C3	< 0.0500 U C3
Xylene, total	ug/l	300 XYL HRL23 (1)	75	< 2.00 U	< 2.00 U
General Parameters					
Alkalinity, total, as CaCO3	mg/l			274	145
Anions	meq/l			6.56	3.03
Cations	meq/l			6.23	3.57
Chloride	mg/l			24.6	1.05
Nitrogen, ammonia, as N	mg/l			< 0.100 U	< 0.100 U
Nitrogen, nitrate + nitrite, as N	mg/l			< 0.100 U	< 0.100 U
Solids, total dissolved	mg/l			339	171
Solids, total suspended	mg/l			37.8	< 4.00 U
Sulfate, as SO4	mg/l			18.9	6.72
Dissolved oxygen, field	mg/l			0.1	0.2
pH, field	pH units			8.56	7.94
Redox (oxidation potential), field	mV			-329	-199
Specific conductance @ 25 deg C, field	umhos/cm			575	368
Temperature, field	deg C			10.2	7.7
Turbidity, field	NTU			15.5	4.9
Dissolved Metals					
Arsenic	ug/l		2.5	< 2.00 U	< 2.00 UF1
Boron	ug/l	500 RAA17	250.0	< 200 U	< 200 U F1
Cadmium	ug/l	0.5 HRL15 (1)		< 2.00 U	< 2.00 U F1
Calcium	mg/l			75.8	44.2 F1
Chromium	ug/l	100 CR HRL93	25.0	6.46	< 4.00 UF1
Copper	ug/l			< 10.0 U	< 10.0 U F1
Iron	ug/l			< 100 U	< 100 U F1
Lead	ug/l			< 10.0 U	< 10.0 U F1
Magnesium	mg/l			26.9	14.4 F1 15.3 F1
Manganese	ug/l	**100 HRL23**		84.3	**114 F1**
Mercury	ug/l			< 0.200 U	< 0.200 U F1
Potassium	mg/l			3.02	1.20 F1
Sodium	mg/l			3.58	2.41 F1
Zinc	ug/l	2000 HRL94	500.0	42.3	17.1 F1

Table 4
Groundwater Data Compared to Groundwater-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

Barr Standard Footnotes and Qualifiers

--	Not analyzed/Not available.
B	The analyte was detected in the associated laboratory blank sample(s).
J	Estimated detected value. Either certain QC criteria were not met or the concentration is between the laboratory's detection and quantitation limits.
J+	The result is an estimated quantity and may be biased high.
J-	The result is an estimated quantity and may be biased low.
U	The analyte was analyzed for, but was not detected.
UJ	The analyte was analyzed for, but was not detected. The reported value is approximate and may be inaccurate or imprecise.

Laboratory Qualifiers

B	The same analyte is found in the associated blank.
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
C5	The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.
F1	MS and/or MSD Recovery exceeds the control limits
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
O1	The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

MDH Human Health-Based Water Guidance Table

(1)	Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.
CR	Value represents the criteria for Chromium, hexavalent.
DCP	Value shown is 1,3-dichloropropene in the MDH criterion, however, the laboratory reports cis and trans isomers individually.
HBV20	Health Based Value 2020.
HBV22	Health Based Value 2022.
HRL09	Health Risk Limit 2009.
HRL13	Health Risk Limit 2013.
HRL15	Health Risk Limit 2015.
HRL18	Health Risk Limit 2018.
HRL23	Health Risk Limit 2023.
HRL93	Health Risk Limit 1993.
HRL94	Health Risk Limit 1994.
HRLMCL	Health Risk Limit; Maximum Contaminant Level.
ND	Not derived due to insufficient information.
RAA13	Risk Assessment Advice 2013.
RAA16	Risk Assessment Advice 2016.
RAA17	Risk Assessment Advice 2017.
XYL	Value shown is for the sum of the mixed o,m and p Xylene isomers.

Table 9
Residential Well Data
Elk River Landfill
Elk River, Minnesota

Location			22130 Quinn St	22915 Hwy 169	ERL Shop Well	Ridges Develop.	22205 Elk Lake Rd	22275 Elk Lake Rd NW	12901 221st Ave NW	22447 Tipton St.	12163 223rd Ave	12265 223rd Ave	12269 223rd St	12183 223rd Ave	22272 Quinn St	11661 225th Ave
Date			10/21/2024	10/21/2024	10/21/2024	10/21/2024	10/22/2024	10/22/2024	10/22/2024	10/21/2024	10/22/2024	10/22/2024	10/22/2024	10/21/2024	10/21/2024	10/21/2024
Unique ID/MPCA Location Unique Identified (LUI)			638355	545375	420558	626766	625475	720300	535970	813437	876409	876411	876410	876412	876413	ZW00217
Parameter	Units	MDH Human Health-Based Water Guidance Table														
Last Updated		01/16/2024														
Exceedance Key		No Exceedance														
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 UC5J3J4	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U J3 J4
Allyl chloride	ug/l	30 HRL94	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	40 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	ND RAA16	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	20 HRL18	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl benzene	ug/l	40 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U

Table 9
Residential Well Data
Elk River Landfill
Elk River, Minnesota

Location			22130 Quinn St	22915 Hwy 169	ERL Shop Well	Ridges Develop.	22205 Elk Lake Rd	22275 Elk Lake Rd NW	12901 221st Ave NW	22447 Tipton St.	12163 223rd Ave	12265 223rd Ave	12269 223rd St	12183 223rd Ave	22272 Quinn St	11661 225th Ave
Date			10/21/2024	10/21/2024	10/21/2024	10/21/2024	10/22/2024	10/22/2024	10/22/2024	10/21/2024	10/22/2024	10/22/2024	10/22/2024	10/21/2024	10/21/2024	10/21/2024
Unique ID/MPCA Location Unique Identified (LUI)			638355	545375	420558	626766	625475	720300	535970	813437	876409	876411	876410	876412	876413	ZW00217
Parameter	Units	MDH Human Health-Based Water Guidance Table														
Last Updated		01/16/2024														
Exceedance Key		No Exceedance														
Ethyl ether	ug/l	200 RAA16 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	ug/l	70 HRL13	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3	< 1.00 U J3
Propylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Toluene	ug/l	70 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U
General Parameters																
Alkalinity, total, as CaCO3	mg/l		222	216	173	184	154	187	169	175	192	187	182	178	177	178
Chemical Oxygen Demand	mg/l		< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Chloride	mg/l		3.9	37.7	< 1 U	< 1 U	16.4	5.13	6.03	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Nitrogen, ammonia, as N	mg/l		< 0.100 U	< 0.100 U	0.153	0.257	0.178	0.391	< 0.100 U	0.243	< 0.100 U	0.187	0.210	< 0.100 U	0.210	0.225
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.100 U	0.130	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Solids, total dissolved	mg/l		266	321	181	195	286	242	226	178	218	185	185	201	175	194
Solids, total suspended	mg/l		< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	4.90	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U
Sulfate, as SO4	mg/l		19.2	27.8	< 5.00 U	< 5.00 U	59.6	21.5	28.7 J6	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	6.17
Dissolved oxygen, field	mg/l		0.8	0.8	0.4	2.8	0.9	0.8	0.7	0.3	1.5	0.5	1.6	0.8	0.4	0.7
pH, field	pH units		7.46	7.71	7.6	7.7	7.3	7.56	7.48	7.53	7.55	7.72	7.33	8.3	7.89	7.89
Redox (oxidation potential), field	mV		110	190	-110	-20	-10	-111	-124	-130	-31	-150	-166	-50	-91	-50
Specific conductance @ 25 deg C, field	umhos/cm		4210	565	340	350	457	402	385	325	337	336	337	420	331	344
Temperature, field	deg C		9.9	10.8	11.9	8.8	11	9.7	9.9	10.5	9.9	9.3	10.8	11.9	10.3	9.9
Turbidity, field	NTU		0.5	9	1.0	6.2	1.4	1.7	1.5	1.5	1.1	1.0	1.0	1.0	1.3	1.7
Total Metals																
Calcium	mg/l		61.1	74.1	41.4	45.8	65.4	54.7	49.8	41.6	< 1.00 U	43.4	43.7	< 1.00 U	41.3	38.8
Magnesium	mg/l		20.9	24.0	12.9	13.9	14.8	15.5	15.1	12.5	< 1.00 U	13.2	13.2	< 1.00 U	12.8	15.0
Potassium	mg/l		1.66	1.75	1.49	1.32	1.49	1.89	1.63	1.58	< 1.00 U	1.36	1.40	< 1.00 U	1.35	1.60
Sodium	mg/l		3.92	3.30	6.45	5.83	3.72	5.16	5.90	5.77	86.4	5.37	5.27	88.7	4.87	8.03

Data Footnotes and Qualifiers

Barr Standard Footnotes and Qualifiers

--	Not analyzed/Not available.
U	The analyte was analyzed for, but was not detected.

Laboratory Qualifiers

B	The same analyte is found in the associated blank.
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
Q	Sample was prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.
V	The sample concentration is too high to evaluate accurate spike recoveries.

MDH Human Health-Based Water Guidance Table

(1)	Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.
DCP	Value shown is 1,3-dichloropropene in the MDH criterion, however, the laboratory reports cis and trans isomers individually.
HRL09	Health Risk Limit 2009.
HRL13	Health Risk Limit 2013.
HRL15	Health Risk Limit 2015.
HRL18	Health Risk Limit 2018.
HRL23	Health Risk Limit 2023.
HRL93	Health Risk Limit 1993.
HRL94	Health Risk Limit 1994.
HRLMCL	Health Risk Limit; Maximum Contaminant Level.
ND	Not derived due to insufficient information.
RAA13	Risk Assessment Advice 2013.
RAA16	Risk Assessment Advice 2016.
RAA17	Risk Assessment Advice 2017.
XYL	Value shown is for the sum of the mixed o,m and p Xylene isomers.

Table 10
Lysimeter Purge Volumes
Elk River Landfill
Elk River, Minnesota

	Purge Volumes (gallons)			
Lysimeter ID	**Winter Monitoring Event**	**Spring Monitoring Event**	**Summer Monitoring Event**	**Fall Monitoring Event**
LYS-6N*	Not measured	247	**143**	**79**
LYS-6S	Not measured	--	--	--
LYS-10	Not measured	--	--	--
LYS-11	Not measured	**15**	**15**	<5
LYS-12	Not measured	0	0	<5
LYS-13	Not measured	**15**	<5	<5
LYS-14	Not measured	0	0	<5
LYS-15	Not measured	0	0	<5
LYS-16	Not measured	0	0	<5
LYS-17	Not measured	**15**	**15**	7
LYS-18	Not measured	0	0	7
LYS-19	Not measured	**15**	0	<5
LYS-20	Not measured	0	0	7

Bold indicates sample was collected for laboratory analysis.
-- no purging conducted; lysimeter undergoing evaluation
* LYS-6N is undergoing a continuous pumping program.

Table 11
Lysimeter Data
Elk River Landfill
Elk River, Minnesota

	Location	LYS-11	LYS-11	LYS-13	LYS-17	LYS-17	LYS-19	LYS-6N	LYS-6N
	Date	4/18/2024	8/02/2024	4/18/2024	4/18/2024	8/02/2024	4/18/2024	8/02/2024	10/22/2024
Parameter	Units								
Volatile Organic Compounds									
1,1,1,2-Tetrachloroethane	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,1,1-Trichloroethane	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,1,2,2-Tetrachloroethane	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,1-Dichloroethane	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,1-Dichloroethylene	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,1-Dichloropropene	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,2,3-Trichlorobenzene	ug/l	< 0.500 U	--	< 0.500 U	< 0.500 U	--	< 0.500 U	--	< 0.500 U Q
1,2,3-Trichloropropane	ug/l	< 0.500 U	--	< 0.500 U	< 0.500 U	--	< 0.500 U	--	< 0.500 U Q
1,2,4-Trichlorobenzene	ug/l	< 0.500 U	--	< 0.500 U	< 0.500 U	--	< 0.500 U	--	< 0.500 U Q
1,2,4-Trimethylbenzene	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	--	< 1.00 U	< 1.00 U	--	< 1.00 U	--	< 1.00 U Q
1,2-Dibromoethane (EDB)	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,2-Dichlorobenzene	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
1,2-Dichloroethane	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,2-Dichloroethylene	ug/l	< 0.100 U	--	0.219	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,2-Dichloroethylene, cis	ug/l	< 0.100 U	--	0.219	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,2-Dichloroethylene, trans	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
1,2-Dichloropropane	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
1,3,5-Trimethylbenzene	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
1,3-Dichlorobenzene	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
1,3-Dichloropropane	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
1,3-Dichloropropene	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,3-Dichloropropene, cis	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
1,3-Dichloropropene, trans	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
1,4-Dichlorobenzene	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
2,2-Dichloropropane	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Acetone	ug/l	< 2.00 U	--	< 2.00 U	< 2.00 U	--	4.55 C5	--	3.30 Q
Allyl chloride	ug/l	< 1.00 U	--	< 1.00 U	< 1.00 U	--	< 1.00 U	--	< 1.00 U Q
Benzene	ug/l	< 0.0400 U	--	0.0780	< 0.0400 U	--	< 0.0400 U	--	< 0.0400 U Q
Bromobenzene	ug/l	< 0.500 U	--	< 0.500 U	< 0.500 U	--	< 0.500 U	--	< 0.500 U Q
Bromochloromethane	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
Bromodichloromethane	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Bromoform	ug/l	< 1.00 U	--	< 1.00 U	< 1.00 U	--	< 1.00 U	--	< 1.00 U Q
Bromomethane	ug/l	< 0.500 U C3	--	< 0.500 U C3	< 0.500 U C3	--	< 0.500 U C3	--	< 0.500 U Q
Butylbenzene	ug/l	< 0.500 U	--	< 0.500 U	< 0.500 U	--	< 0.500 U	--	< 0.500 U C3 Q
Butylbenzene, sec	ug/l	< 0.500 U	--	< 0.500 U	< 0.500 U	--	< 0.500 U	--	< 0.500 U Q
Butylbenzene, tert	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
Carbon tetrachloride	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
Chlorobenzene	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Chlorodibromomethane	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Chloroethane	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
Chloroform	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Chloromethane	ug/l	< 0.500 U	--	< 0.500 U	< 0.500 U	--	< 0.500 U	--	< 0.500 U Q
Chlorotoluene, o	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Chlorotoluene, p	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U C3 Q
Cumene (isopropyl benzene)	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Cymene p- (toluene isopropyl p-)	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
Dibromomethane (methylene bromide)	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
Dichlorodifluoromethane (Freon-12)	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U C3 Q
Dichlorofluoromethane (Freon-21)	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Ethyl benzene	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Ethyl ether	ug/l	< 0.100 U	--	0.560	< 0.100 U	--	1.10	--	< 0.100 U Q
Hexachlorobutadiene	ug/l	< 1.00 U	--	< 1.00 U	< 1.00 U	--	< 1.00 U	--	< 1.00 U Q
Methyl ethyl ketone (2-butanone)	ug/l	< 4.00 U	--	< 4.00 U	< 4.00 U	--	< 4.00 U	--	< 4.00 U Q
Methyl isobutyl ketone (MIBK)	ug/l	< 1.00 U	--	< 1.00 U	< 1.00 U	--	< 1.00 U	--	< 1.00 U Q
Methyl tertiary butyl ether (MTBE)	ug/l	< 0.0400 U	--	< 0.0400 U	< 0.0400 U	--	0.0430	--	0.0880 Q
Methylene chloride	ug/l	< 1.00 U	--	< 1.00 U	< 1.00 U	--	< 1.00 U	--	< 1.00 U Q
Naphthalene	ug/l	< 0.500 U	--	< 0.500 U	< 0.500 U	--	< 0.500 U	--	< 0.500 U Q
Propylbenzene	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
Styrene	ug/l	< 0.500 U	--	< 0.500 U	< 0.500 U	--	< 0.500 U	--	< 0.500 U Q
Tetrachloroethylene	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Tetrahydrofuran	ug/l	< 0.500 U	--	26.8	< 0.500 U	--	2.08	--	0.974 C5 Q
Toluene	ug/l	< 0.200 U	--	< 0.200 U	< 0.200 U	--	< 0.200 U	--	< 0.200 U Q
Trichloroethylene (TCE)	ug/l	< 0.0400 U	--	0.0610	< 0.0400 U	--	< 0.0400 U	--	< 0.0400 U Q

Table 11
Lysimeter Data
Elk River Landfill
Elk River, Minnesota

Location		LYS-11	LYS-11	LYS-13	LYS-17	LYS-17	LYS-19	LYS-6N	LYS-6N
Date		4/18/2024	8/02/2024	4/18/2024	4/18/2024	8/02/2024	4/18/2024	8/02/2024	10/22/2024
Parameter	Units								
Trichlorofluoromethane (Freon-11)	ug/l	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	< 0.100 U Q
Vinyl chloride	ug/l	< 0.0500 U	--	< 0.0500 U	< 0.0500 U	--	< 0.0500 U	--	< 0.0500 U J3 Q
Xylene, total	ug/l	< 0.260 U	--	< 0.260 U	< 0.260 U	--	0.342	--	< 0.260 U Q

Table 11
Lysimeter Data
Elk River Landfill
Elk River, Minnesota

	Location	LYS-11	LYS-11	LYS-13	LYS-17	LYS-17	LYS-19	LYS-6N	LYS-6N
	Date	4/18/2024	8/02/2024	4/18/2024	4/18/2024	8/02/2024	4/18/2024	8/02/2024	10/22/2024
Parameter	Units								
General Parameters									
Alkalinity, bicarbonate, as CaCO3	mg/l	622	668	< 20 U	554	609	664	789	--
Chloride	mg/l	79.2	74.1	< 1 U P1	64.6	70.5	749	1590	--
pH	pH units	7.25 T8	7.36 T8	4.09 T8	7.93 T8	7.94 T8	6.88 T8	7.16 T8	--
Solids, total dissolved	mg/l	1760	1800	58.0 B	854 B	736	2560	5690	--
Solids, total suspended	mg/l	128 J3	17.0	< 4.00 U	159	< 4.00 U	11.5	< 4.00 U	--
Specific conductance @ 25 deg C	umhos/cm	2580	2480	89.8	1400	1230	4090	8640	--
Sulfate, as SO4	mg/l	517	539	7.7 P1	93.5	13.3	443	533	--
Dissolved oxygen, field	mg/l	--	2.4	--	--	4.1	--	1.3	--
pH, field	pH units	6.8	6.90	5.82	8.33	7.44	6.67	7.07	7.33
Redox (oxidation potential), field	mV	--	228	--	--	186	--	180	--
Specific conductance @ 25 deg C, field	umhos/cm	1847	2599	49	1215	1287	3139	8922	8000
Temperature, field	deg C	12.6	16.9	9.7	19.3	22.4	15.5	19.1	17.5
Turbidity, field	NTU	--	1.5	--	--	38	--	21	--
Dissolved Metals									
Calcium	mg/l	375 F1	361	5.50 F1	163 F1	162	420 F1	444	--
Magnesium	mg/l	132 F1	139	1.15 F1	54.4 F1	58.5	128 F1	152	--
Potassium	mg/l	12.1 F1	12.1	< 1.00 U F1	6.53 F1	6.45	14.4 F1	249	--
Sodium	mg/l	43.9 F1	43.6	< 1.00 U F1	24.6 F1	24.4	281 F1	1050	--

B The same analyte is found in the associated blank

C5 The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.

F1 Sample filtration was performed in the laboratory.

H Recommended sample preservation, extraction or analysis holding time was exceeded.

J+ The result is an estimated quantity and may be biased high.

J3 The associated batch QC was outside the established quality control range for precision.

Q Sample was prepared and/or analyzed past holding time as defined in the method. Concentrations should beconsidered minimum values.

U The analyte was analyzed for, but was not detected.

Table 12
Quarterly Leachate Data
Elk River Landfill
Elk River, Minnesota

Location		SP-01	SP-01	SP-01	SP-01
Date		1/08/2024	4/01/2024	7/10/2024	10/03/2024
Parameter	Units				
Volatile Organic Compounds					
1,1,1-Trichloroethane	ug/l	< 1.85 U	< 1.85 U	< 1.85 U	< 1.00 UH
1,1,2,2-Tetrachloroethane	ug/l	< 1.39 U	< 1.39 U	< 1.39 U	< 1.00 UH
1,1,2-Trichloroethane	ug/l	< 1.19 U	< 1.19 U	< 1.19 U	< 1.00 UH
1,1-Dichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH
1,1-Dichloroethylene	ug/l	< 1.21 U	< 1.21 U	< 1.21 U	< 1.00 UH
1,2,4-Trichlorobenzene	ug/l	< 8.80 U	< 8.80 U	< 8.80 U	< 4.40 UH
1,2-Dichloroethane	ug/l	< 1.30 U	2.45	< 1.30 U	< 1.00 UH
1,2-Dichloroethylene, trans	ug/l	< 2.08 U	< 2.08 U	< 2.08 U	< 1.04 UH
1,2-Dichloropropane	ug/l	< 2.84 U J4	< 2.84 U	< 2.84 U	< 1.42 UH
1,3-Dichloropropene, cis	ug/l	< 1.51 U J4	< 1.51 U	< 1.51 U	< 1.00 UH
1,3-Dichloropropene, trans	ug/l	< 2.28 U	< 2.28 U	< 2.28 U	< 1.14 UH
2-Chloroethyl vinyl ether	ug/l	< 50.0 U C3	< 50.0 U	< 50.0 U	< 50.0 UH
Acetone	ug/l	3270	7410 C3	1410	1520 C5H
Acrolein	ug/l	< 127 U J4	< 127 U	< 20.0 U C3	< 63.5 UH
Acrylonitrile	ug/l	< 7.22 U	< 7.22 U	< 7.22 U	< 5.00 UH
Benzene	ug/l	3.85	3.80	4.55	2.18 H
Bromodichloromethane	ug/l	< 1.45 U	< 1.45 U	< 1.45 U	< 1.00 UH
Bromoform	ug/l	< 2.34 U	< 2.34 U	< 2.34 U	< 1.17 UH
Bromomethane	ug/l	< 3.94 U C3	< 3.94 U C3	< 3.94 U	< 1.97 UH
Carbon tetrachloride	ug/l	< 1.80 U	< 1.80 U	< 1.80 U	< 1.00 UH
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH
Chlorodibromomethane	ug/l	< 1.22 U	< 1.22 U	< 1.22 U	< 1.00 UH
Chloroethane	ug/l	< 3.40 U	< 3.40 U	< 3.40 U	< 1.70 UH
Chloroform	ug/l	5.00	< 2.06 U	23.7	< 1.03 UH
Chloromethane	ug/l	< 8.70 U	< 8.70 U	< 8.70 U	< 4.35 UH
Ethyl benzene	ug/l	15.7	18.4	7.40	12.1 H
Ethyl ether	ug/l	34.7	62.3	23.7	19.5 H
Hexachlorobutadiene	ug/l	< 2.43 U	< 2.43 U	< 2.43 U C3	< 2.00 UH
Isopropyl alcohol	ug/l	1700	2520 C3	139	< 41.3 UH
Methyl ethyl ketone (2-butanone)	ug/l	3730	6280	961	617 H
Methyl isobutyl ketone (MIBK)	ug/l	51.6	55.5	47.8	18.1 H
Methylene chloride	ug/l	< 13.3 U	< 13.3 U	< 13.3 U	< 6.64 UH
Naphthalene	ug/l	< 9.75 U	< 9.75 U	< 9.75 U	5.53 H
Tetrachloroethylene	ug/l	< 1.79 U	< 1.79 U	< 1.79 U	< 1.00 UH
Tetrahydrofuran	ug/l	1500	2100 C5 J4	1870 C5	1580 H
Toluene	ug/l	296	67.8	27.3	31.9 H
Trichloroethylene (TCE)	ug/l	< 1.17 U	< 1.17 U	< 1.17 U	< 1.00 UH
Vinyl chloride	ug/l	< 2.31 U	< 2.31 U	< 2.31 U	< 1.15 UH
Xylene, m & p	ug/l	25.4	26.2	11.5	21.4 H
Xylene, o	ug/l	10.9	13.8	7.35	12.3 H
Xylene, total	ug/l	36.3	40.0	18.9	33.7 H
Semivolatile Organic Compounds					
1,2,4-Trichlorobenzene	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
1,2-Dichlorobenzene	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
1,2-Diphenylhydrazine	ug/l	< 10.0 U N2	< 10.0 U N2	< 10.0 U N2	< 10.0 U N2
1,3-Dichlorobenzene	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
1,4-Dichlorobenzene	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
2,2'-oxybis (1-chloropropane)	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
2,4,6-Trichlorophenol	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
2,4-Dichlorophenol	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
2,4-Dimethylphenol	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
2,4-Dinitrophenol	ug/l	< 10.0 U	< 16.3 U	< 18.0 U	< 32.5 U
2,4-Dinitrotoluene	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 16.5 U
2,6-Dinitrotoluene	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
2-Chloronaphthalene	ug/l	< 5.00 U J4	< 5.00 U J4	< 5.00 U	< 5.00 U
2-Chlorophenol	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
2-Methyl-4,6-dinitrophenol	ug/l	< 10.0 U	< 13.2 U	< 14.6 U	< 26.3 U

Table 12
Quarterly Leachate Data
Elk River Landfill
Elk River, Minnesota

Location		SP-01	SP-01	SP-01	SP-01
Date		1/08/2024	4/01/2024	7/10/2024	10/03/2024
Parameter	Units				
2-Nitrophenol	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
3,3`-Dichlorobenzidine	ug/l	< 5000 U	< 5000 U	< 5000 U	< 5000 U
4-Bromophenyl phenyl ether	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
4-Chloro-3-methylphenol	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
4-Chlorophenyl phenyl ether	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
4-Nitrophenol	ug/l	< 15.0 U	< 15.0 U	< 15.0 U	< 20.1 U
Acenaphthene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Acenaphthylene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Anthracene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Benz(a)anthracene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Benzidine	ug/l	< 80.0 U J4	< 80.0 U	< 80.0 U	< 80.0 U
Benzo(a)pyrene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Benzo(b)fluoranthene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Benzo(g,h,i)perylene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Benzo(k)fluoranthene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Bis(2-chloroethoxy)methane	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Bis(2-chloroethyl)ether	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 16.2 U
Bis(2-ethylhexyl)phthalate	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Butyl benzyl phthalate	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Chrysene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Dibenz(a,h)anthracene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Diethyl phthalate	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Dimethyl phthalate	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Di-n-butyl phthalate	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Di-n-octyl phthalate	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Fluoranthene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Fluorene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Hexachlorobenzene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Hexachlorobutadiene	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Hexachlorocyclopentadiene	ug/l	< 10.0 U	< 11.7 U	< 12.9 U	< 23.3 U
Hexachloroethane	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Indeno(1,2,3-cd)pyrene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Isophorone	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Naphthalene	ug/l	3.77	2.01	3.35	< 3.72 U
Nitrobenzene	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
n-Nitrosodimethylamine	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 12.6 U
n-Nitrosodi-n-propylamine	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
n-Nitrosodiphenylamine	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 11.9 U
Pentachlorophenol	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Phenanthrene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Phenol	ug/l	42.8	62.7	< 10.0 U	28.6
Pyrene	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Pesticides					
4,4'-DDD	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
4,4'-DDE	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
4,4'-DDT	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
a-BHC	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
Aldrin	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
b-BHC	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
Chlordane, alpha & gamma	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 UJ-
d-BHC	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
Dieldrin	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
Endosulfan I	ug/l	0.314 P	0.456 P	< 0.0500 U	0.299 J-
Endosulfan II	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
Endosulfan sulfate	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
Endrin	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
Endrin aldehyde	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ4J-
g-BHC (Lindane)	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-

Table 12
Quarterly Leachate Data
Elk River Landfill
Elk River, Minnesota

Location		SP-01	SP-01	SP-01	SP-01
Date		1/08/2024	4/01/2024	7/10/2024	10/03/2024
Parameter	Units				
Heptachlor	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
Heptachlor epoxide	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 UJ-
Toxaphene	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 UJ-

Table 12
Quarterly Leachate Data
Elk River Landfill
Elk River, Minnesota

Location		SP-01	SP-01	SP-01	SP-01
Date		1/08/2024	4/01/2024	7/10/2024	10/03/2024
Parameter	Units				
Polychlorinated Biphenyls					
Aroclor 1016	ug/l	< 0.200 U	< 0.200 U	< 0.200 U	< 0.200 UJ-
Aroclor 1221	ug/l	< 0.200 U	< 0.200 U	< 0.200 U	< 0.200 UJ-
Aroclor 1232	ug/l	< 0.200 U	< 0.200 U	< 0.200 U	< 0.200 UJ-
Aroclor 1242	ug/l	< 0.200 U	< 0.200 U	< 0.200 U	< 0.200 UJ-
Aroclor 1248	ug/l	< 0.200 U	< 0.200 U	< 0.200 U	< 0.200 UJ-
Aroclor 1254	ug/l	< 0.200 U	< 0.200 U	< 0.200 U	< 0.200 UJ-
Aroclor 1260	ug/l	< 0.240 U	< 0.200 U	< 0.200 U	< 0.200 UJ-
Per- and Polyfluoroalkyl Substances					
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ug/l	< 0.0253 U	< 0.0247 U	< 0.0337 U	< 0.0293 U
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	ug/l	< 0.0253 U	< 0.0247 UJ	< 0.0337 UJ	< 0.0293 UJL1
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	ug/l	< 0.0253 U	< 0.0247 U	< 0.0337 U	< 0.0293 UJL1
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	ug/l	0.196 J	0.167 J	0.254 J	0.272 L1
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol (N-EtFOSE)	ug/l	0.116	0.177 J	< 0.0843 U	0.0930
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol (N-MeFOSE)	ug/l	0.257	0.376	0.169	0.166
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ug/l	3.07	1.56	1.66	2.14
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ug/l	25.9	21	39.5	44.4
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ug/l	< 0.0316 U L1	< 0.0309 U	0.0901	< 0.0366 UJ
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	ug/l	< 0.0253 U	< 0.0247 U	< 0.0337 U	< 0.0293 U
9-Chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	ug/l	< 0.0253 U	< 0.0247 U	< 0.0337 U	< 0.0293 U
Hexafluoropropylene oxide dimer acid (HFPO-DA)	ug/l	< 0.0253 U	< 0.0247 U	< 0.0337 U	< 0.0293 U
Methylperfluoro-1-octanesulfonamide (N-MEFOSA)	ug/l	< 0.0063 U	0.0074 J	< 0.0084 U	< 0.0073 U
n-Ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ug/l	0.0611	0.0679	0.0469	0.0681
n-Ethylperfluoroctansulfonamide (N-EtFOSA)	ug/l	< 0.0063 U	< 0.0062 UJ	< 0.0084 U	< 0.0073 U
n-Methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ug/l	0.137	0.102	0.121	0.156
Nonafluoro-3, 6-dioxaheptanoic acid (NFDHA)	ug/l	< 0.0127 U	< 0.0124 U	< 0.0169 U	< 0.0146 U
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ug/l	< 0.0127 U	< 0.0124 U	< 0.0169 U	< 0.0146 U
Perfluoro-3-methoxypropanoic acid (PFMPA)	ug/l	< 0.0127 U	< 0.0124 U	< 0.0169 U	< 0.0146 UJ
Perfluoro-4-methoxybutanoic acid (PFMBA)	ug/l	< 0.0127 U	< 0.0124 U	< 0.0169 U	< 0.0146 UJ
Perfluorobutanesulfonic acid (PFBS)	ug/l	2.92	1.72	4.85	5.39
Perfluorobutanoic acid (PFBA)	ug/l	1.35 J	1.29	2.02	2.01 JL1
Perfluorodecanesulfonic acid (PFDS)	ug/l	< 0.0063 U	< 0.0062 U	< 0.0084 U	< 0.0073 U
Perfluorodecanoic acid (PFDA)	ug/l	0.0249	0.0208	0.0200	0.0248
Perfluorododecanesulfonic acid (PFDOS)	ug/l	< 0.0063 U	< 0.0062 U	< 0.0084 U	< 0.0073 U
Perfluorododecanoic acid (PFDoA)	ug/l	< 0.0063 U	< 0.0062 UJ	< 0.0084 U	< 0.0073 U L1
Perfluoroheptanesulfonic acid (PFHpS)	ug/l	0.0064	< 0.0062 U	0.0085	0.0137
Perfluoroheptanoic acid (PFHpA)	ug/l	0.588	0.466	0.629	0.63
Perfluorohexanesulfonic acid (PFHxS)	ug/l	0.511	0.428	0.523	0.643
Perfluorohexanoic acid (PFHxA)	ug/l	2.99	3.25	13.9	4.57
Perfluorononanesulfonic acid (PFNS)	ug/l	< 0.0063 U	< 0.0062 U	< 0.0084 U	< 0.0073 U
Perfluorononanoic acid (PFNA)	ug/l	0.0566	0.0402	0.0485	0.0565
Perfluorooctanesulfonamide (PFOSA / FOSA)	ug/l	0.0119	0.0155	0.0090	0.0153
Perfluorooctanesulfonic acid (PFOS)	ug/l	0.175	0.143	0.172	0.201
Perfluorooctanoic acid (PFOA)	ug/l	1.21	0.98	1.51	1.49
Perfluoropentanesulfonic acid (PFPeS)	ug/l	0.0257	0.0142	0.0226	0.0269 L1
Perfluoropentanoic acid (PFPeA)	ug/l	1.83 J	1.84 J	2.01	1.93 JL1
Perfluorotetradecanoic acid (PFTA)	ug/l	< 0.0063 U	< 0.0062 U	< 0.0084 U	< 0.0073 U L1
Perfluorotridecanoic acid (PFTrDA)	ug/l	< 0.0063 U	< 0.0062 U	< 0.0084 U	< 0.0073 U L1
Perfluoroundecanoic acid (PFUnA)	ug/l	< 0.0063 U	< 0.0062 U	< 0.0084 U	< 0.0073 U
General Parameters					
Alkalinity, total, as CaCO3	mg/l	4790	6650	6520	7590
Chemical Oxygen Demand	mg/l	1660	1820 H	1870	2530 H
Chloride	mg/l	1220	1800	1620	1970
Cyanide	mg/l	0.0127	< 0.0100 U	< 0.0100 U	0.0294 H
Flash point	deg F	> 170 U	> 170 U	> 170 U	> 170 U
pH	pH units	7.46 T8	7.74 T8	7.78 T8	7.89 T8
Solids, total suspended	mg/l	116 J3	118	44.3 J3	112
Sulfate, as SO4	mg/l	151	66.9	198	118

Table 12
Quarterly Leachate Data
Elk River Landfill
Elk River, Minnesota

Location		SP-01	SP-01	SP-01	SP-01
Date		1/08/2024	4/01/2024	7/10/2024	10/03/2024
Parameter	Units				
pH, field	pH units	7.69	7.14	7.67	7.74
Specific conductance @ 25 deg C, field	umhos/cm	10600	--	--	--
Temperature, field	deg C	12.0	14.12	24.4	19.4
Total Metals					
Antimony	ug/l	< 20.0 U	< 20.0 U	< 20.0 U	< 20.0 U
Arsenic	ug/l	67.9	70.6	92.2	101
Beryllium	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U
Boron	ug/l	16100	15700	17600	19100
Cadmium	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U
Calcium	mg/l	281	208	257	200
Chromium	ug/l	165	172	249	273
Copper	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Lead	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Magnesium	mg/l	137	195	157	180
Mercury	ug/l	< 0.200 U	< 0.490 U	< 0.490 U	< 0.490 U
Molybdenum	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Nickel	ug/l	144	231	219	248
Potassium	mg/l	320	469	469	556
Selenium	ug/l	< 25.0 U	< 25.0 U	< 25.0 U	< 25.0 U
Silver	ug/l	< 6.00 U	< 6.00 U	< 6.00 U	< 6.00 U
Sodium	mg/l	1030	1550	1510	1750
Thallium	ug/l	< 20.0 U	< 20.0 U	< 20.0 U	< 20.0 U
Zinc	ug/l	182	328	209	243

> Greater than.

C3 The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

C5 The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.

H Recommended sample preservation, extraction or analysis holding time was exceeded.

J Estimated detected value. Either certain QC criteria were not met or the concentration is between the laboratory's detection and quantitation limits.

J- The result is an estimated quantity and may be biased low.

J3 The associated batch QC was outside the established quality control range for precision.

J4 The associated batch QC was outside the established quality control range for accuracy.

L1 Analyte recovery in the laboratory control sample (LCS) was above QC limits. Results for this analyte in associated samples may be biased high.

N2 Analyte reported using a calibration and validation based on Azobenzene (CAS 103-33-3). 1,2-Diphenylhydrazine decomposes into Azobenzene during the analysis.

P RPD between the primary and confirmatory analysis exceeded 40%.

P1 RPD value not applicable for sample concentrations less than 5 times the reporting limit.

T8 Sample(s) received past/too close to holding time expiration.

U The analyte was analyzed for, but was not detected.

Table 13
2025 Groundwater Monitoring Plan
Elk River Landfill
Elk River, Minnesota

Monitoring Point	Unique Well ID[1]	Annual Sampling Frequency in SAP[2]	Parameters[3] (# planned analyses in 2025)	2025 Well Status	Unit Monitored	Well Screen Placement
Monitoring Wells						
P-17C	496278	1x	VOCs (1), Inorganics (1)	In Network (NC), GWCAM	Till/Lower outwash	S
22-OWA	420729	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-22L	801470	1x	VOCs (1), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-29C	496289	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-29D	496294	3x	VOCs (3), Inorganics (1)	In Network	Bedrock	S
36-OWA	498324	--	Depth to water	WL only	Upper outwash	WT
301-OWA	598567	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-301C	598562	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-301L	767989	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
302-OWA	598568	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-302C	598563	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash	S
P-303C	598532	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	S
P-304C	598565	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash	S
P-305C	598566	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-308C	621858	1x	VOCs (1), Inorganics (1)	In Network (NC)	Lower outwash	S
P-308L	836661	--	VOCs (1), Inorganics (1)	GWCAM (NC)	Lower outwash	S
P-309C	635420	1x	VOCs (1), Inorganics (1)	In Network (NC)	Lower outwash	S
P-310C	646855	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	S
P-311C	646854	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	S
P-311L	801471	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-311D	650145	3x	VOCs (3), Inorganics (1)	In Network	Bedrock	S
312-OWA	646853	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-313C	969668	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash	S
P-314C	969669	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
315-OWA	696663	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-315L	722063	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
317-OWA	696666	--	--	To be sealed	Upper outwash	WT
P-317L	722092	--	--	To be sealed	Lower outwash	S
P-320C	737638	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-320C2	756593	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
P-320L	737637	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-321L	767990	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-322L	767991	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-323L	786203	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-324L	786202	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-325L	804281	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-326L	804282	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S

Table 13
2025 Groundwater Monitoring Plan
Elk River Landfill
Elk River, Minnesota

Monitoring Point	Unique Well ID[1]	Annual Sampling Frequency in SAP[2]	Parameters[3] (# planned analyses in 2025)	2025 Well Status	Unit Monitored	Well Screen Placement
P-327L	812996	1x	VOCs (1), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-328L	812994	1x	VOCs (1), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-329L	812995	3x	VOCs (3), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-333L	828060	2x	VOCs (2), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-334L	828061	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-335L	828062	3x	VOCs (3), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
336-OWA	853108	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
337-OWA	853109	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
P-337L	853110	1x	VOCs (1), Inorganics (1)	In Network	Lower outwash (bottom)	S
P-338L	853139	3x	VOCs (3), Inorganics (1)	In Network, GWCAM	Lower outwash (bottom)	S
P-340L	953140	1x	VOCs (1), Inorganics (1)	In Network, GWCAS	Lower outwash (bottom)	S
P-341L	877298	1x[5]	VOCs (1), Inorganics (1)	GWCAS	Lower outwash (bottom)	S
P-342C[4]	TBD	2x[5]	VOCs (2), Inorganics (2)	Baseline, GWCAM	Lower Outwash	S
P-342L	871179	2x[5]	VOCs (2), Inorganics (1)	GWCAM	Lower outwash (bottom)	S
401-OWA	683321	1x	VOCs (1), Inorganics (1)	In Network	Upper outwash	WT
402-OWA	683320	--	Depth to water	Future Network	Upper outwash	WT
P-403C	683318	2x	VOCs (1), Inorganics (2)	In Network	Upper outwash	S
405-OWA	683316	--	Depth to water	WL only	Upper outwash	WT
406-OWA	683317	--	Depth to water	WL only	Surficial outwash	WT
407-OWA	683315	--	Depth to water	WL only	Surficial outwash	WT
408-OWA	717920	2x	VOCs (1), Inorganics (2)	In Network	Upper outwash	WT
P-694477[6]	694477	3x	VOCs (3), Inorganics (1)	In Network	Lower outwash	S
Residential Wells						
22447 Tipton St	813437	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12163 223rd Ave	876409	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12269 223rd St	876410	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12265 223rd Ave[7]	876411	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
12183 223rd Ave	846412	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
22272 Quinn St	876413	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
22130 Quinn St[8]	638355	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
ERL Shop Well	420558	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
Ridges Develop.	626766	1x	VOCs (1), inorganics (1)	per Permit SW-74	--	--
22205 Elk Lake Rd	625475	--	VOCs (1), inorganics (1)	GWCAWP	--	--
22275 Elk Lake Rd	720300	--	VOCs (1), inorganics (1)	GWCAWP	--	--

Notes and definitions:

[1] Minnesota unique well ID or MPCA EQuIS sys_loc_code.

[2] Sampling frequency listed in Sampling and Analysis Plan (SAP; Barr, 2024); pending update in 2025

[3] Per Permit SW-74; addnl monitoring may be conducted per other plans.

[4] Baseline monitoring to be completed 2025.

[5] Anticipated future annual sampling frequency in SAP shown.

[6] Former residential well at 22447 Tipton St. Disconnected from the house in September 2015.

[7] Listed as 11265 223rd Ave in Permit SW-74. Correct address shown above.

[8] Replacement well installed but not connected to house in 2023.

VOCs - Organic compounds; see Table A1 in SAP.

Inorganics - See Table A2 in SAP.

Status Key

In Network - monitoring well is incorporated into network (and included in SAP)

NC - Non-compliance monitoring well located within 200' of cell boundary

GWCAM - well is monitored to evaluate natural attenuation per GWCAWP (Apr. 2024)

GWCAS - well is monitored for sentinel monitoring purposes per the GWCAWP (Apr. 2024)

per Permit SW-74 - residential well is monitored per Solid Waste Permit SW-74

GWCAWP - residential well is monitored per the GWCAWP (Apr. 2024)

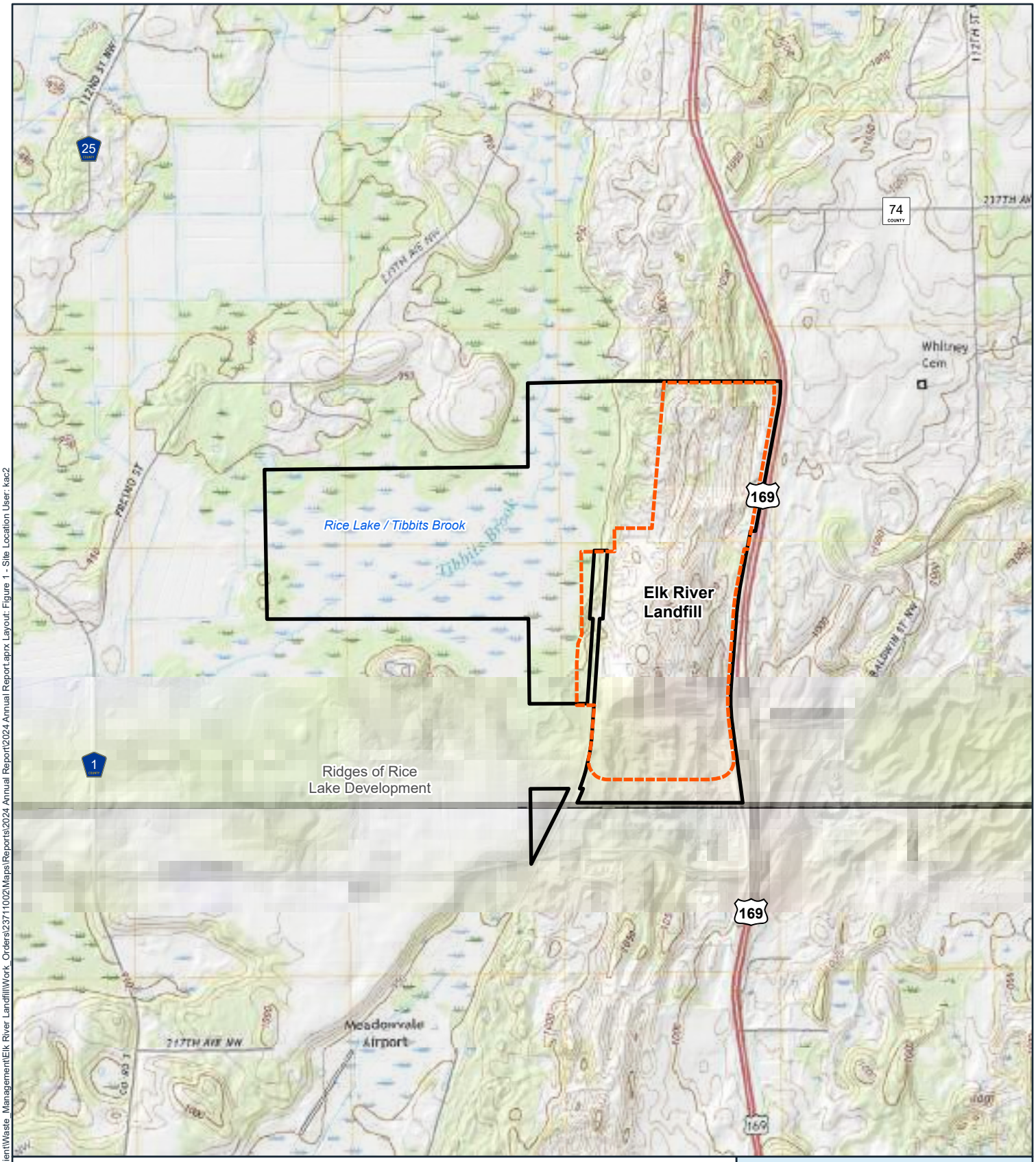
WL only - monitoring well is used for water level monitoring only per SAP and/or Permit SW-74

Well Screen Placement Key

WT - Well screen is constructed to intercept the water table

S - Monitoring well is constructed with a submerged screen

Figures



Property Boundary

Groundwater Compliance Boundary

Background Source: USGS 7.5 Minute Quadrangle
Data Source: Barr, Wenck, MNDOT, MNDNR

N

0 1,000 2,000 3,000

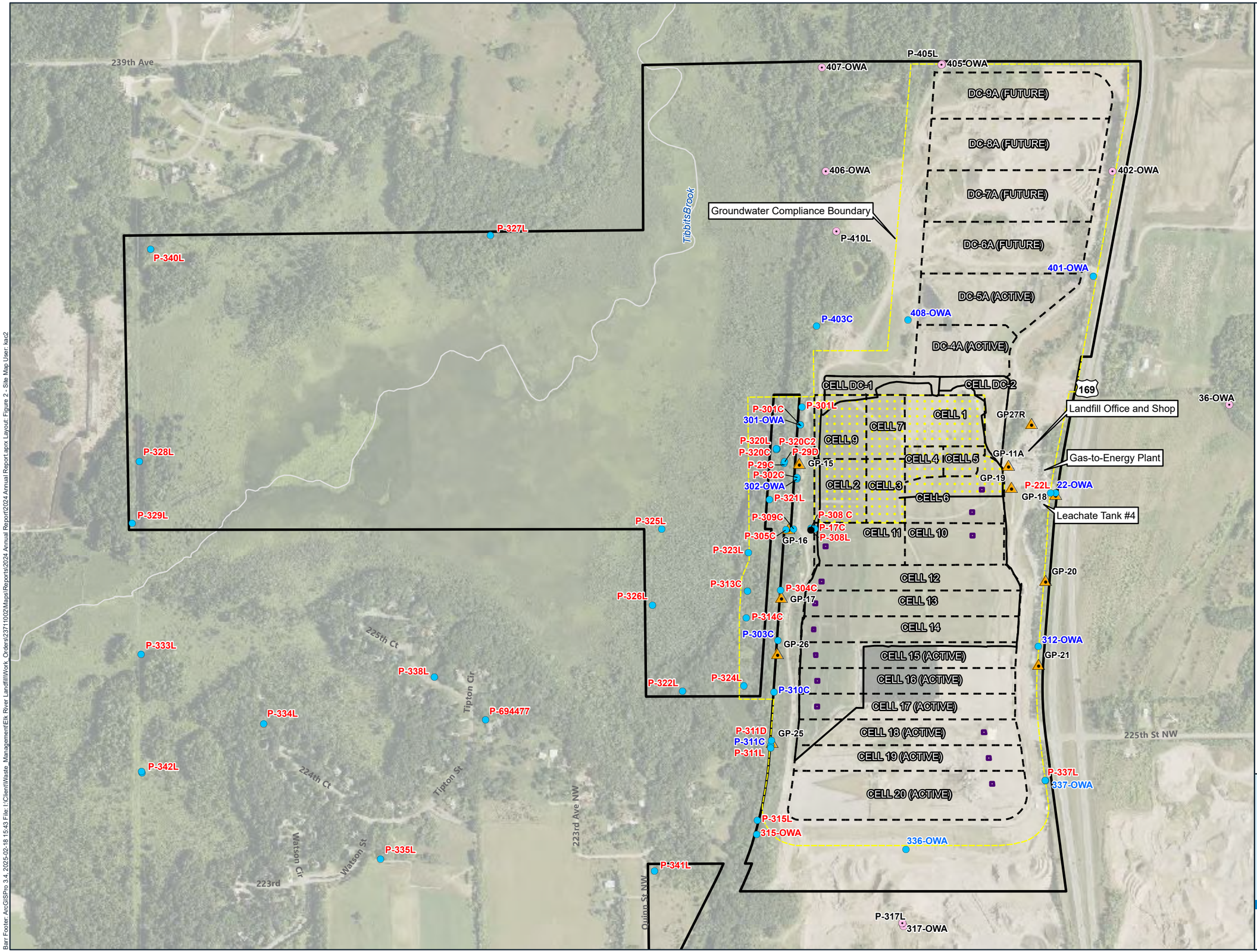
Feet

Site Location
Elk River Landfill
Elk River, MN

FIGURE 1

BARR

Barr Footer: ArcGISPro 3.4, 2025-02-18 14:12 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711002\Maps\Reports\2024 Annual Report\2024 Annual Report.aprx Layout: Figure 1 - Site Location User: kac2



Property Boundary
Pre-Subtitle D Area
Cell Boundary
Lysimeter
Monitoring Well
Piezometer
Test Well
Gas Monitoring Probe
P320C — Blue ID indicates well has surface water-based intervention limits
P320L — Red ID indicates well has groundwater-based intervention limits

N

0 350 700 1,050
Feet

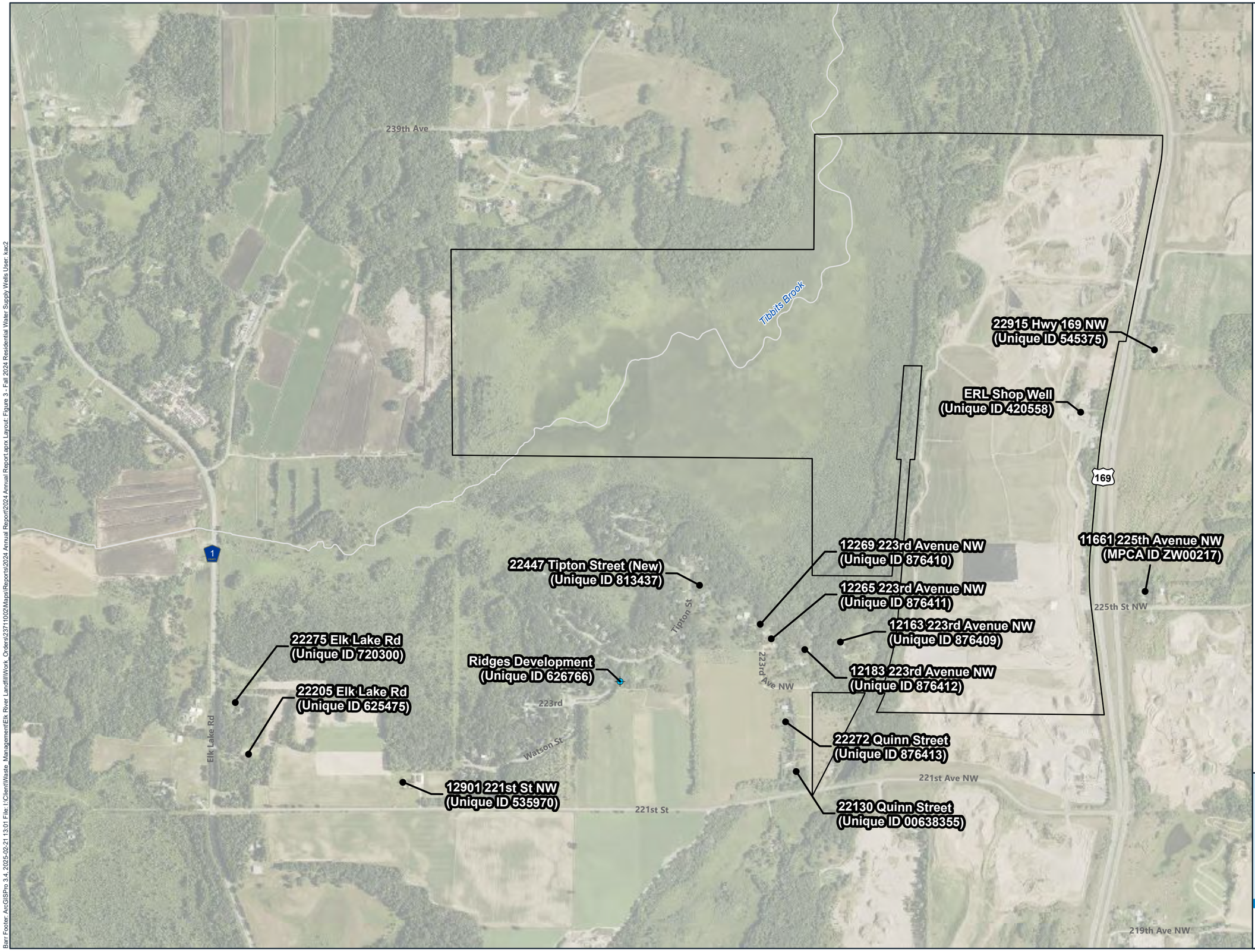
Imagery Source: USDA-FSA NAIP Imagery (2023)

Site Map
Elk River Landfill
Elk River, Minnesota

FIGURE 2

BARR

Barr Footer: ArcGISPro 3.4, 2025-02-18 15:43 File: I:\Client\Waste_Management\Elk_River_Landfill\Work_Orders\23711002\Maps\Reports\2024 Annual Report\2024 Annual Report.aprx Layout: Figure 2 - Site Map User: kac2



Property Boundary

Residential Well Location

Community Water Supply Well

Notes:
(1) 12265 223rd Ave is listed as 11265 223rd Ave in Permit SW-74
(2) 11661 225th Ave is listed as 11611 225th Ave in Permit SW-74
(3) 22248 Elk Lake Rd, 13175 221st St NW, 22915 Hwy 169 NW and 11661 225th Ave NW are sampled every 3 years (e.g. 2027).
(4) Sample was not collected at 22248 Elk Lake Rd and 13175 221st St NW because access was not approved by landowner.

N

0 500 1,000 1,500

Feet

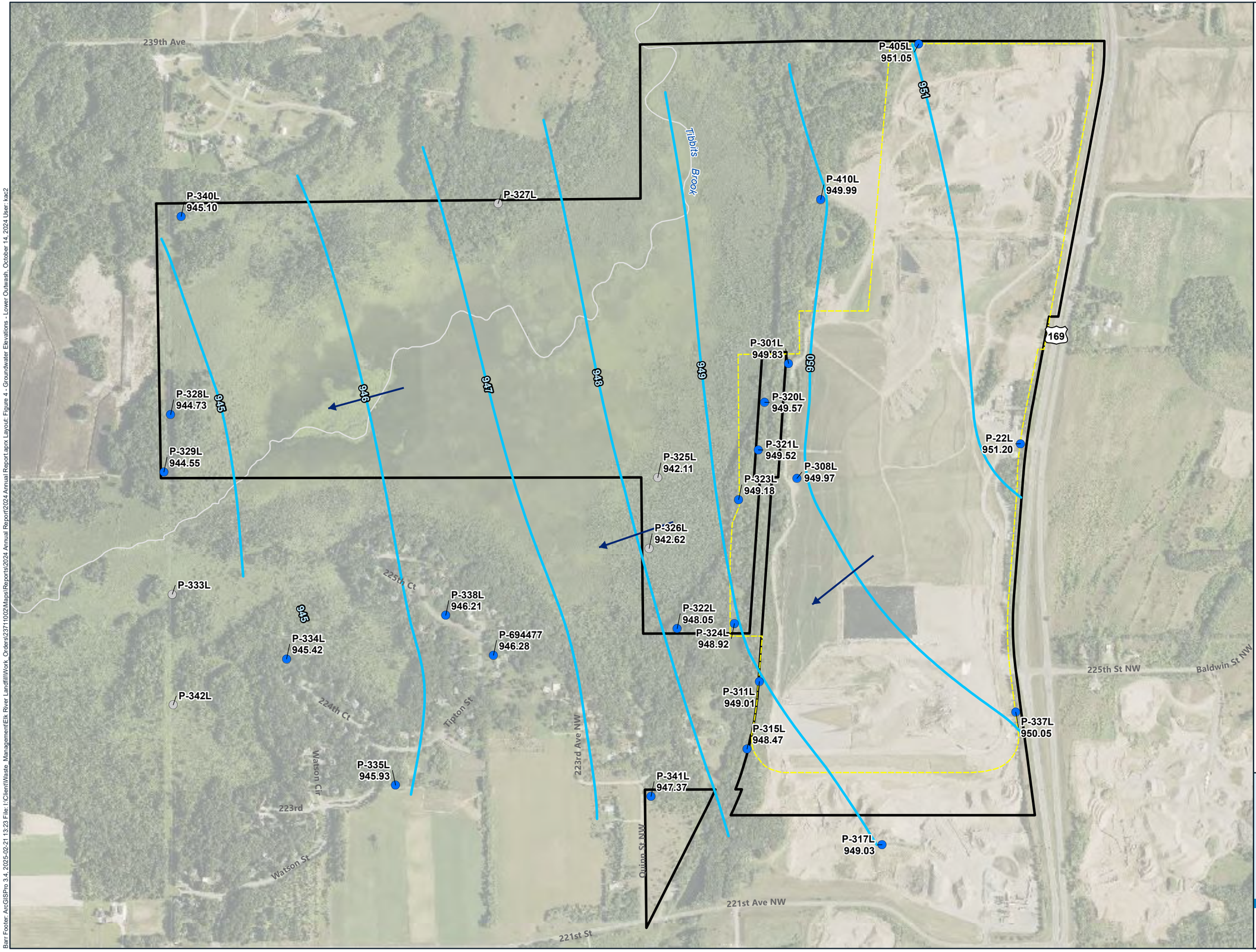
Imagery Source: USDA-FSA NAIP Imagery (2023)

Fall 2024 Residential Water Supply Wells
Elk River Landfill
Elk River, Minnesota

FIGURE 3

BARR

Barr Footer: ArcGISPro 3.4, 2025-02-21 13:01 File: I:\Client\Waste_Management\Elk_River_Landfill\Work_Orders\23711002\Maps\Reports\2024 Annual Report\2024 Annual Report.aprx Layout: Figure 3 - Fall 2024 Residential Water Supply Wells User: kac2



Property Boundary

Groundwater Compliance Boundary

Lower Outwash Monitoring Well

Lower Outwash Monitoring Well (Not Used for Groundwater Contours)

Groundwater Contour (feet MSL)

Flow Line

N

0 375 750 1,125

Feet

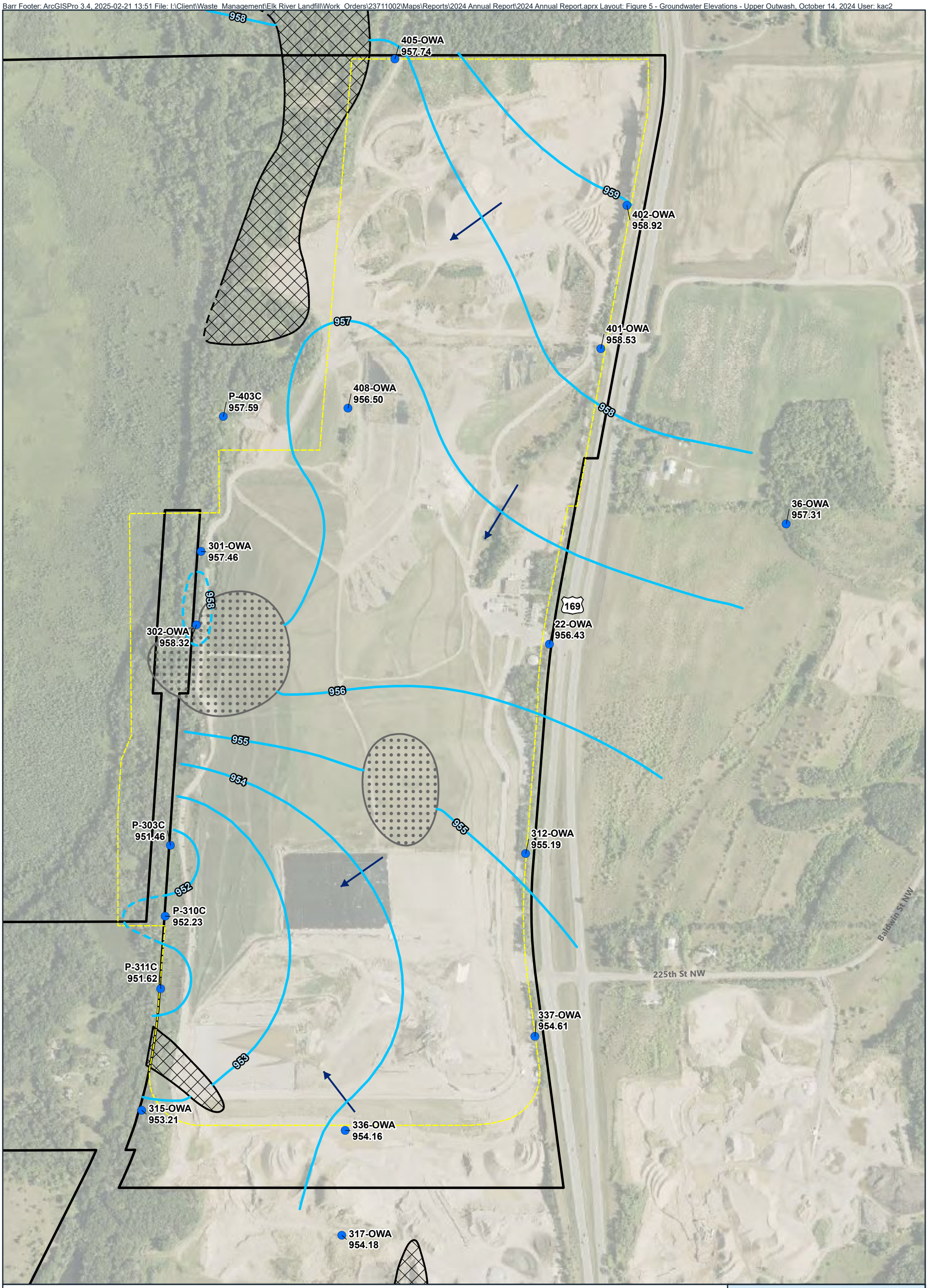
Imagery Source: USDA-FSA NAIP Imagery (2023)

Groundwater Elevations - Lower Outwash
October 14, 2024
Elk River Landfill
Elk River, Minnesota

FIGURE 4

BARR

Barr Footer: ArcGISPro 3.4, 2025-02-21 13:23 File: I:\Client\Waste_Management\Elk_River_Landfill\Work_Orders\23711002\Maps\Report\2024 Annual Report.aprx Layout: Figure 4 - Groundwater Elevations - Lower Outwash, October 14, 2024 User: kac2



Property Boundary
Groundwater Compliance Boundary
Upper Outwash Monitoring Well
Groundwater Contour (feet MSL)
Flow Line
Till Ridge Delineation
Saturated Upper Outwash Not Present Due to Local Till High

Imagery Source: USDA-FSA NAIP Imagery (2023)

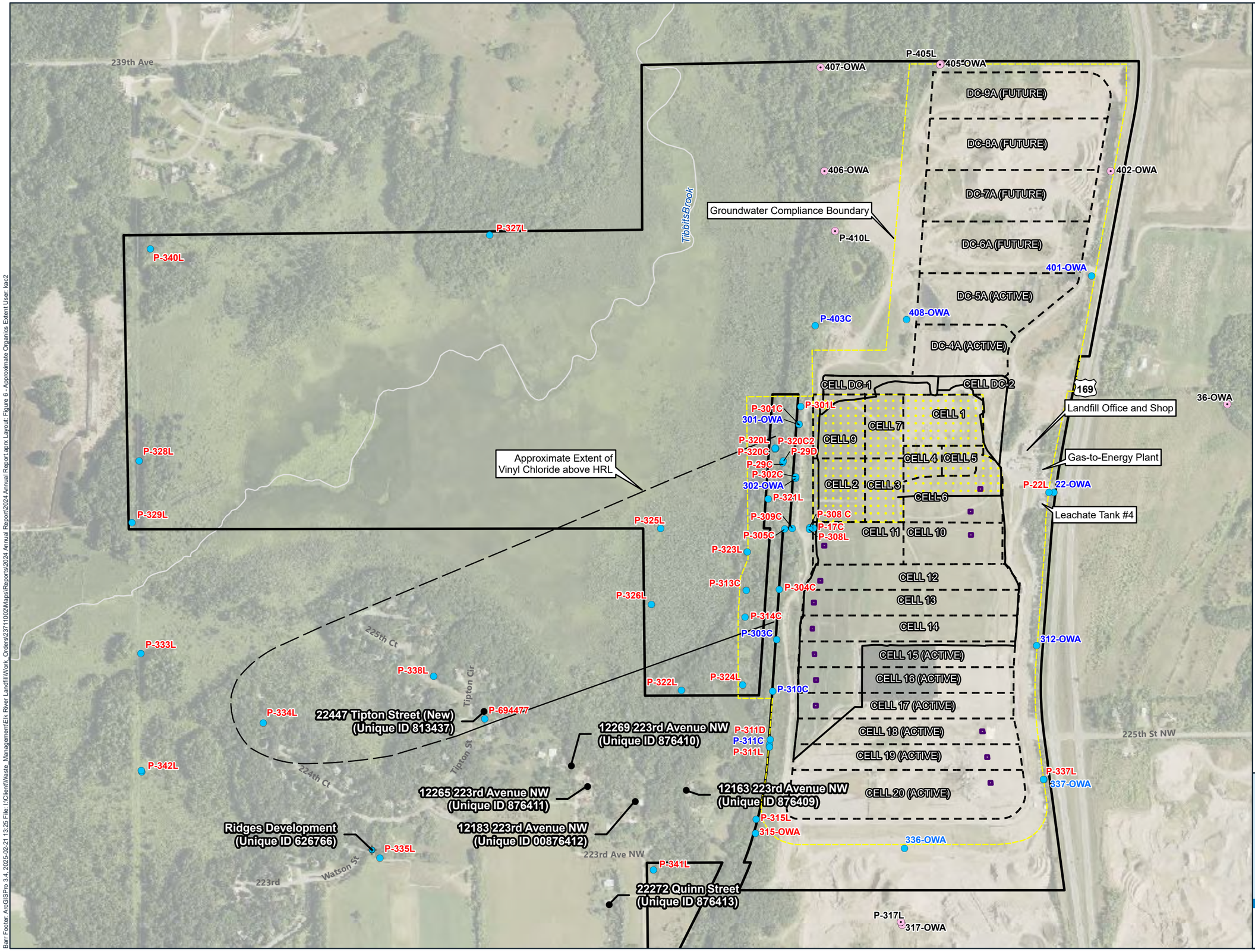
N

0 250 500 750
Feet

Groundwater Elevations - Upper Outwash
October 14, 2024
Elk River Landfill
Elk River, Minnesota

FIGURE 5

BARR



Property Boundary
Pre-Subtitle D Area
Cell Boundary
Lysimeter
Monitoring Well
Piezometer
Residential Well Network Location
Community Water Supply Well
P320C Blue ID indicates well has surface water-based intervention limits
P320L Red ID indicates well has groundwater-based intervention limits

Notes:
(1) See Barr 2018a and 2021b for information on organics extent.
(2) Unique ID well #813437, 876409, 876410, 876411, 876412, 876413, and 626766 are completed in deeper geologic unit(s) than the unit where vinyl chloride is present.

N

0 350 700 1,050
Feet

Imagery Source: USDA-FSA NAIP Imagery (2023)

Approximate Organics Extent
Elk River Landfill
Elk River, Minnesota

FIGURE 6

BARR

Barr Footer: ArcGISPro 3.4, 2025-02-21 13:25 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711002\Maps\Reports\2024 Annual Report\2024 Annual Report.aprx Layout: Figure 6 - Approximate Organics Extent User: kac2

Appendices

Appendix A

Previous Groundwater Quality Data and Flow Interpretation

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-17C	P-17C	P-22L	P-22L	P-29C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-301C	P-301C	P-301C	P-301C
Date		7/24/2023	7/24/2024	7/24/2023	7/22/2024	4/18/2023	7/18/2023	10/20/2023	4/16/2024	7/24/2024	10/15/2024	4/18/2023	7/18/2023	10/20/2023	4/16/2024	9/20/2024	10/15/2024	4/18/2023	7/19/2023	10/20/2023	4/19/2024
Parameter	Units																				
Volatile Organic Compounds																					
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**2.18**	**3.01**	**3.05**	**3.57**	**4.16**	**3.81**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	**0.286**	**0.276**	< 0.100 U	< 1.00 U	**0.262**	**0.245**	**0.520**	**0.607**	**0.586**	**0.587**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	**2.16**	**2.06**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	ug/l	< 10.0 U C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	**1.08**	**0.952**	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	ug/l	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UC3J3J4
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	**4.03**	**3.15**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U J3
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	**2.27**	**1.50**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	**3.93**	**2.98**	**3.17**	**2.75**	**2.43**	**3.34**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**2.22**	**2.33**	**2.97**	**1.93**
Ethane	ug/l	< 0.17 U	< 1.29 U	< 0.17 U	< 1.29 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	**30.7**	**18.9 J3**	< 1.00 U	< 1.00 U	**13.2**	**13.6**	**8.79**	**10.8**	**12.3**	**9.41**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.34**	**1.61**	**1.42**	< 1.00 U
Ethylene	ug/l	< 0.24 U	< 1.27 U	< 0.24 U	< 1.27 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methane	ug/l	**740**	**1390**	**2.6 J**	**68.4**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J3	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	ug/l	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Propylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	< 5.00 U	**5.45**	< 5.00 U	< 5.00 U	< 5.00 UC5J3J4	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3 J3	< 5.00 U C3	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U
Toluene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	< 0.0500 U	**0.289**	< 0.0500 U	< 0.0500 U	**0.150**	< 0.0500 U	**0.414**	**0.412 C3**	**0.396**	**0.654 J4**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 0.0500 U	< 0.0500 U J4	< 0.0500 U	< 0.0500 U	**0.226**	**0.109 C3**
Xylene, total	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-17C	P-17C	P-22L	P-22L	P-29C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-301C	P-301C	P-301C	P-301C
Date		7/24/2023	7/24/2024	7/24/2023	7/22/2024	4/18/2023	7/18/2023	10/20/2023	4/16/2024	7/24/2024	10/15/2024	4/18/2023	7/18/2023	10/20/2023	4/16/2024	9/20/2024	10/15/2024	4/18/2023	7/19/2023	10/20/2023	4/19/2024
Parameter	Units																				
General Parameters																					
Alkalinity, total, as CaCO3	mg/l	**1090**	**1110**	**187**	**177**	--	**469**	--	--	**447**	--	--	**180**	--	--	--	--	--	**531**	--	--
Anions	meq/l	**30.2**	**30.7**	**5.34**	**4.94**	--	**11.9**	--	--	**11.3**	--	--	**3.64**	--	--	--	--	--	**13.7**	--	--
Carbon, total organic	mg/l	**41.4**	**44.6**	< 1.00 U	< 1.00 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cations	meq/l	**28.0**	**28.5**	**5.22**	**4.68**	--	**12.0**	--	--	**11.3**	--	--	**3.38**	--	--	--	--	--	**13.2**	--	--
Cation-Anion balance	%	**-3.71**	**12.5**	**-1.18**	**-2.74**	--	**0.238**	--	--	**0.00151**	--	--	**-3.74**	--	--	--	--	--	**-1.75**	--	--
Chemical Oxygen Demand	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Chloride	mg/l	**297**	**304**	**33.5**	**31.5**	--	**70.4**	--	--	**61.9**	--	--	< 1.00 U	--	--	--	--	--	**25.3**	--	--
Dissolved oxygen, field	mg/l	**2.4**	**1**	**1.1**	**0.8**	**0.2**	**1.5**	**0.6**	**0.1**	**0**	**0**	**0.2**	**0.7**	**0.2**	**0.1**	**0.1**	**0**	**0.8**	**0.6**	**1**	**0.3**
Iron, ferrous, FE II, field	mg/l	--	**3.30 >**	--	**0.32**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l	--	**0.400**	--	**0.057**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l	**38.6**	**44.4**	< 0.100 U	< 0.100 U	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	--	--	--	< 0.100 U	--	--
Nitrogen, nitrate + nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, nitrate, as N	mg/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U T8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, total kjeldahl (TKN)	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
pH, field	pH units	**6.51**	**6.85**	**7.72**	**8.62**	**7.19**	**6.79**	**7.22**	**8.13**	**7.65**	**7.17**	**8.25**	**7.53**	**8.27**	**8.53**	**7.9**	**8.19**	**7.30**	**7.15**	**7.21**	**7.62**
Redox (oxidation potential), field	mV	**-82**	**-75**	**-123**	**-81**	**-109**	**-73**	**-105**	**-189**	**-111.4**	**116.7**	**-141**	**-77**	**-134**	**-249**	**-195**	**209.4**	**-85**	**-58**	**-65**	**-158**
Solids, total dissolved	mg/l	**1610**	**1550**	**292 B**	**278**	--	**625**	--	--	**545**	--	--	**179**	--	--	--	--	--	**680**	--	--
Solids, total suspended	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Specific conductance @ 25 ºC, field	umhos/cm	**2350**	**2611**	**504**	**429**	**1186**	**1035**	**998**	**318**	**385**	**841**	**305**	**323**	**316**	**321**	**375**	**301**	**1185**	**1153**	**1195**	**1137**
Sulfate, as SO4	mg/l	< 5.00 U	**< 5.00 U**	**31.2**	**24.6**	--	**26.7**	--	--	**27.8**	--	--	< 5.00 U	--	--	--	--	--	**115**	--	--
Sulfide, as S^{2-}	mg/l	--	**0.03**	--	**0.80 >**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C	**16.1**	**15.2**	**11.4**	**11.2**	**11.0**	**12.1**	**12**	**10.1**	**12**	**12.9**	**10.5**	**12.0**	**12.1**	**10.6**	**12.8**	**12**	**10.0**	**15.3**	**15.3**	**10.6**
Turbidity, field	NTU	**23.7**	**32**	**4.8**	**6.3**	**19.1**	**44.5**	**15.9**	**4**	**6.5**	**6.1**	**4.5**	**7.1**	**2.3**	**12.5**	**1**	**2**	**5.7**	**6.5**	**7.2**	**17**
Dissolved Metals																					
Arsenic	ug/l	**21.2**	**22.3**	< 2.00 U	< 2.00 U	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	--	--	--	**4.72**	--	--
Boron	ug/l	**5100**	**4330**	< 200 U	< 200 U	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	--	--	--	< 200 U	--	--
Cadmium	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Calcium	mg/l	**132**	**143**	**50.1**	**32.6**	--	**147**	--	--	**144**	--	--	**38.5**	--	--	--	--	--	**148**	--	--
Chromium	ug/l	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	--	--	--	< 4.00 U	--	--
Copper	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Iron	ug/l	**13400**	**12800**	< 100 U	**290**	--	**2660**	--	--	**1540**	--	--	**138**	--	--	--	--	--	**1420**	--	--
Lead	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Magnesium	mg/l	**89.2**	**90.8**	**30.3**	**32.6**	--	**47.1**	--	--	**44.6**	--	--	**14.7**	--	--	--	--	--	**65.8**	--	--
Manganese	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Mercury	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Potassium	mg/l	**28.1**	**28.9**	**1.66**	**4.75**	--	**3.64**	--	--	**2.7**	--	--	**1.36**	--	--	--	--	--	**2.67**	--	--
Sodium	mg/l	**296**	**291**	**4**	**5.31**	--	**12.8**	--	--	**5.96**	--	--	**4.74**	--	--	--	--	--	**8**	--	--
Zinc	ug/l	**12.1**	**13.0**	< 10.0 U	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	--	--	--	< 10.0 U	--	--

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

	Location	P-301C	P-301C	P-301L	P-301L	P-301L	P-301L	P-301L	P-301L	P-302C	P-302C	P-302C	P-302C	P-302C	P-302C	P-304C	P-304C	P-304C	P-304C	P-304C
	Date	7/26/2024	10/16/2024	4/18/2023	7/19/2023	10/20/2023	4/19/2024	7/26/2024	10/16/2024	4/24/2023	7/20/2023	10/18/2023	4/19/2024	7/24/2024	10/17/2024	4/24/2023	7/20/2023	10/18/2023	4/18/2024	7/24/2024
Parameter	Units																			
Volatile Organic Compounds																				
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C3	< 0.500 UH	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 UH	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**2.50**	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.08**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
1,2-Dichloroethane	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	**0.498 H**	**0.466**	**0.392**	**0.416**	**0.461**	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	< 0.100 U	**0.135**	**0.140**	< 0.100 U	**0.148**	**0.129**	< 0.100 U	< 0.100 U	< 0.100 U	**0.192 H**	**0.209**	**0.221**	**0.193**	**0.278**	< 0.100 U	**0.543**	**0.757**	**0.444**	**0.530**
1,2-Dichloroethylene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 UH	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Acetone	ug/l	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 UH	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 UH	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UC3J3J4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 UC3J3J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UC3J3J4	< 1.00 U C3
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 UH	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH J4	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U J3	< 1.00 U
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5 J4	**6.46**	< 1.00 UH	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**2.00**	**13.7**	**4.31 H**	**4.12**	**4.00**	**3.86 J3**	**5.10**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3
Ethane	ug/l	--	--	--	--	--	--	--	--	**0.79 HJ**	< 3.4 U	< 45.0 U	--	< 1.29 U	**1.66**	**0.42 HJ**	< 3.4 U	< 45.0 U	--	< 1.29 U
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	< 1.00 U	< 1.00 U	**1.76**	**1.99**	**1.58**	**1.15**	< 1.00 U	< 1.00 U	**10.4**	**35.3 H**	**25.6**	**28.2**	**23.4 J3**	**33.2**	**5.73**	**9.02**	**12.0**	**8.54**	**4.52 J3**
Ethylene	ug/l	--	--	--	--	--	--	--	--	< 0.24 UH	< 4.8 U	< 39.6 U	--	< 1.27 U	< 1.20 U	< 0.24 UH	< 4.8 U	< 39.6 U	--	< 1.27 U
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 UH	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methane	ug/l	--	--	--	--	--	--	--	--	**25000 EH**	**34000**	**27000 1b**	--	**43500**	**31300**	**720 H**	**71 J**	**204 1b**	--	**124**
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 UH	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 UH	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3
Propylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 UH	< 5.00 UC5J3J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 UC5J3J4	< 5.00 U	< 5.00 U
Toluene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 UH	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	**0.198**	**0.180**	**0.206**	**0.161**	**0.215**
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UH	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	< 0.0500 U	< 0.0500 U J4	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 0.0500 U	**0.106 J4**	**0.253**	**0.743 H**	**0.469 C3**	**0.538 C3**	**0.680**	**0.745**	< 0.0500 U	**0.296**	< 0.0500 U C3	< 0.0500 U C3	**0.383**
Xylene, total	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 UH	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

	Location	P-301C	P-301C	P-301L	P-301L	P-301L	P-301L	P-301L	P-301L	P-302C	P-302C	P-302C	P-302C	P-302C	P-302C	P-304C	P-304C	P-304C	P-304C	P-304C
	Date	7/26/2024	10/16/2024	4/18/2023	7/19/2023	10/20/2023	4/19/2024	7/26/2024	10/16/2024	4/24/2023	7/20/2023	10/18/2023	4/19/2024	7/24/2024	10/17/2024	4/24/2023	7/20/2023	10/18/2023	4/18/2024	7/24/2024
Parameter	Units																			
General Parameters																				
Alkalinity, total, as CaCO3	mg/l	**341**	--	--	**326**	--	--	**339**	--	**750**	**748**	**791**	--	**845**	**798**	**747**	**688**	**737**	--	**667**
Anions	meq/l	**7.24**	--	--	**7.74**	--	--	**7.21**	--	--	**21.5**	--	--	**22.0**	--	--	**15.5**	--	--	**14.9**
Carbon, total organic	mg/l	--	--	--	--	--	--	--	--	**22.7**	**18.4**	**18.9**	--	**18.6**	**16.3**	**7.56**	**6.71**	**8.82**	--	**8.01**
Cations	meq/l	**7.27**	--	--	**7.41**	--	--	**7.32**	--	--	**21.5**	--	--	**22.5**	--	--	**15.5**	--	--	**15.2**
Cation-Anion balance	%	**0.205**	--	--	**-2.19**	--	--	**0.744**	--	--	**0.0620**	--	--	**1.32**	--	--	**0.0619**	--	--	**0.931**
Chemical Oxygen Demand	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Chloride	mg/l	**1.97**	--	--	**33.0**	--	--	**2.40**	--	**269**	**212 E**	**208**	--	**158**	**164**	**37.3**	**32.5**	**39.9**	--	**28.9 J6**
Dissolved oxygen, field	mg/l	**0**	**0**	**0.5**	**0.7**	**0.8**	**0.7**	**0**	**0**	**0.1**	**0.6**	**0.5**	**0**	**0.2**	**0.2**	**0.1**	**0.5**	**0.5**	**0.1**	**0.3**
Iron, ferrous, FE II, field	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	**2.89**	--	--	--	--	--	**2.94**
Manganese II, field	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	**0.237**	--	--	--	--	--	**0.749**
Nitrogen, ammonia, as N	mg/l	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U
Nitrogen, nitrate + nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, nitrate, as N	mg/l	--	--	--	--	--	--	--	--	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U
Nitrogen, nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, total kjeldahl (TKN)	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
pH, field	pH units	**7.19**	**7.34**	**7.45**	**7.25**	**7.36**	**7.67**	**7.21**	**7.45**	**7.07**	**6.87**	**7.03**	**7.34**	**7.27**	**7.17**	**6.69**	**6.49**	**6.55**	**6.92**	**6.94**
Redox (oxidation potential), field	mV	**19.6**	**16.33**	**-79**	**-67**	**-70**	**-126**	**21.4**	**107.7**	**-117**	**-111**	**-77**	**-16.9**	**-159**	**-172**	**-65**	**-55**	**-54**	**-89**	**-91**
Solids, total dissolved	mg/l	**365**	--	--	**400**	--	--	**366**	--	--	**1100**	--	--	**1070**	--	--	**749**	--	--	**692**
Solids, total suspended	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Specific conductance @ 25 ºC, field	umhos/cm	**443**	**1183**	**684**	**699**	**719**	**693**	**442**	**586**	**1872**	**1500**	**1715**	**1914**	**1917**	**1708**	**1309**	**1112**	**977**	**1172**	**1257**
Sulfate, as SO4	mg/l	**17.7**	--	--	**14.1**	--	--	**18.1**	--	**17.6**	**26.4**	**24.6**	--	**30.4**	**26.8**	**40.0**	**38.4**	**34.1**	--	**34.7 J6**
Sulfide, as S^{2-}	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	**0.02**	--	--	--	--	--	**0.04**
Temperature, field	deg C	**11.6**	**11.1**	**10.1**	**10.7**	**10.7**	**9.2**	**11.6**	**10.3**	**13.5**	**13.6**	**13.2**	**12.9**	**13.3**	**13.6**	**9.8**	**10.6**	**10.6**	**10.3**	**10.9**
Turbidity, field	NTU	**6.3**	**4.6**	**1.7**	**4.0**	**2.1**	--	**7.1**	**1.9**	**4**	**17.9**	**2.5**	**4**	**7**	**3.5**	**9**	**13.1**	**8.3**	**15**	**6**
Dissolved Metals																				
Arsenic	ug/l	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	**10.5**	--	--	**9.99**	--	--	**2.61**	--	--	**3.34**
Boron	ug/l	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	**720**	--	--	**559**	--	--	**363**	--	--	**309**
Cadmium	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Calcium	mg/l	**96.1**	--	--	**92.4**	--	--	**96.7**	--	--	**163**	--	--	**171**	--	--	**171 O1 V**	--	--	**166**
Chromium	ug/l	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U
Copper	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Iron	ug/l	< 100 U	--	--	**232**	--	--	< 100 U	--	--	**13200**	--	--	**14800**	--	--	**6200 O1**	--	--	**6200**
Lead	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Magnesium	mg/l	**27.2**	--	--	**30.4**	--	--	**27.4**	--	--	**116**	--	--	**131**	--	--	**62.2**	--	--	**63.4**
Manganese	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Mercury	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Potassium	mg/l	**1.93**	--	--	**2.42**	--	--	**1.97**	--	--	**5.54**	--	--	**5.33**	--	--	**2.31**	--	--	**2.19**
Sodium	mg/l	**4.29**	--	--	**5.23**	--	--	**4.33**	--	--	**74**	--	--	**58.7**	--	--	**35 O1**	--	--	**31.2**
Zinc	ug/l	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

	Location	P-304C	P-305C	P-305C	P-305C	P-305C	P-305C	P-305C	P-308L	P-308L	P-308L	P-309C	P-309C	P-311D	P-311D	P-311D	P-311D	P-311D	P-311D	P-311L	P-311L
	Date	10/17/2024	4/18/2023	7/19/2023	10/20/2023	4/18/2024	7/26/2024	10/15/2024	4/24/2023	7/24/2023	7/24/2024	7/19/2023	7/26/2024	4/18/2023	7/19/2023	10/20/2023	5/15/2024	7/25/2024	10/16/2024	4/18/2023	7/19/2023
Parameter	Units																				
Volatile Organic Compounds																					
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	< 1.00 U	< 1.00 U	**1.10**	< 1.00 U	< 1.00 U	< 1.00 U	**1.63**	**9.48**	**9.48**	**2.60**	**4.49**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.59**	**1.30**
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	**0.250**	< 0.250 U	**0.282 C5**	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	**0.599**	< 0.100 U	**0.166**	**0.282**	< 0.100 U	**0.136**	**0.303**	< 0.100 U	**1.83**	< 1.00 U	**1.36**	**0.186**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	ug/l	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U
Allyl chloride	ug/l	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	**0.862**	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Bromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 UC3J3J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.47**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.15**	**4.91 C3**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.85**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	**1.90**	**1.48**	**1.52**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	**1.02**	< 1.00 U	< 1.00 U	**2.10**	**8.99**	**9.13**	**2.55 J3**	**3.26**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.66**	**1.05**
Ethane	ug/l	< 1.20 U	--	--	--	--	--	--	**0.48 HJ**	< 0.17 U	< 1.29 U	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	**8.29**	< 1.00 U	**8.30**	**6.69**	**1.37**	**6.08**	**14.7**	**27.7**	**26.9**	**22.0 J3**	**32.2**	**26.1**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**2.28**	**2.13**
Ethylene	ug/l	< 1.20 U	--	--	--	--	--	--	< 0.24 UH	< 0.24 U	< 1.27 U	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methane	ug/l	**94.1**	--	--	--	--	--	--	**910 H**	**1300**	**3610**	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.02**	**1.26**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U
Naphthalene	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U
Propylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	< 5.00 U	< 5.00 U J3 J4	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U C3	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U C5	**8.47 C5**	< 5.00 U J3 J4	< 5.00 U	< 5.00 U	< 5.00 U J4	< 5.00 U	< 5.00 U C3	< 5.00 UC5J3J4	< 5.00 U C5
Toluene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	**0.214**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	**0.286**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 0.0500 U	**0.113 J4**	< 0.0500 U	**1.09**	**1.74**	**0.235**	**0.111**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U J4	< 0.0500 U	< 0.0500 U
Xylene, total	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-304C	P-305C	P-305C	P-305C	P-305C	P-305C	P-305C	P-308L	P-308L	P-308L	P-309C	P-309C	P-311D	P-311D	P-311D	P-311D	P-311D	P-311D	P-311L	P-311L
Date		10/17/2024	4/18/2023	7/19/2023	10/20/2023	4/18/2024	7/26/2024	10/15/2024	4/24/2023	7/24/2023	7/24/2024	7/19/2023	7/26/2024	4/18/2023	7/19/2023	10/20/2023	5/15/2024	7/25/2024	10/16/2024	4/18/2023	7/19/2023
Parameter	Units																				
General Parameters																					
Alkalinity, total, as CaCO3	mg/l	**680**	--	**353**	--	--	**318**	--	**609**	**592**	**510**	**699**	**1100**	--	**190**	--	--	**188**	--	--	**389**
Anions	meq/l	--	--	**9.61**	--	--	**8.49**	--	--	**13.1**	--	**22.8**	**34.7**	--	**3.85**	--	--	**3.84**	--	--	**9.14**
Carbon, total organic	mg/l	**6.77**	--	--	--	--	--	--	**3.61 H**	**3.84**	**3.84**	--	--	--	--	--	--	--	--	--	--
Cations	meq/l	--	--	**9.31**	--	--	**8.82**	--	--	**13.3**	--	**22.1**	**34.8**	--	**3.61**	--	--	**3.90**	--	--	**8.84**
Cation-Anion balance	%	--	--	**-1.61**	--	--	**1.89**	--	--	**0.789**	--	**-1.57**	**22.1**	--	**-3.24**	--	--	**0.840**	--	--	**-1.69**
Chemical Oxygen Demand	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Chloride	mg/l	**32.6**	--	**87.0**	--	--	**69.3**	--	**45.6**	**39.8**	**42.5**	**308**	**450**	--	< 1.00 U	--	--	< 1.00 U	--	--	**34.9**
Dissolved oxygen, field	mg/l	**0.2**	**0.5**	**0.9**	**0.5**	**0.4**	**0**	**0**	**0.1**	**0.8**	--	**0.9**	**0**	**0.3**	**1.3**	**0.7**	**0.4**	**4.3**	**2**	**0.6**	**1.0**
Iron, ferrous, FE II, field	mg/l	--	--	--	--	--	--	--	--	--	**3.30 >**	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l	--	--	--	--	--	--	--	--	--	**0.290**	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	< 0.100 U	**4.06**	--	< 0.100 U	--	--	**0.135**	--	--	< 0.100 U
Nitrogen, nitrate + nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, nitrate, as N	mg/l	< 1.00 U	--	--	--	--	--	--	< 1.00 U	< 1.00 U	< 1.00 U	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, total kjeldahl (TKN)	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
pH, field	pH units	**6.8**	**7.79**	**7.15**	**7.48**	**8.08**	**8.0201**	**7.37**	**6.97**	**6.97**	--	**6.66**	**6.94**	**7.54**	**7.62**	**7.6**	**7.84**	**8.12**	**7.66**	**7.39**	**7.48**
Redox (oxidation potential), field	mV	**-93**	**-150**	**-57**	**-99**	**-209**	**-208.8**	**-174.3**	**-155**	**-117**	--	**-91**	**-125.7**	**-92**	**-27**	**-80**	**-105**	**-110.6**	**-124**	**-78**	**-45**
Solids, total dissolved	mg/l	--	--	**512**	--	--	**416**	--	--	**647 B**	--	**1240**	**1900**	--	**182 J3**	--	--	**185**	--	--	**465**
Solids, total suspended	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Specific conductance @ 25 ºC, field	umhos/cm	**1198**	**493**	**845**	**873**	**510**	**521**	**1120**	**776**	**1083**	--	**2129**	**2420**	**335**	**359**	**350**	**368**	**270**	**351**	**777**	**811**
Sulfate, as SO4	mg/l	**33.5**	--	**5.33**	--	--	**8.26**	--	**13.6**	**8.66**	< 5.00 U	**8.24**	**8.26**	--	< 5.00 U	--	--	< 5.00 U	--	--	**18.1**
Sulfide, as S^{2-}	mg/l	--	--	--	--	--	--	--	--	--	**0.03**	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C	**11.2**	**12.2**	**13.1**	**13**	**12.5**	**13.8**	**13.5**	**14.4**	**18.6**	--	**14.2**	**11.4**	**9.0**	**9.3**	**9**	**9.9**	**15.4**	**9**	**9.0**	**9.2**
Turbidity, field	NTU	**7.2**	**24.3**	**4.9**	**19.9**	**3**	**14.1**	**4.3**	**19.1**	**7.5**	--	**35.3**	**4.3**	**0.7**	**1.5**	**0.9**	**1.3**	**9.6**	**2**	**37.7**	**56.1**
Dissolved Metals																					
Arsenic	ug/l	--	--	**5.95**	--	--	**5.91**	--	--	< 2.00 U	--	**32.6**	**35.2**	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U
Boron	ug/l	--	--	**450**	--	--	**310**	--	--	< 200 U	--	**1470**	**3150**	--	< 200 U	--	--	< 200 U	--	--	< 200 U
Cadmium	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Calcium	mg/l	--	--	**71.0**	--	--	**64.9**	--	--	**133**	--	**176**	**158**	--	**45.2**	--	--	**49.4**	--	--	**111**
Chromium	ug/l	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	< 4.00 U	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U
Copper	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Iron	ug/l	--	--	**3520**	--	--	**2240**	--	--	**9860**	--	**16800**	**12800**	--	**1260**	--	--	**1220**	--	--	**937**
Lead	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Magnesium	mg/l	--	--	**51.8**	--	--	**54**	--	--	**67.1**	--	**82.6**	**107**	--	**13.1**	--	--	**14.3**	--	--	**35.6**
Manganese	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Mercury	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Potassium	mg/l	--	--	**2.47**	--	--	**2.22**	--	--	**3.72**	--	**5.8**	**9.68**	--	**1.29**	--	--	**1.18**	--	--	**1.86**
Sodium	mg/l	--	--	**30.2**	--	--	**22.9**	--	--	**17.3**	--	**133**	**400**	--	**4.51**	--	--	**4.4**	--	--	**6.51**
Zinc	ug/l	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	< 10.0 U	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-311L	P-311L	P-311L	P-311L	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-315L	P-315L	P-315L
Date		10/20/2023	4/19/2024	7/25/2024	10/16/2024	4/24/2023	7/20/2023	10/17/2023	4/16/2024	7/24/2024	10/17/2023	10/27/2022	4/18/2023	7/18/2023	10/17/2023	4/16/2024	7/24/2024	10/16/2024	4/18/2023	7/18/2023	5/15/2024
Parameter	Units																				
Volatile Organic Compounds																					
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	**1.49**	**2.63**	**4.74**	**2.55**	**2.63**	**2.63**	**2.85**	**2.79**	**1.67**	**1.99**	**1.89**	**1.92**	**2.15**	**2.45**	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C4	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	**1.62**	**0.615**	**0.483**	**0.545**	**0.495**	< 1.00 U	**0.418**	**0.459**	**0.491**	**0.481**	**0.501**	**0.646**	< 0.100 U	< 0.100 U	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	ug/l	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	**1.74**	< 1.00 U	**4.20**	**3.40**	**2.41**	**2.24 J3**	**3.20**	**1.67**	< 1.00 U	**1.14**	**1.61**	**1.06**	**1.33**	**2.02**	< 1.00 U	< 1.00 U	< 1.00 U
Ethane	ug/l	--	--	--	--	**0.42 HJ**	< 3.4 U	--	--	< 1.29 U	< 1.20 U	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	**1.04**	< 1.00 U	< 1.00 U	**2.26**	**10.1**	**16.9**	**10.0**	**10.1**	**9.64 J3**	**12.5**	**12.8**	**10.4**	**11.1**	**10.3**	**10.2**	**12.5**	**12.0**	< 1.00 U	< 1.00 U	< 1.00 U
Ethylene	ug/l	--	--	--	--	< 0.24 UH	< 4.8 U	--	--	< 1.27 U	< 1.20 U	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methane	ug/l	--	--	--	--	**380 H**	**260**	--	--	**773**	**558**	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Propylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	**16.1 C5**	**12.3**	**18.4 C3**	**16.1**	**15.7**	**15.5**	**7.53**	**5.33 C5J3J4**	**7.90 C5**	**6.71 C3**	< 5.00 U	< 5.00 U C5	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U J4
Toluene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U J4	< 0.0500 U	**0.299**	**0.172**	**0.133 C3**	**1.30**	**0.154**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	**0.256**	**0.115 J4**	< 0.0500 U	< 0.0500 U	< 0.0500 U
Xylene, total	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-311L	P-311L	P-311L	P-311L	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-315L	P-315L	P-315L
Date		10/20/2023	4/19/2024	7/25/2024	10/16/2024	4/24/2023	7/20/2023	10/17/2023	4/16/2024	7/24/2024	10/17/2024	10/27/2022	4/18/2023	7/18/2023	10/17/2023	4/16/2024	7/24/2024	10/16/2024	4/18/2023	7/18/2023	5/15/2024
Parameter	Units																				
General Parameters																					
Alkalinity, total, as CaCO3	mg/l	--	--	**303**	--	**562**	**568**	**547**	--	**580**	**540**	--	--	**707**	--	--	**699**	--	--	**193**	--
Anions	meq/l	--	--	**6.72**	--	--	**14.0**	--	--	**14.1**	--	--	--	**16.3**	--	--	**16.2**	--	--	**3.88**	--
Carbon, total organic	mg/l	--	--	--	--	**3.72**	**4.13**	**3.62**	--	**4.68**	**3.23**	--	--	--	--	--	--	--	--	--	--
Cations	meq/l	--	--	**6.81**	--	--	**14.6**	--	--	**13.9**	--	--	--	**15.8**	--	--	**16.4**	--	--	**3.68**	--
Cation-Anion balance	%	--	--	**0.674**	--	--	**2.10**	--	--	**-0.691**	--	--	--	**-1.55**	--	--	**0.624**	--	--	**-2.73**	--
Chemical Oxygen Demand	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Chloride	mg/l	--	--	**2.50**	--	**70.6**	**79.9**	**74.0**	--	**70.2**	**74.1**	--	--	**37.5**	--	--	**31.4**	--	--	< 1.00 U	--
Dissolved oxygen, field	mg/l	**0.9**	**0.4**	**0**	**0**	**0.5**	**0.9**	**0.6**	**1.1**	**0.5**	**0.5**	**2.0**	**0.4**	**0.9**	**0.7**	**0.3**	**0**	**0**	**0.8**	**1.5**	**0.8**
Iron, ferrous, FE II, field	mg/l	--	--	--	--	--	--	--	--	**1.67**	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l	--	--	--	--	--	--	--	--	**0.231**	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, nitrate, as N	mg/l	--	--	--	--	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, total kjeldahl (TKN)	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
pH, field	pH units	**7.38**	**7.47**	**7.94**	**7.32**	**7.06**	**6.89**	**6.83**	**7.23**	**7.26**	**7.03**	**6.82**	**6.67**	**6.43**	**6.64**	**6.91**	**6.93**	**11**	**7.30**	**7.05**	**8.13**
Redox (oxidation potential), field	mV	**-50**	**-81**	**-145.9**	**-81.8**	**-93**	**-12**	**-47**	**-87**	**-25**	**-55**	**-52**	**-78**	**-41**	**-42**	**-66**	**-89.9**	**-71.6**	**-35**	**-43**	**-111**
Solids, total dissolved	mg/l	--	--	**337**	--	--	**685**	--	--	**672**	--	--	--	**840**	--	--	**786**	--	--	**200**	--
Solids, total suspended	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Specific conductance @ 25 ºC, field	umhos/cm	**805**	**848**	**382**	**721**	**815**	**1099**	**1014**	**1254**	**946**	**1135**	**1352**	**1340**	**1363**	**1319**	**1301**	**786**	**1073**	**355**	**449**	**343**
Sulfate, as SO4	mg/l	--	--	**29.1**	--	**25.0**	**19.7**	**25.2**	--	**26.0**	**24.5**	--	--	**51.8**	--	--	**62.3**	--	--	< 5.00 U	--
Sulfide, as S^{2-}	mg/l	--	--	--	--	--	--	--	--	**0.80 >**	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C	**9.2**	**9**	**9.5**	**10.4**	**8.3**	**13**	**9.2**	**8.5**	**12.2**	**9.7**	**9.0**	**8.4**	**9.5**	**9.2**	**8.1**	**9.8**	**9.2**	**10.0**	**12.2**	**12**
Turbidity, field	NTU	**4.03**	**49**	**13.9**	**32.2**	**3.4**	**21.9**	**8.2**	**8**	**5**	**3.5**	**17.1**	**1.1**	**17.3**	**1.5**	**1.3**	**15.7**	**1.2**	**16.3**	**19.5**	**6**
Dissolved Metals																					
Arsenic	ug/l	--	--	**4.08**	--	--	< 2.00 U	--	--	**2.73**	--	--	--	< 2.00 U	--	--	< 2.00 U	--	--	**2.63**	--
Boron	ug/l	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--
Cadmium	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Calcium	mg/l	--	--	**85.2 O1**	--	--	**175**	--	--	**160**	--	--	--	**193**	--	--	**199**	--	--	**38.6**	--
Chromium	ug/l	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--
Copper	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Iron	ug/l	--	--	**327**	--	--	**4880**	--	--	**1820**	--	--	--	**5930**	--	--	**4530**	--	--	**171**	--
Lead	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Magnesium	mg/l	--	--	**28.3**	--	--	**64**	--	--	**60.1**	--	--	--	**63.3**	--	--	**67.7**	--	--	**12.7**	--
Manganese	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Mercury	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Potassium	mg/l	--	--	**1.17**	--	--	**2.43**	--	--	**2.77**	--	--	--	**2.83**	--	--	**2.95**	--	--	**2.14**	--
Sodium	mg/l	--	--	**4.47**	--	--	**9.09**	--	--	**19.3**	--	--	--	**14.5**	--	--	**14.7**	--	--	**14.9**	--
Zinc	ug/l	--	--	< 10.0 U	--	--	**11.2**	--	--	< 10.0 U	--	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-315L	P-315L	315-OWA	315-OWA	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320L	P-320L	P-320L
Date		7/26/2024	10/16/2024	7/18/2023	7/26/2024	4/18/2023	7/18/2023	10/20/2023	4/16/2024	7/24/2024	10/15/2024	4/18/2023	7/18/2023	10/20/2023	4/16/2024	7/24/2024	10/15/2024	4/18/2023	7/18/2023	10/20/2023
Parameter	Units																			
Volatile Organic Compounds																				
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	< 0.750 U C3 J4	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.98**	**1.84**	**1.42**
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	**0.115**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	**0.155**	**0.121**	**0.154**
1,2-Dichloroethylene, trans	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	ug/l	< 10.0 U C3	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5 J4	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**3.76**	**1.40**	**3.00**	**2.15**	**3.62**	**3.15**	**2.51**	**2.63**	**2.88**	**2.56**	**2.47**	**3.35**	**1.82**	**1.43**	**1.64**
Ethane	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**11.2**	**7.09**	**4.01**	**8.88**	**5.49**	**8.65**	**3.49**	**9.64**	**7.29**	**4.44**	**11.4**	**4.61**	**7.87**	**7.99**	**5.91**
Ethylene	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methane	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U C3	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Propylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	< 5.00 U C3	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 UC5J3J4	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U C3	< 5.00 UC5J3J4	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U C3	< 5.00 U J3 J4	< 5.00 U	< 5.00 U
Toluene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	< 0.0500 U	< 0.0500 U J4	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	**0.240**	< 0.0500 U C3	**0.392**	< 0.0500 U J4	**0.334**	**0.0630**	< 0.0500 U	**0.214 C3**	< 0.0500 U	**0.301 J4**	**0.417**	< 0.0500 U	**0.212**
Xylene, total	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-315L	P-315L	315-OWA	315-OWA	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320L	P-320L	P-320L
Date		7/26/2024	10/16/2024	7/18/2023	7/26/2024	4/18/2023	7/18/2023	10/20/2023	4/16/2024	7/24/2024	10/15/2024	4/18/2023	7/18/2023	10/20/2023	4/16/2024	7/24/2024	10/15/2024	4/18/2023	7/18/2023	10/20/2023
Parameter	Units																			
General Parameters																				
Alkalinity, total, as CaCO3	mg/l	**189**	--	**54.8**	**74.2**	--	**234**	--	--	**459**	--	--	**418**	--	--	**418**	--	--	**390**	--
Anions	meq/l	**3.85**	--	**1.41**	**1.79**	--	**7.09**	--	--	**12.5**	--	--	**10.8**	--	--	**10.8**	--	--	**9.35**	--
Carbon, total organic	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cations	meq/l	**3.80**	--	**1.50**	**1.81**	--	**5.29**	--	--	**12.7**	--	--	**7.91**	--	--	**10.9**	--	--	**8.70**	--
Cation-Anion balance	%	**-0.731**	--	**2.95**	**0.592**	--	**-14.5**	--	--	**0.893**	--	--	**-15.4**	--	--	**0.146**	--	--	**-3.63**	--
Chemical Oxygen Demand	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Chloride	mg/l	**2.89 J6 P1**	--	**3.49**	**3.17**	--	**82.4**	--	--	**78.8**	--	--	**72.1**	--	--	**72.5**	--	--	**42.4**	--
Dissolved oxygen, field	mg/l	**0.8**	**0.3**	**5.9**	**1.2**	**0.4**	**0.9**	**0.4**	**1.2**	**0**	**0**	**0.2**	**0.7**	**0.8**	**1.5**	**0**	**0**	**0.3**	**1.0**	**0.7**
Iron, ferrous, FE II, field	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l	**0.141**	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, nitrate, as N	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, total kjeldahl (TKN)	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
pH, field	pH units	**7.98**	**8.13**	**6.45**	**8.11**	**7.24**	**6.93**	**7.16**	**7.49**	**7.65**	**7.28**	**7.17**	**6.98**	**7.24**	**7.41**	**7.76**	**7.22**	**7.17**	**6.62**	**7.29**
Redox (oxidation potential), field	mV	**-98**	**-90**	--	**112**	**-121**	**-49**	**-103**	**-119**	**-190.9**	**-148.1**	**-84**	**-55**	**-99**	**-123**	**-208**	**-171.2**	**-65**	**-30**	**-66**
Solids, total dissolved	mg/l	**196**	--	**104**	**118**	--	**383**	--	--	**635**	--	--	**585**	--	--	**538**	--	--	**479**	--
Solids, total suspended	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Specific conductance @ 25 ºC, field	umhos/cm	**385**	**364**	**190**	**220**	**1049**	**1013**	**1050**	**928**	**785**	**847**	**1050**	**1103**	**940**	**975**	**694**	**972**	**828**	**697**	**837**
Sulfate, as SO4	mg/l	< 5.00 U	--	**10.5**	**10.6**	--	< 5.00 U	--	--	**52.0**	--	--	**19.5**	--	--	**21.5**	--	--	**16.9**	--
Sulfide, as S^{2-}	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C	**10.1**	**8.8**	**10.9**	**12.2**	**10.0**	**14.8**	**11.4**	**10.2**	**11.5**	**11.7**	**10.0**	**14.9**	**11.8**	**10.1**	**12**	**11.5**	**10.2**	**15.5**	**11.7**
Turbidity, field	NTU	**15**	**7.3**	**101**	**65**	**6.1**	**27.3**	**4.1**	**3**	**4.3**	**12.3**	**4.3**	**63.2**	**3**	**1.7**	--	**2.3**	**9.2**	**79.3**	**6.1**
Dissolved Metals																				
Arsenic	ug/l	**2.90**	--	< 2.00 U	< 2.00 U	--	< 2.00 U	--	--	**7.23**	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--
Boron	ug/l	< 200 U	--	< 200 U	< 200 U	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--
Cadmium	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Calcium	mg/l	**39.8**	--	**17.5**	**20.7**	--	**32.9**	--	--	**151**	--	--	**81.2**	--	--	**126**	--	--	**107**	--
Chromium	ug/l	< 4.00 U	--	< 4.00 U	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--
Copper	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Iron	ug/l	**128**	--	**118**	**408**	--	**2270**	--	--	**5290**	--	--	**4110**	--	--	**3320**	--	--	**3710**	--
Lead	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Magnesium	mg/l	**13.6**	--	**4.82**	**6.25**	--	**39.1**	--	--	**55**	--	--	**40.6**	--	--	**48**	--	--	**35.6**	--
Manganese	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Mercury	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Potassium	mg/l	**2.17**	--	**3.84**	**3.81**	--	**2.53**	--	--	**2.61**	--	--	**2.42**	--	--	**3.22**	--	--	**2.73**	--
Sodium	mg/l	**14.6**	--	**2.98**	**3.57**	--	**6.5**	--	--	**8.84**	--	--	**6.99**	--	--	**9.64**	--	--	**4.81**	--
Zinc	ug/l	< 10.0 U	--	< 10.0 U	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

	Location	P-320L	P-320L	P-320L	P-321L	P-321L	P-321L	P-321L	P-321L	P-321L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-323L	P-323L	P-323L	P-323L	P-323L
	Date	4/16/2024	7/24/2024	10/15/2024	4/24/2023	7/20/2023	10/18/2023	4/18/2024	7/23/2024	10/17/2024	4/18/2023	7/18/2023	10/17/2023	4/16/2024	7/26/2024	10/16/2024	4/24/2023	7/20/2023	10/18/2023	4/18/2024	7/23/2024
Parameter	Units																				
Volatile Organic Compounds																					
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	**1.63**	**2.10**	**1.26**	**2.21**	**2.56**	**1.90**	**1.46**	**2.57**	**2.88**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**6.71**	**6.50**	**5.59**	**1.94**	**8.04**
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	**0.351**	**0.374**	**0.337**	< 0.250 U	**0.335**
1,2-Dichloroethylene, cis	ug/l	**0.179**	**0.242**	**0.149**	**0.322**	**0.336**	**0.379**	< 0.100 U	**0.385**	**0.372**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	**3.14**	**3.18**	**2.97**	**0.324**	**3.08**
1,2-Dichloroethylene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	ug/l	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Bromomethane	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
Chloroform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C5	< 1.00 U C5	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	**1.47**	**1.47**	**1.49**	**2.74**	**2.79**	**2.56**	**1.31**	**3.04 C5**	**3.18**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**3.04**	**3.29**	**3.68**	**2.23**	**4.46 C5**
Ethane	ug/l	--	--	--	**0.39 HJ**	< 3.4 U	< 45.0 U	--	**3.39**	< 1.20 U	--	--	--	--	--	--	**0.78 HJ**	< 3.4 U	< 45.0 U	--	< 1.29 U
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	**7.27**	**8.91**	**6.41**	**6.81**	**8.52**	**5.67**	**2.50**	**6.68**	**8.71**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**22.2**	**24.4**	**18.3**	**6.92**	**23.2**
Ethylene	ug/l	--	--	--	< 0.24 UH	< 4.8 U	< 39.6 U	--	< 1.27 U	< 1.20 U	--	--	--	--	--	--	< 0.24 UH	< 4.8 U	< 39.6 U	--	< 1.27 U
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methane	ug/l	--	--	--	**190 H**	**240**	**199 1b**	--	**298**	**329**	--	--	--	--	--	--	**58 H**	**58 J**	**223**	--	**106**
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.06**
Methylene chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	ug/l	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Propylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
Styrene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 UC5J3J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U C3	< 5.00 U	< 5.00 U C5	< 5.00 U C3	**9.77**	**14.4**	**12.3 C5J3J4**	< 5.00 U	**12.3 B**
Toluene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	**0.669**	**0.707**	**0.871**	< 0.100 U	**0.927**
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	**0.228 C3**	**0.296**	**0.221 J4**	**0.334**	**0.482**	**0.219 C3**	< 0.0500 U	**0.285**	**0.366**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 0.0500 U	< 0.0500 U J4	< 0.0500 U	**0.285**	**0.189 C3**	**0.223**	**0.222**
Xylene, total	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

	Location	P-320L	P-320L	P-320L	P-321L	P-321L	P-321L	P-321L	P-321L	P-321L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-323L	P-323L	P-323L	P-323L	P-323L
	Date	4/16/2024	7/24/2024	10/15/2024	4/24/2023	7/20/2023	10/18/2023	4/18/2024	7/23/2024	10/17/2024	4/18/2023	7/18/2023	10/17/2023	4/16/2024	7/26/2024	10/16/2024	4/24/2023	7/20/2023	10/18/2023	4/18/2024	7/23/2024
Parameter	Units																				
General Parameters																					
Alkalinity, total, as CaCO3	mg/l	--	375	--	420	413	413	--	423	413	--	430	--	--	422	--	730	680	696	--	699
Anions	meq/l	--	9.72	--	--	10.7	--	--	10.8	--	--	9.90	--	--	9.56	--	--	17.4	--	--	18.2
Carbon, total organic	mg/l	--	--	--	2.76 B	2.20	2.32	--	1.68	1.21	--	--	--	--	--	--	6.36	6.19	6.65	--	6.73
Cations	meq/l	--	9.80	--	--	10.6	--	--	10.9	--	--	9.61	--	--	9.86	--	--	17.4	--	--	18.2
Cation-Anion balance	%	--	0.403	--	--	-0.303	--	--	-1.32	--	--	-1.48	--	--	1.56	--	--	0.0482	--	--	0.107
Chemical Oxygen Demand	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloride	mg/l	--	62.9	--	69.2	63.3	65.1	--	57.9	51.5	--	35.7	--	--	33.0	--	115	118	122	--	133
Dissolved oxygen, field	mg/l	0.1	0	0	0.3	0.9	0.7	0.7	1.1	1	0.4	0.9	0.8	1.5	0.7	0	0.1	0.9	0.6	0	0.3
Iron, ferrous, FE II, field	mg/l	--	--	--	--	--	--	--	0.56	--	--	--	--	--	--	--	--	--	--	--	2.87
Manganese II, field	mg/l	--	--	--	--	--	--	--	0.200	--	--	--	--	--	--	--	--	--	--	--	0.541
Nitrogen, ammonia, as N	mg/l	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U
Nitrogen, nitrate + nitrite, as N	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	--	--	--	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U P1	< 1.00 U	--	--	--	--	--	--	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U
Nitrogen, nitrite, as N	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, total kjeldahl (TKN)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, field	pH units	7.48	7.73	7.25	7.24	6.99	7.13	7.29	7.45	7.29	7.60	6.95	7.16	7.71	7.95	7.22	6.8	6.59	6.64	6.9	6.99
Redox (oxidation potential), field	mV	-125	162.6	-155.9	-71	-78	-54	-102	-98	-105	-150	-46	-72	-141	-180	-87	-64	-58	-5	-96	-97
Solids, total dissolved	mg/l	--	482	--	--	556	--	--	554	--	--	497	--	--	433	--	--	832	--	--	924
Solids, total suspended	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm	678	631	760	935	576	759	975	986	919	752	875	993	823	800	719	1163	960	1532	1577	995
Sulfate, as SO4	mg/l	--	21.6	--	31.5	32.6	33.2	--	33.8	32.6	--	14.4	--	--	9.82	--	20.6	22.7	22.5	--	22.5
Sulfide, as S^{2-}	mg/l	--	--	--	--	--	--	--	0.07	--	--	--	--	--	--	--	--	--	--	--	0.11
Temperature, field	deg C	10	12.1	11.8	11.9	12.1	11.9	10.8	11.5	11.8	8.5	9.8	10.5	7.6	11	9	9.8	10.3	10.3	9.9	10.5
Turbidity, field	NTU	0.3	7.3	10.6	3.5	2	2.5	2	1	0.5	19.7	13.5	4	7.9	32	4.7	167	12.6	6.2	15	8.4
Dissolved Metals																					
Arsenic	ug/l	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U
Boron	ug/l	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	--	286	--	--	319
Cadmium	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/l	--	123	--	--	128	--	--	130 O1 V	--	--	112	--	--	112	--	--	187	--	--	188
Chromium	ug/l	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U
Copper	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	ug/l	--	1560	--	--	800	--	--	957 O1	--	--	1650	--	--	2070	--	--	2970	--	--	6050
Lead	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l	--	40.3	--	--	46	--	--	49.6	--	--	44.4	--	--	47.3	--	--	73.1	--	--	78.8
Manganese	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l	--	2.64	--	--	2.91	--	--	2.79	--	--	2.07	--	--	2.3	--	--	3.77	--	--	4.02
Sodium	mg/l	--	5.13	--	--	8.86	--	--	5.02	--	--	5.19	--	--	6.28	--	--	42	--	--	46.7
Zinc	ug/l	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-323L	P-324L	P-324L	P-324L	P-324L	P-324L	P-324L	P-325L	P-325L	P-325L	P-325L	P-325L	P-325L	P-326L	P-326L	P-326L	P-326L	P-326L	P-326L	P-327L
Date		10/17/2024	4/18/2023	7/18/2023	10/20/2023	5/15/2024	7/26/2024	10/16/2024	4/24/2023	7/20/2023	10/17/2023	4/16/2024	7/23/2024	10/17/2024	4/24/2023	7/20/2023	10/17/2023	4/16/2024	7/23/2024	10/17/2024	7/19/2023
Parameter	Units																				
Volatile Organic Compounds																					
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	**6.18**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**6.17**	**6.91**	**4.08**	**6.21**	**7.09**	**6.47**	**4.46**	**3.54**	**5.75**	**4.13**	**4.91**	**4.40**	< 1.00 U
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	**0.313**	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	**0.250**	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	**2.16**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	**1.40**	**1.69**	**1.61**	**1.52**	**1.56**	**1.33**	< 0.100 U	**0.675**	**1.54**	**1.66**	**1.73**	**1.39**	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	ug/l	< 10.0 UC5J3J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U
Allyl chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Bromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	**1.36**	**1.59 C5**	**1.11 C5**	< 1.00 U	< 1.00 U	**1.23**	< 1.00 U	**1.27 C5**	< 1.00 U C5	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	**3.15**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**5.91**	**7.20**	**5.02**	**6.87**	**8.03 C5**	**6.96**	**2.40**	**3.05**	**8.65**	**3.42**	**4.51 C5**	**3.92**	< 1.00 U
Ethane	ug/l	**1.24**	--	--	--	--	--	--	**0.82 HJ**	**6.3 J**	--	--	< 1.29 U	**1.38**	**0.38 HJ**	< 3.4 U	--	--	< 1.29 U	< 1.20 U	--
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	**21.9**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**22.1**	**29.3**	**14.6**	**25.9**	**24.1**	**24.6**	**15.0**	**13.6**	**23.9**	**14.4**	**14.4**	**14.1**	< 1.00 U
Ethylene	ug/l	< 1.20 U	--	--	--	--	--	--	< 0.24 UH	**9.3 J**	--	--	< 1.27 U	< 1.20 U	< 0.24 UH	< 4.8 U	--	--	< 1.27 U	< 1.20 U	--
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methane	ug/l	**91.2**	--	--	--	--	--	--	**560 H**	**740**	--	--	**1060**	**952**	**190 H**	**160**	--	--	**328**	**299**	--
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**1.03**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	ug/l	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U
Propylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U
Styrene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	**8.63**	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U C5	< 5.00 U C3	**5.39**	**5.34**	**12.5 C3**	< 5.00 U	< 5.00 U	< 5.00 U	**13.4 C5**	**16.4**	< 5.00 U C3	**9.62**	**10.7 B**	**9.67**	< 5.00 U
Toluene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	**0.740**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	**0.154**	**0.120**	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	**0.236**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U J4	**0.462**	**0.712**	**0.228**	**0.533 C3**	**0.556**	**0.643**	< 0.0500 U	**0.200**	**0.529**	**0.156 C3**	**0.160**	**0.176**	< 0.0500 U
Xylene, total	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

	Location	P-323L	P-324L	P-324L	P-324L	P-324L	P-324L	P-324L	P-325L	P-325L	P-325L	P-325L	P-325L	P-325L	P-326L	P-326L	P-326L	P-326L	P-326L	P-326L	P-327L
	Date	10/17/2024	4/18/2023	7/18/2023	10/20/2023	5/15/2024	7/26/2024	10/16/2024	4/24/2023	7/20/2023	10/17/2023	4/16/2024	7/23/2024	10/17/2024	4/24/2023	7/20/2023	10/17/2023	4/16/2024	7/23/2024	10/17/2024	7/19/2023
Parameter	Units																				
General Parameters																					
Alkalinity, total, as CaCO3	mg/l	**683**	--	**290**	--	--	**334**	--	**642**	**624**	**621**	--	**620**	**621**	**610**	**623**	**645**	--	**688**	**633**	**214**
Anions	meq/l	--	--	**6.76**	--	--	**7.65**	--	--	**16.8**	--	--	**16.6**	--	--	**14.5**	--	--	**15.9**	--	**4.67**
Carbon, total organic	mg/l	**6.44**	--	--	--	--	--	--	**9.67**	**9.51**	**8.44**	--	**8.56**	**8.12**	**3.21**	**2.77**	**2.65**	--	**3.02**	**2.84**	--
Cations	meq/l	--	--	**6.85**	--	--	**7.58**	--	--	**16.9**	--	--	**16.5**	--	--	**14.3**	--	--	**15.8**	--	**4.35**
Cation-Anion balance	%	--	--	**0.696**	--	--	**-0.421**	--	--	**0.425**	--	--	**-0.342**	--	--	**-0.527**	--	--	**-0.408**	--	**-3.57**
Chemical Oxygen Demand	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Chloride	mg/l	**131**	--	**34.1**	--	--	**34.2 J6**	--	**131**	**138**	**117**	--	**130**	**122**	**56.9**	**58.1**	**59.0**	--	**62.4**	**67.0**	**10.1**
Dissolved oxygen, field	mg/l	**0.2**	**0.2**	**0.8**	**0.5**	**0.3**	**0.7**	**0**	**0.2**	**1.5**	**0.8**	**0.6**	**0.9**	**0.7**	**1.3**	**2.3**	**3.3**	**1.8**	**1.2**	**0.8**	**0.9**
Iron, ferrous, FE II, field	mg/l	--	--	--	--	--	--	--	--	--	--	--	**1.52**	--	--	--	--	--	**2.28**	--	--
Manganese II, field	mg/l	--	--	--	--	--	--	--	--	--	--	--	**0.255**	--	--	--	--	--	**0.313**	--	--
Nitrogen, ammonia, as N	mg/l	--	--	< 0.100 U	--	--	< 0.100 U J5	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	**0.378**
Nitrogen, nitrate + nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, nitrate, as N	mg/l	< 1.00 U	--	--	--	--	--	--	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	--
Nitrogen, nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, total kjeldahl (TKN)	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
pH, field	pH units	**6.879**	**7.62**	**6.86**	**7.18**	**7.89**	**7.88**	**7.7**	**7.73**	**6.88**	**7.5**	**7.38**	**7.45**	**7.35**	**7.17**	**6.87**	**7.45**	**7.29**	**7.33**	**7.21**	**6.9**
Redox (oxidation potential), field	mV	**-107**	**-167**	**-78**	**-125**	**-180**	**-203**	**-186.4**	**-73**	**-35**	**-24**	**-85**	**20**	**-35**	**-36**	**-39**	**-31**	**-89**	**-56**	**-85**	**-95**
Solids, total dissolved	mg/l	--	--	**319**	--	--	**360**	--	--	**842**	--	--	**866**	--	--	**700 J3**	--	--	**725**	--	**217**
Solids, total suspended	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Specific conductance @ 25 ºC, field	umhos/cm	**1490**	**645**	**633**	**720**	**622**	**597**	**598**	**1485**	**1499**	**1405**	**1376**	**1559**	**1503**	**1245**	**1283**	**1275**	**1109**	**1389**	**1373**	**350**
Sulfate, as SO4	mg/l	**18.9**	--	< 5.00 U	--	--	< 5.00 U	--	**24.6**	**18.6**	**25.4**	--	**26.2**	**23.9**	**22.1**	**17.5**	**25.3**	--	**19.0**	**17.7**	**5.88**
Sulfide, as S^{2-}	mg/l	--	--	--	--	--	--	--	--	--	--	--	< -9999 ND	--	--	--	--	--	< -9999 ND	--	--
Temperature, field	deg C	**10.8**	**8.8**	**10.3**	**10.5**	**9.7**	**10**	**9.4**	**7.7**	**9.6**	**8.2**	**8**	**11.2**	**10.5**	**6.9**	**15**	**8.8**	**7.3**	**12.1**	**10.3**	**9.9**
Turbidity, field	NTU	**21**	**53.7**	**87**	**21.1**	**22**	**15**	**7.2**	**4**	**3.2**	**3.3**	**3.5**	**10**	**8**	**6.3**	**4.1**	**7**	**1.5**	**17**	**9.3**	**22.1**
Dissolved Metals																					
Arsenic	ug/l	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	**3.27**
Boron	ug/l	--	--	< 200 U	--	--	< 200 U	--	--	**362**	--	--	**251**	--	--	< 200 U	--	--	< 200 U	--	< 200 U
Cadmium	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Calcium	mg/l	--	--	**49.8**	--	--	**62.4**	--	--	**187**	--	--	**181**	--	--	**163**	--	--	**181**	--	**50.3**
Chromium	ug/l	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	< 4.00 U
Copper	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Iron	ug/l	--	--	**7690**	--	--	**5850**	--	--	**1980**	--	--	**2140**	--	--	**9590**	--	--	**12600**	--	**2120**
Lead	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Magnesium	mg/l	--	--	**44.3**	--	--	**46**	--	--	**67.7**	--	--	**71.4**	--	--	**59.5**	--	--	**70.6**	--	**16.9**
Manganese	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Mercury	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Potassium	mg/l	--	--	**2.47**	--	--	**2.62**	--	--	**3.26**	--	--	**3.14**	--	--	**2.79**	--	--	**2.53**	--	**2.75**
Sodium	mg/l	--	--	**8.65**	--	--	**9.28**	--	--	**42.6**	--	--	**32.4**	--	--	**20.1**	--	--	**9.71**	--	**6.98**
Zinc	ug/l	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	< 10.0 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-327L	P-327L	P-328L	P-328L	P-328L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L	P-333L	P-333L	P-333L	P-333L	P-334L	P-334L	P-334L	P-334L	P-334L
Date		4/15/2024	7/25/2024	7/21/2023	4/15/2024	7/25/2024	4/19/2023	7/21/2023	10/20/2023	4/15/2024	7/25/2024	10/16/2024	5/15/2023	8/10/2023	4/15/2024	7/25/2024	4/24/2023	7/24/2023	10/18/2023	5/15/2024	7/22/2024
Parameter	Units																				
Volatile Organic Compounds																					
1,1,1,2-Tetrachloroethane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,1,1-Trichloroethane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,1,2,2-Tetrachloroethane	ug/l	--	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U	< 0.500 U	--
1,1,2-Trichloroethane	ug/l	--	< 0.750 U	< 0.750 U	--	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	--
1,1-Dichloroethane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**2.79**	**3.30**	**2.68**	**4.20**	--
1,1-Dichloroethylene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,1-Dichloropropene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2,3-Trichlorobenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	--
1,2,3-Trichloropropane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2,4-Trichlorobenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	--
1,2,4-Trimethylbenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	--
1,2-Dibromoethane (EDB)	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2-Dichlorobenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2-Dichloroethane	ug/l	--	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--
1,2-Dichloroethylene, cis	ug/l	--	< 0.100 U	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--
1,2-Dichloroethylene, trans	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2-Dichloropropane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,3,5-Trimethylbenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,3-Dichlorobenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,3-Dichloropropane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,3-Dichloropropene, cis	ug/l	--	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--
1,3-Dichloropropene, trans	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,4-Dichlorobenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
2,2-Dichloropropane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Acetone	ug/l	--	< 10.0 U C3	< 10.0 U J3	--	< 10.0 U C3	< 10.0 U	< 10.0 U J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--
Allyl chloride	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Benzene	ug/l	--	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--
Bromobenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Bromochloromethane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Bromodichloromethane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Bromoform	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Bromomethane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--
Butylbenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--
Butylbenzene, sec	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Butylbenzene, tert	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Carbon tetrachloride	ug/l	--	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--
Chlorobenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Chlorodibromomethane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Chloroethane	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Chloroform	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Chloromethane	ug/l	--	< 1.00 U J3	< 1.00 U	--	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Chlorotoluene, o	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Chlorotoluene, p	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Cumene (isopropyl benzene)	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Cymene p- (toluene isopropyl p-)	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--
Dibromomethane (methylene bromide)	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Dichlorodifluoromethane (Freon-12)	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**7.03**	**8.14**	**7.48 C3**	**7.27**	--
Dichlorofluoromethane (Freon-21)	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**14.9**	**16.8**	**16.9**	**19.1**	--
Ethane	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.42 HJ**	**0.35 J**	< 45.0 U	--	< 1.29 U
Ethyl benzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Ethyl ether	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**12.1**	**15.1**	**12.3**	**20.8**	--
Ethylene	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.24 HJ**	< 0.24 U	< 39.6 U	--	< 1.27 U
Hexachlorobutadiene	ug/l	--	< 0.250 U	< 0.250 U J3	--	< 0.250 U	< 0.250 U	< 0.250 U J3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U	< 0.250 U	--
Methane	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**730 H**	**920**	**1120 1b**	--	**2110**
Methyl ethyl ketone (2-butanone)	ug/l	--	< 10.0 U	< 10.0 U	--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	--
Methyl isobutyl ketone (MIBK)	ug/l	--	< 5.00 U	< 5.00 U	--	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	--
Methyl tertiary butyl ether (MTBE)	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Methylene chloride	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Naphthalene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	--
Propylbenzene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Styrene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Tetrachloroethylene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Tetrahydrofuran	ug/l	--	< 5.00 U C3	< 5.00 U	--	< 5.00 U C3	< 5.00 U J3 J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U C3 J3	< 5.00 U	< 5.00 U	< 5.00 U C5	**6.44**	**5.24**	< 5.00 U J3 J4	**7.47**	--
Toluene	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Trichloroethylene (TCE)	ug/l	--	< 0.100 U	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--
Trichlorofluoromethane (Freon-11)	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Trichlorotrifluoroethane (Freon 113)	ug/l	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Vinyl chloride	ug/l	--	< 0.0500 U	< 0.0500 U	--	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 0.0500 U	< 0.0500 U J4	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 0.0500 U	**0.341**	**0.409**	**0.326 C3**	**0.584**	--
Xylene, total	ug/l	--	< 2.00 U	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-327L	P-327L	P-328L	P-328L	P-328L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L	P-333L	P-333L	P-333L	P-333L	P-334L	P-334L	P-334L	P-334L	P-334L
Date		4/15/2024	7/25/2024	7/21/2023	4/15/2024	7/25/2024	4/19/2024	7/21/2023	10/20/2023	4/15/2024	7/25/2024	10/16/2024	5/15/2023	8/10/2023	4/15/2024	7/25/2024	4/24/2023	7/24/2023	10/18/2023	5/15/2024	7/22/2024
Parameter	Units																				
General Parameters																					
Alkalinity, total, as CaCO3	mg/l	**208**	**197**	**201**	**215**	**205**	--	**198**	--	**210**	**206**	--	--	**201**	**205**	**198**	**285**	**275**	**281**	--	**308**
Anions	meq/l	--	**4.36**	**4.55**	--	**4.60**	--	**4.32**	--	--	**4.50**	--	--	**4.34**	--	**4.39**	--	**6.33**	--	--	--
Carbon, total organic	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**1.03 B**	**1.33 B**	**1.43**	--	< 1.40 UB
Cations	meq/l	--	**4.51**	**4.46**	--	**4.54**	--	**4.25**	--	--	**4.38**	--	--	**4.91**	--	**4.33**	--	**6.11**	--	--	--
Cation-Anion balance	%	--	**3.23**	**-1.03**	--	**3.11**	--	**-0.925**	--	--	**-1.26**	--	--	**6.24**	--	**-0.687**	--	**-1.80**	--	--	--
Chemical Oxygen Demand	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Chloride	mg/l	**11.2**	**10.6 J6**	**7.05**	**6.87**	**6.09**	--	**2.93**	--	**3.04**	**3.45**	--	--	**2.94**	**3.94**	**3.43**	**16.9**	**16.7**	**17.9**	--	**21.6**
Dissolved oxygen, field	mg/l	**0.2**	**0.8**	**0.9**	**15.9**	**0.9**	**0.3**	**0.5**	**0.4**	**0.5**	**0.5**	**0.4**	**1.2**	**0.9**	**0.4**	**0.6**	**0.2**	**0.7**	**0.3**	**1**	--
Iron, ferrous, FE II, field	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**1.44**
Manganese II, field	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.042**
Nitrogen, ammonia, as N	mg/l	--	**0.214**	**0.236**	--	**0.225**	--	< 0.100 U	--	--	< 0.100 U	--	--	**0.115 B**	--	< 0.100 U	--	< 0.100 U	--	--	--
Nitrogen, nitrate + nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, nitrate, as N	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U T8
Nitrogen, nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Nitrogen, total kjeldahl (TKN)	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
pH, field	pH units	**8.37**	**8.18**	**7.62**	**8.04**	**7.96**	**7.87**	**7.72**	**7.65**	**7.98**	**7.9**	**7.74**	**7.48**	**7.65**	**7.94**	**7.85**	**7.7**	**7.35**	**7.74**	**7.48**	--
Redox (oxidation potential), field	mV	**-230**	**-201**	**-65**	**-184**	**-147**	**-88**	**-125**	**-81**	**-140**	**-125**	**-137**	**-19**	**-60**	**-139**	**-139**	**-88**	**-39**	**-69**	**-12**	--
Solids, total dissolved	mg/l	--	**224**	**238**	--	**229**	--	**223**	--	--	**224**	--	--	**227**	--	**228**	--	**334 B**	--	--	--
Solids, total suspended	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Specific conductance @ 25 ºC, field	umhos/cm	**409**	**418**	**384**	**424**	**436**	**387**	**389**	**393**	**395**	**413**	**392**	**398**	**411**	**400**	**403**	**560**	**454**	**583**	**613**	--
Sulfate, as SO4	mg/l	**5.85**	**6.28**	**16.7**	**15.5**	**15.9**	--	**13.9**	--	**13.4**	**13.8**	--	--	**11.6**	**16.5**	**16.5**	**18.5**	**17.8**	**19.5**	--	**18.6**
Sulfide, as S^{2-}	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.17**
Temperature, field	deg C	**8**	**9**	**8.9**	**8.2**	**9.7**	**7.8**	**8.5**	**8.8**	**9.2**	**9.9**	**9.2**	**12**	**11.8**	**7.9**	**9.9**	**8.5**	**9.1**	**9**	**10.5**	--
Turbidity, field	NTU	**9.1**	**1**	**10.1**	**0.1**	**13**	**21.3**	**12.9**	**12.1**	**9.5**	**2**	**9**	**5**	**27.3**	**2.3**	**2**	**5**	**20.7**	**4.1**	**3.8**	--
Dissolved Metals																					
Arsenic	ug/l	--	**3.62**	< 2.00 U	--	< 2.00 U	--	< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	< 2.00 U	--	< 2.00 U	--	--	--
Boron	ug/l	--	< 200 U	< 200 U	--	< 200 U	--	< 200 U	--	--	< 200 U	--	--	< 200 U	--	< 200 U	--	< 200 U	--	--	--
Cadmium	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Calcium	mg/l	**58.9 F1**	**51.5**	**53.0**	**63.9 F1**	**54.8**	--	**48.8**	--	**59.5 F1**	**51.1**	--	--	**54.7 O1**	**62.6 F1**	**53.0**	--	**73.9**	--	--	--
Chromium	ug/l	--	< 4.00 U	< 4.00 U	--	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	--	**6.77**	--	< 4.00 U	--	< 4.00 U	--	--	--
Copper	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Iron	ug/l	--	**2320**	**1020**	--	**810**	--	**603**	--	--	**1080**	--	--	**6570**	--	**1310**	--	**258**	--	--	--
Lead	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Magnesium	mg/l	**19.1 F1**	**18.5**	**18.2**	**20.6 F1**	**18.2**	--	**18.1**	--	**18.1 F1**	**18**	--	--	**21.5**	**19.3 F1**	**17.7**	--	**27.1**	--	--	--
Manganese	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Mercury	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Potassium	mg/l	**1.85 F1**	**1.61**	**1.41**	**1.48 F1**	**1.42**	--	**1.78**	--	**1.66 F1**	**1.77**	--	--	**1.32**	**1.29 F1**	**1.3**	--	**1.58**	--	--	--
Sodium	mg/l	**6.64 F1**	**6.8**	**5.59**	**5.64 F1**	**5.8**	--	**5.79**	--	**5.77 F1**	**6.07**	--	--	**3.44**	**3.33 F1**	**3.51**	--	**3.15**	--	--	--
Zinc	ug/l	--	< 10.0 U	< 10.0 U	--	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	--	**54.3**	--	< 10.0 U	--	**17.7**	--	--	--

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

	Location	P-334L	P-334L	P-335L	P-335L	P-335L	P-335L	P-335L	P-335L	P-337L	P-337L	P-338L	P-338L	P-338L
	Date	9/19/2024	10/17/2024	4/19/2023	7/21/2023	10/20/2023	4/15/2024	7/25/2024	10/16/2024	7/20/2023	7/25/2024	4/24/2023	7/24/2023	10/18/2023
Parameter	Units													
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U Q	< 0.500 U	< 0.500 U C3	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U Q	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	**4.86**	**3.89**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	**8.00**	**9.67**	**7.90**
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U Q	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U Q	< 0.100 U	**0.465**	**0.706**	**0.784**
1,2-Dichloroethylene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U Q	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	ug/l	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U	< 10.0 U J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	**10.9 C5 Q**	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U Q	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U Q	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	**12.7**	**6.90 C5**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U Q	< 1.00 U	**2.79**	**4.03**	**4.07 C3**
Dichlorofluoromethane (Freon-21)	ug/l	**25.4**	**16.7**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	**12.2**	**14.9**	**15.0**
Ethane	ug/l	--	< 1.20 U	--	--	--	--	--	--	--	--	**0.92 HJ**	**0.58 J**	< 45.0 U
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	**20.5**	**17.9**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	**22.3**	**29.5**	**23.4**
Ethylene	ug/l	--	< 1.20 U	--	--	--	--	--	--	--	--	< 0.24 UH	< 0.24 U	< 39.6 U
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U Q	< 0.250 U	< 0.250 U C3	< 0.250 U	< 0.250 U
Methane	ug/l	--	**2020**	--	--	--	--	--	--	--	--	**1300 H**	**1400**	**1720 1b**
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U Q	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U Q	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	ug/l	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Propylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	**9.04 C3 J3**	**7.81**	< 5.00 U J3 J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U Q	< 5.00 U C3	**10.3**	**15.6**	**19.5 C5J3J4**
Toluene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U Q	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U Q	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	**0.690**	**0.545**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	**0.162**	< 0.0500 U J4	< 0.0500 U Q	< 0.0500 U	**0.693**	**1.02**	**0.782 C3**
Xylene, total	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U Q	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

	Location	P-334L	P-334L	P-335L	P-335L	P-335L	P-335L	P-335L	P-335L	P-337L	P-337L	P-338L	P-338L	P-338L
	Date	9/19/2024	10/17/2024	4/19/2023	7/21/2023	10/20/2023	4/15/2024	7/25/2024	10/16/2024	7/20/2023	7/25/2024	4/24/2023	7/24/2023	10/18/2023
Parameter	Units													
General Parameters														
Alkalinity, total, as CaCO3	mg/l	--	**300**	--	**187**	--	**202**	**197**	--	**198**	**193**	**436**	**428**	**455**
Anions	meq/l	--	--	--	**4.15**	--	--	**4.42**	--	**4.99**	**4.98**	--	**9.97**	--
Carbon, total organic	mg/l	--	**1.16**	--	--	--	--	--	--	--	--	**2.32**	**2.72**	**2.91**
Cations	meq/l	--	--	--	**4.04**	--	--	**4.33**	--	**4.84**	**5.08**	--	**9.92**	--
Cation-Anion balance	%	--	--	--	**-1.30**	--	--	**-1.01**	--	**-1.54**	**1.06**	--	**-0.281**	--
Chemical Oxygen Demand	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	**--**	--
Chloride	mg/l	--	**23.6**	--	**3.67**	--	**4.04**	**4.10**	--	**9.16**	**9.34**	**37.6**	**37.9**	**41.2**
Dissolved oxygen, field	mg/l	**0.8**	**0.7**	**0.3**	**1.7**	**1.2**	**1.1**	**0.8**	**1.8**	**0.5**	**0**	**0.2**	**0.7**	**0.6**
Iron, ferrous, FE II, field	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l	--	--	--	< 0.100 U	--	--	< 0.100 U	--	< 0.100 U	< 0.100 U	--	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	--	--
Nitrogen, nitrate, as N	mg/l	--	< 1.00 U	--	--	--	--	--	--	--	--	< 1.00 U	< 1.00 U	< 1.00 U
Nitrogen, nitrite, as N	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	--	--
Nitrogen, total kjeldahl (TKN)	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	--	--
pH, field	pH units	**7.23**	**7.27**	**6.90**	**6.93**	**7.03**	**7.62**	**8.12**	**7.87**	**7.55**	**7.47**	**7.56**	**7.25**	**7.52**
Redox (oxidation potential), field	mV	**-86**	**-36**	**-67**	**-66**	**-62**	**-138**	**-135**	**-114**	**-47**	**-221.9**	**-98**	**-87**	**-77**
Solids, total dissolved	mg/l	--	--	--	**222**	--	--	**229**	--	**278**	**272**	--	**505 B**	--
Solids, total suspended	mg/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm	**644**	**630**	**382**	**385**	**339**	**398**	**407**	**408**	**346**	**316**	**755**	**808**	**880**
Sulfate, as SO4	mg/l	--	**18.7**	--	**14.6**	--	**15.1**	**17.6**	--	**37.0**	**41.6**	**16.9**	**16.9**	**18.1**
Sulfide, as S^{2-}	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C	**10**	**9.7**	**9.9**	**10.5**	**10.6**	**11**	**11.1**	**11.4**	**10.1**	**10**	**8.8**	**10.0**	**9.7**
Turbidity, field	NTU	**5**	**13**	**9.9**	**12.1**	**8.5**	**8.1**	**28**	**12**	**67**	**9.4**	**4.1**	**7.9**	**3.3**
Dissolved Metals														
Arsenic	ug/l	--	--	--	< 2.00 U	--	--	< 2.00 U	--	< 2.00 U	< 2.00 U	--	< 2.00 U	--
Boron	ug/l	--	--	--	< 200 U	--	--	< 200 U	--	< 200 U	< 200 U	--	< 200 U	--
Cadmium	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	--	--
Calcium	mg/l	--	--	--	**47.9**	--	**60.0 F1**	**52.3**	--	**56.7**	**60.8**	--	**117**	--
Chromium	ug/l	--	--	--	< 4.00 U	--	--	< 4.00 U	--	< 4.00 U	< 4.00 U	--	< 4.00 U	--
Copper	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	--	--
Iron	ug/l	--	--	--	**404**	--	--	**879**	--	**457**	**604**	--	**1630**	--
Lead	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	--	--
Magnesium	mg/l	--	--	--	**17.3**	--	**19.6 F1**	**17.8**	--	**22.2**	**22.4**	--	**46.3**	--
Manganese	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	--	--
Mercury	ug/l	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	--	--	--
Potassium	mg/l	--	--	--	**1.3**	--	**1.34 F1**	**1.42**	--	**1.36**	**1.45**	--	**1.87**	--
Sodium	mg/l	--	--	--	**3.99**	--	**4.07 F1**	**4.35**	--	**3.08**	**3.32**	--	**4.15**	--
Zinc	ug/l	--	--	--	< 10.0 U	--	--	< 10.0 U	--	< 10.0 U	< 10.0 U	--	< 10.0 U	--

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

	Location	P-338L	P-338L	P-338L	P-340L	P-340L	P-341L	P-341L	P-341L	P-341L	P-341L	P-342L	P-342L	P-342L	P-342L	P694477	P694477	P694477	P694477	P694477	P694477
	Date	4/18/2024	7/22/2024	10/17/2024	8/10/2023	7/22/2024	8/10/2023	10/17/2023	4/15/2024	7/23/2024	9/19/2024	5/15/2023	8/10/2023	4/15/2024	7/24/2024	4/21/2023	7/21/2023	10/20/2023	4/18/2024	7/26/2024	10/16/2024
Parameter	Units																				
Volatile Organic Compounds																					
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U J4	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U J4	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	--	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	**3.77**	**10.5**	**10.0**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**2.44**	**2.67**	**1.96**	**9.48**	**3.51**	**2.61**
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	< 0.100 U	**0.981**	**0.918**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	< 1.00 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	**0.860**	**0.103**	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U
Acetone	ug/l	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U C3	< 10.0 U	--	< 10.0 U J3 J4	< 10.0 U	< 10.0 U J3 J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3
Allyl chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Bromomethane	ug/l	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	**7.52**	**5.21**	**4.42 C5**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	**2.47**	**2.75**	**2.12**	**4.63**	**2.78**	**3.00 C5 J4**
Dichlorofluoromethane (Freon-21)	ug/l	**15.9**	**15.9**	**15.1**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	**3.74**	**4.77**	**4.29**	**13.8**	**4.98**	**5.44**
Ethane	ug/l	--	**9.15**	**1.78**	--	< 1.29 U	--	--	--	< 1.29 U	--	--	--	--	< 1.29 U	--	--	--	--	--	--
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	**17.6**	**30.0**	**30.3**	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	**9.40**	**10.4**	**7.67**	**30.5**	**13.5**	**10.1**
Ethylene	ug/l	--	< 1.27 U	< 1.20 U	--	< 1.27 U	--	--	--	< 1.27 U	--	--	--	--	< 1.27 U	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methane	ug/l	--	**2880**	**2630**	--	**24.9**	--	--	--	< 0.678 U	--	--	--	--	**42.9**	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	--	< 10.0 U J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	--	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U J4	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4
Naphthalene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	--	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Propylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	**8.38**	**16.2 B**	**7.52**	< 5.00 U	< 5.00 U	< 5.00 U J3	< 5.00 U C3	< 5.00 U	--	< 5.00 U C3 J3	< 5.00 U C3 J3	< 5.00 U J3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	**20.8**	< 5.00 U	< 5.00 U C3
Toluene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	**0.442**	**1.05**	**0.984**	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	--	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U C3	< 0.0500 U	< 0.0500 U	**0.425**	**0.251**	**0.795**	**0.489**	**0.474 J4**
Xylene, total	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table A1
2023-2024 Groundwater Data for Lower Outwash/Deep Wells
Elk River Landfill
Elk River, Minnesota

Location		P-338L	P-338L	P-338L	P-340L	P-340L	P-341L	P-341L	P-341L	P-341L	P-341L	P-342L	P-342L	P-342L	P-342L	P694477	P694477	P694477	P694477	P694477	P694477
Date		4/18/2024	7/22/2024	10/17/2024	8/10/2023	7/22/2024	8/10/2023	10/17/2023	4/15/2024	7/23/2024	9/19/2024	5/15/2023	8/10/2023	4/15/2024	7/24/2024	4/21/2023	7/21/2023	10/20/2023	4/18/2024	7/26/2024	10/16/2024
Parameter	Units																				
General Parameters																					
Alkalinity, total, as CaCO3	mg/l	--	474 449	448	193	196 179	266	274 274	274	272	--	188	187	129 145	203 198	--	372	--	--	436	--
Anions	meq/l	--	10.6	--	4.21	3.98	6.33	6.77	6.56	--	--	4.02	4.01	3.03	4.22	--	8.29	--	--	9.74	--
Carbon, total organic	mg/l	--	2.63	2.21	--	< 1.00 U	2.15 B	< 1.00 U	--	< 1.00 U	--	--	1.19 B	--	1.03	--	--	--	--	--	--
Cations	meq/l	--	10.9	--	4.45	4.56	7.19	6.53	6.23	--	--	3.90	4.16	3.57	4.25	--	8.14	--	--	9.69	--
Cation-Anion balance	%	--	1.27	--	2.77	6.85	6.40	-1.86	--	--	--	-1.41	1.88	--	0.387	--	-0.920	--	--	0.477	--
Chemical Oxygen Demand	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloride	mg/l	--	43.8 43.6	45.1	3.85	49.4 4.72	22.2	27.4 27.6	24.6	24.5	--	1.04	1.04	1.17 1.05	1.20 1.38	--	17.6	--	--	21.3 J6	--
Dissolved oxygen, field	mg/l	0.5	0.4	0.7	0.7	10.7	1.7	0.8	0.1	--	0.5	0.7	0.8	0.2	0.9	0.1	0.3	0.2	0.1	0.1	0.2
Iron, ferrous, FE II, field	mg/l	--	1870	--	--	1050	--	--	--	2490	--	--	--	--	770	--	--	--	--	--	--
Manganese II, field	mg/l	--	252	--	--	175	--	--	--	368	--	--	--	--	64	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l	--	< 0.100 U	--	0.143 B	< 0.100 U	0.102	< 0.100 U	< 0.100 U	--	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--	< 0.100 U	--	--	< 0.100 U J3	--
Nitrogen, nitrate + nitrite, as N	mg/l	--	--	--	--	--	0.679	< 0.100 U	< 0.100 U	--	--	< 0.100 U	< 0.100 U	< 0.100 U	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	--	< 1.00 U T8	< 1.00 U	--	< 1.00 U	0.272	< 1.00 U	--	< 1.00 U	--	--	< 0.100 U	--	< 1.00 U	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, total kjeldahl (TKN)	mg/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, field	pH units	7.63	7.74	7.49	7.80	8.45	6.23	7.16	8.56	--	7.55	7.52	7.70	7.94	8.06	7.16	7.17	7.35	7.4	7.72	7.45
Redox (oxidation potential), field	mV	-161	-176	-166	-43	72	-45	-72	-329	--	-172	-45	-59	-199	-43	-155	-194	-163	-98	-210	192
Solids, total dissolved	mg/l	--	545	--	229	207	365	339 B	339	--	--	209	206	171	210	--	433	--	--	460	--
Solids, total suspended	mg/l	--	--	--	--	--	125	22.5	37.8	--	--	63.3	60.4	< 4.00 U	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm	895	953	910	400	404	621	626	575	--	685	413	390	368	411	720	743	690	653	822	786
Sulfate, as SO4	mg/l	--	18.0 18.8	18.0	12.0	35.2 12.5	18.4	24.6 24.7	18.9	23.7	--	10.7	11.5 J6	5.78 6.72	9.38 10.3	--	17.3	--	--	20.4 J6	--
Sulfide, as S^{2-}	mg/l	--	0.19	--	--	0.10	--	--	--	0.08	--	--	--	--	0.54	--	--	--	--	--	--
Temperature, field	deg C	9.2	10.1	9.6	11.9	11.5	12.2	11.4	10.2	--	10.6	12.0	12.0	7.7	12.1	9.9	4.0	10.2	9.7	9.6	9.6
Turbidity, field	NTU	2	1	0.8	12.3	8	43.1	207	15.5	--	60.3	50.0	27.2	4.9	19	0.8	3.0	1.9	2.3	1.3	0.8
Dissolved Metals																					
Arsenic	ug/l	--	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	--	< 2.00 U	< 2.00 U	< 2.00 UF1	< 2.00 U	--	< 2.00 U	--	--	< 2.00 U	--
Boron	ug/l	--	< 200 U	--	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	--	--	< 200 U	< 200 U	< 200 U F1	< 200 U	--	< 200 U	--	--	< 200 U	--
Cadmium	ug/l	--	--	--	--	--	< 2.00 U	< 2.00 U	< 2.00 U	--	--	< 2.00 U	< 2.00 U	< 2.00 U F1	--	--	--	--	--	--	--
Calcium	mg/l	--	128	--	51.8	51.6	86.1	78.7	75.8	--	--	45.4 O1	47.0	41.8 F1 44.2 F1	49.7	--	97.6	--	--	120 V	--
Chromium	ug/l	--	< 4.00 U	--	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	6.46	--	--	< 4.00 U	4.84	< 4.00 UF1	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--
Copper	ug/l	--	--	--	--	--	< 10.0 U	< 10.0 U	< 10.0 U	--	--	< 10.0 U	< 10.0 U	< 10.0 U F1	--	--	--	--	--	--	--
Iron	ug/l	--	2360	--	395	400	438	< 100 U	< 100 U	--	--	< 100 U	< 100 U	< 100 U F1	1410	--	2170	--	--	1370	--
Lead	ug/l	--	--	--	--	--	< 10.0 U	< 10.0 U	< 10.0 U	--	--	< 10.0 U	< 10.0 U	< 10.0 U F1	--	--	--	--	--	--	--
Magnesium	mg/l	--	50.1	--	19.5	21	31.5	29.4	26.9	--	--	17.8	19.9	14.4 F1 15.3 F1	19.1	--	35.9	--	--	40.8	--
Manganese	ug/l	--	--	--	--	--	768	240	84.3	--	--	193 O1	170	114 F1	--	--	--	--	--	--	--
Mercury	ug/l	--	--	--	--	--	< 0.200 U	< 0.200 U	< 0.200 U	--	--	< 0.200 U	0.348	< 0.200 U F1	--	--	--	--	--	--	--
Potassium	mg/l	--	2.14	--	1.31	1.39	3.16	2.60 B	3.02	--	--	1.56	1.77	1.03 F1 1.20 F1	1.36	--	1.64	--	--	1.97	--
Sodium	mg/l	--	4.54	--	4.69	4.79	4.11	3.87	3.58	--	--	2.87	3.05	2.01 F1 2.41 F1	2.58	--	4.42	--	--	5.3	--
Zinc	ug/l	--	< 10.0 U	--	16.9	< 10.0 U	46.6	< 10.0 U	42.3	--	--	< 10.0 U	43.8	17.1 F1	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--

Table A2
2023-2024 Groundwater Data for Upper Outwash/Shallow Wells
Elk River Landfill
Elk River, Minnesota

Location		22-OWA	22-OWA	301-OWA	301-OWA	302-OWA	302-OWA	P-303C	P-303C	P-303C		P-310C	P-310C	P-311C	P-311C	312-OWA	312-OWA	336-OWA	336-OWA	337-OWA	337-OWA
Date		7/18/2023	7/26/2024	7/19/2023	7/26/2024	7/19/2023	7/26/2024	7/19/2023	9/19/2024	10/16/2024		7/19/2023	7/26/2024	7/19/2023	7/25/2024	7/19/2023	7/25/2024	7/18/2023	7/26/2024	7/18/2023	7/25/2024
Sample Type		N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N
Parameter	Units																				
Volatile Organic Compounds																					
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U C3	< 1.00 U J3	< 1.00 U C3	< 1.00 U J3	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U J3	< 1.00 U C3	< 1.00 U J3	< 1.00 U C3
Acetone	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C5	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U C3 J3	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U C5	< 10.0 U	< 10.0 U C5	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Allyl chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	ug/l	< 1.00 U	< 1.00 U C3	< 1.00 U J3	< 1.00 U C3	< 1.00 U J3	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U J3	< 1.00 U C3	< 1.00 U J3	< 1.00 U C3
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroform	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J4	< 1.00 U J4	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U
Ethane	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U
Ethyl ether	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethylene	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	< 0.250 U J3	< 0.250 U	< 0.250 U J3	< 0.250 U	< 0.250 U J3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J3	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U J3	< 0.250 U	< 0.250 U J3	< 0.250 U
Methane	ug/l	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J3	< 10.0 U C3	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	ug/l	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3
Propylbenzene	ug/l	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3
Styrene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U
Tetrahydrofuran	ug/l	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3 J3	< 5.00 U C3	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Toluene	ug/l	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U
Vinyl chloride	ug/l	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U J4	< 0.0500 U J4	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U	< 0.0500 U
Xylene, total	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U

Table A2
2023-2024 Groundwater Data for Upper Outwash/Shallow Wells
Elk River Landfill
Elk River, Minnesota

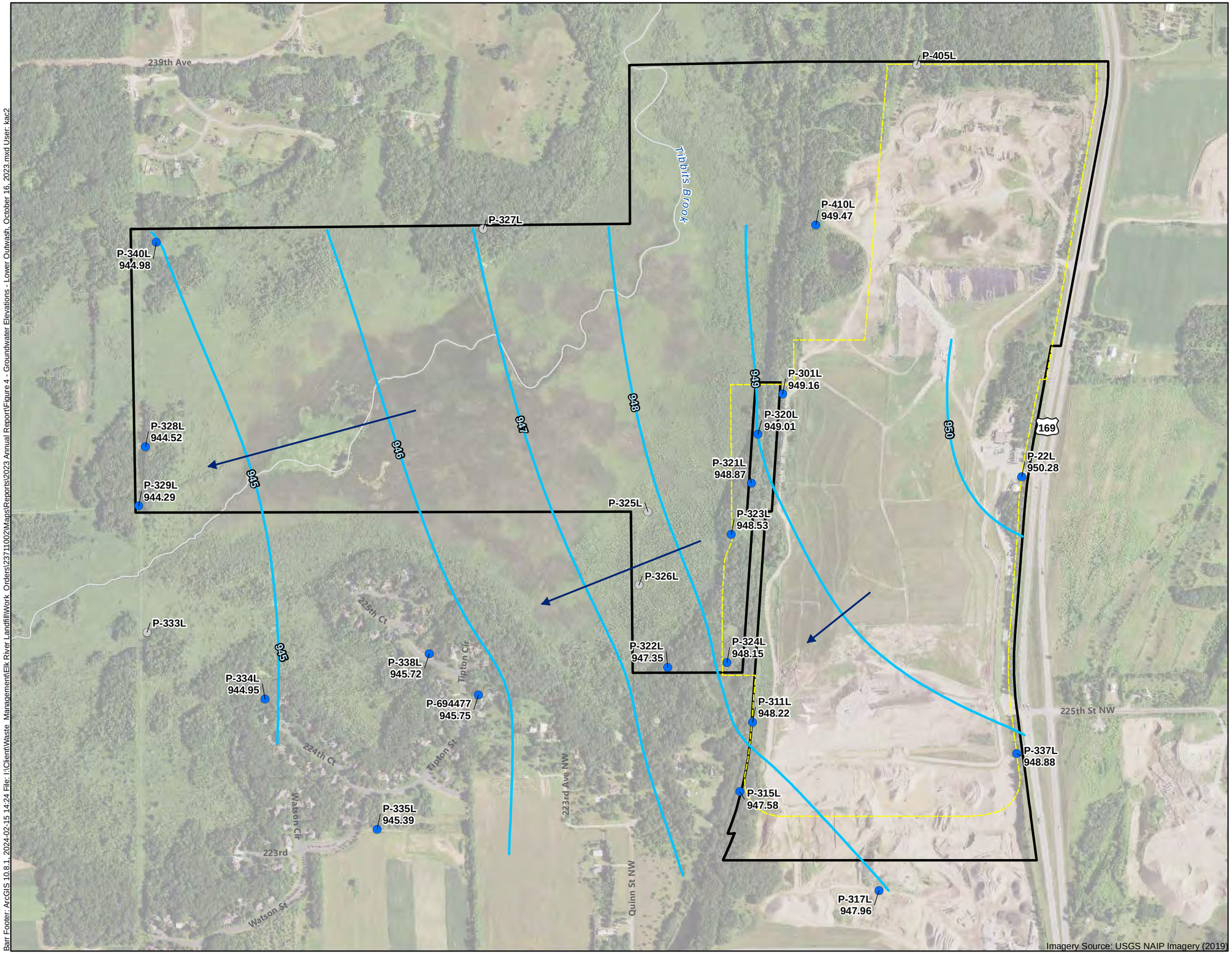
Location		22-OWA	22-OWA	301-OWA	301-OWA	302-OWA	302-OWA	P-303C	P-303C	P-303C		P-310C	P-310C	P-311C	P-311C	312-OWA	312-OWA	336-OWA	336-OWA	337-OWA	337-OWA
Date		7/18/2023	7/26/2024	7/19/2023	7/26/2024	7/19/2023	7/26/2024	7/19/2023	9/19/2024	10/16/2024		7/19/2023	7/26/2024	7/19/2023	7/25/2024	7/19/2023	7/25/2024	7/18/2023	7/26/2024	7/18/2023	7/25/2024
Sample Type		N	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N
Parameter	Units																				
General Parameters																					
Alkalinity, total, as CaCO3	mg/l	**314**	**361**	**405**	**325**	**317**	**284**	**485**	--	--	--	**636**	**691**	**322**	**285**	**269**	**245**	**173**	**195**	**641**	**621**
Anions	meq/l	**10.2**	**11.9**	**8.95**	**6.96**	**6.70**	**5.83**	**11.1**	--	--	--	**13.2**	**14.1**	**7.11**	**6.40**	**11.3**	**13.0**	**3.75**	**4.64**	**13.9**	**13.6**
Carbon, total organic	mg/l																				
Cation-Anion balance	%	**0.643**	**4.86**	**-1.40**	**1.83**	**-3.48**	**0.200**	**-0.428**	--	--	--	**-2.19**	**1.00**	**-1.89**	**1.72**	**34.7**	**3.85**	**0.108**	**5.52**	**0.879**	**3.93**
Cations	meq/l	**10.4**	**13.1**	**8.70**	**7.22**	**6.25**	**5.86**	**11.0**	--	--	--	**12.7**	**14.4**	**6.84**	**6.63**	**11.1**	**14.0**	**3.76**	**5.18**	**14.2**	**14.9**
Chloride	mg/l	**118**	**138**	**2.63**	**2.40**	**1.90**	**1.15**	**12.2**	--	--	--	**4.35**	**4.45**	**2.57**	**2.63**	**194**	**273**	**3.96**	**12.7**	**11.5**	**14.6**
Dissolved oxygen, field	mg/l	**9.7**	**5.2**	**1.1**	**0**	**1.7**	**0**	**3.2**	**0.4**	**0**	--	**0.5**	**0.8**	**5.5**	**0**	**5.8**	**6.6**	**5.8**	**7.7**	**7.0**	**0.1**
Ion Balance	%																				
Iron, ferrous, FE II, field	mg/l																				
Manganese II, field	mg/l																				
Nitrogen, ammonia, as N	mg/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--	--	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Nitrogen, nitrate, as N	mg/l																				
Nitrogen, nitrite, as N	mg/l																				
Nitrogen, nitrate + nitrite, as N	mg/l																				
Nitrogen, total kjeldahl (TKN)	mg/l																				
pH, field	pH units	**6.48**	**7.29**	**6.86**	**7.18**	**6.66**	**7.28**	**7.25**	**8.22**	**6.94**	--	**6.90**	**7.37**	**7.07**	**7.96**	**7.00**	**7.42**	**8.03**	**7.74**	**6.70**	**6.91**
Redox (oxidation potential), field	mV	**138.9**	**58**	**-28.8**	**22.4**	**-26.2**	**-28.3**	**-177.6**	**-187**	**-81.7**	--	**-184.4**	**-132**	**-156.9**	**-146.6**	**158.0**	**12.8**	**40.9**	**95**	**54.8**	**-35.1**
Solids, total dissolved	mg/l	**571**	**677**	**438**	**372**	**313**	**303**	**453**	--	--	--	**588**	**704**	**344**	**339**	**616**	**882**	**189**	**283**	**672**	**720**
Solids, total suspended	mg/l																				
Specific conductance @ 25 ºC, field	umhos/cm	**995**	**864**	**673**	**441**	**507**	**359**	**783**	**368**	**884**	--	**973**	**1232**	**533**	**387**	**1095**	**1035**	**306**	**480**	**927**	**838**
Sulfate, as SO4	mg/l	**30.6**	**38.3**	**37.9**	**19.1**	**14.8**	**5.96**	**51.8**	--	--	--	**19.4**	**8.29**	**29.2**	**30.2**	**19.7**	**19.4**	**8.51**	**18.5**	**39.2**	**36.1**
Sulfide, as S^{2-}	mg/l																				
Temperature, field	deg C	**10.8**	**10.6**	**11.4**	**11.6**	**12.1**	**10.7**	**11.5**	**12.9**	**10.8**	--	**10.8**	**11.3**	**9.6**	**9.4**	**13.9**	**12.2**	**11.9**	**12.4**	**12.4**	**10.1**
Turbidity, field	NTU	**3.9**	**5.4**	**1.6**	**6.4**	**4.95**	--	**23.3**	**2**	**4.9**	--	**28.5**	**24**	**103.0**	**14.4**	**174.0**	**21.7**	--	**6**	**145.0**	**6.9**
Dissolved Metals																					
Arsenic	ug/l	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	--	--	< 2.00 U	< 2.00 U	**3.16**	**2.99**	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U
Boron	ug/l	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	--	--	--	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U	< 200 U
Cadmium	ug/l																				
Calcium	mg/l	**123**	**151 V**	**109**	**92.0**	**75.8**	**76.9**	**127 O1 V**	--	--	--	**169**	**196**	**82.8**	**80.7**	**105**	**142**	**42.8**	**63.7**	**179**	**184**
Chromium	ug/l	< 4.00 U	**5.22**	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	--	--	--	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U
Copper	ug/l																				
Iron	ug/l	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	--	--	--	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U
Lead	ug/l																				
Magnesium	mg/l	**38.1**	**44.3**	**35.2**	**28.8**	**26.9**	**22.7**	**50.2**	--	--	--	**46.3**	**50.9**	**30**	**28.7**	**29.2**	**36.2**	**14**	**18.8**	**58.7**	**60.4**
Manganese	ug/l																				
Mercury	ug/l																				
Potassium	mg/l	**2.13**	**1.95**	**3.37**	**2.1**	**2.04**	**1.74**	**1.45**	--	--	--	**2.4**	**2.49**	**1.31**	**1.22**	**3.25**	**3.51**	**1.47**	**1.72**	**1.82**	**1.8**
Sodium	mg/l	**24.2**	**43.2**	**6.3**	**4.55**	**4.6**	**2.6**	**12.2 O1**	--	--	--	**8.27**	**8.56**	**4.78**	**4.74**	**77.6**	**89.6**	**10.1**	**9.49**	**9.39**	**11.1**
Zinc	ug/l	**26.2**	**23.2**	**10.3**	**12.6**	**14.0**	**12.8**	**16.2**	--	--	--	**10.4**	**24.0**	**10.8**	< 10.0 U	**16.6**	**11.4**	**12.2**	**26.1**	**13.8**	**14.0**

Table A2
2023-2024 Groundwater Data for Upper Outwash/Shallow Wells
Elk River Landfill
Elk River, Minnesota

Location		401-OWA	P-403C	P-403C	P-403C	408-OWA	408-OWA	408-OWA
Date		4/20/2023	4/20/2023	10/23/2023	10/16/2024	4/20/2023	10/23/2023	10/16/2024
Sample Type		N	N	N	N	N	N	N
Parameter	Units							
Volatile Organic Compounds								
1,1,1,2-Tetrachloroethane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,1,1-Trichloroethane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,1,2,2-Tetrachloroethane	ug/l	< 0.500 U	< 0.500 U	--	--	< 0.500 U	--	--
1,1,2-Trichloroethane	ug/l	< 0.750 U	< 0.750 U	--	--	< 0.750 U	--	--
1,1-Dichloroethane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,1-Dichloroethylene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,1-Dichloropropene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,2,3-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,2,3-Trichloropropane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,2,4-Trichlorobenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,2,4-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,2-Dibromo-3-chloropropane (DBCP)	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,2-Dibromoethane (EDB)	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,2-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,2-Dichloroethane	ug/l	< 0.250 U	< 0.250 U	--	--	< 0.250 U	--	--
1,2-Dichloroethylene, cis	ug/l	< 0.100 U	< 0.100 U	--	--	< 0.100 U	--	--
1,2-Dichloroethylene, trans	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,3,5-Trimethylbenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,3-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,3-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,3-Dichloropropene, cis	ug/l	< 0.500 U	< 0.500 U	--	--	< 0.500 U	--	--
1,3-Dichloropropene, trans	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
1,4-Dichlorobenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
2,2-Dichloropropane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Acetone	ug/l	< 10.0 U	< 10.0 U	--	--	< 10.0 U	--	--
Allyl chloride	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Benzene	ug/l	< 0.500 U	< 0.500 U	--	--	< 0.500 U	--	--
Bromobenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Bromochloromethane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Bromodichloromethane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Bromoform	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Bromomethane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Butylbenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Butylbenzene, sec	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Butylbenzene, tert	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Carbon tetrachloride	ug/l	< 0.250 U	< 0.250 U	--	--	< 0.250 U	--	--
Chlorobenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Chlorodibromomethane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Chloroethane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Chloroform	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Chloromethane	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Chlorotoluene, o	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Chlorotoluene, p	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Cumene (isopropyl benzene)	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Cymene p- (toluene isopropyl p-)	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Dibromomethane (methylene bromide)	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Dichlorodifluoromethane (Freon-12)	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Dichlorofluoromethane (Freon-21)	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Ethane	ug/l	--	--	--	--	--	--	--
Ethyl benzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Ethyl ether	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Ethylene	ug/l	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	< 0.250 U	< 0.250 U	--	--	< 0.250 U	--	--
Methane	ug/l	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	< 10.0 U	< 10.0 U	--	--	< 10.0 U	--	--
Methyl isobutyl ketone (MIBK)	ug/l	< 5.00 U	< 5.00 U	--	--	< 5.00 U	--	--
Methyl tertiary butyl ether (MTBE)	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Methylene chloride	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Naphthalene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Propylbenzene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Styrene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Tetrachloroethylene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Tetrahydrofuran	ug/l	< 5.00 U	< 5.00 U	--	--	< 5.00 U	--	--
Toluene	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Trichloroethylene (TCE)	ug/l	< 0.100 U	< 0.100 U	--	--	< 0.100 U	--	--
Trichlorofluoromethane (Freon-11)	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Trichlorotrifluoroethane (Freon 113)	ug/l	< 1.00 U	< 1.00 U	--	--	< 1.00 U	--	--
Vinyl chloride	ug/l	< 0.0500 U	< 0.0500 U	--	--	< 0.0500 U	--	--
Xylene, total	ug/l	< 2.00 U	< 2.00 U	--	--	< 2.00 U	--	--

Table A2
2023-2024 Groundwater Data for Upper Outwash/Shallow Wells
Elk River Landfill
Elk River, Minnesota

	Location	401-OWA	P-403C	P-403C	P-403C	408-OWA	408-OWA	408-OWA
	Date	4/20/2023	4/20/2023	10/23/2023	10/16/2024	4/20/2023	10/23/2023	10/16/2024
	Sample Type	N	N	N	N	N	N	N
Parameter	Units							
General Parameters								
Alkalinity, total, as CaCO3	mg/l	**359**	**254**	**374**	**323**	**246**	**278**	**297**
Anions	meq/l	**15.6**	**5.66**	**8.91**	**7.37**	**5.20**	**5.92**	**6.19**
Carbon, total organic	mg/l							
Cation-Anion balance	%	--	--	**-10.5**	**1.78**	--	**14.9**	**-1.05**
Cations	meq/l	**16.2**	**5.34**	**7.22**	**7.64**	**5.37**	**7.98**	**6.06**
Chloride	mg/l	**299**	**1.25 B**	**3.78**	**2.52**	**2.66**	**1.29**	**1.19**
Dissolved oxygen, field	mg/l	**9**	**1.7**	**1.5**	**1.6**	**8**	**6.2**	**2.4**
Ion Balance	%							
Iron, ferrous, FE II, field	mg/l							
Manganese II, field	mg/l							
Nitrogen, ammonia, as N	mg/l	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Nitrogen, nitrate, as N	mg/l							
Nitrogen, nitrite, as N	mg/l							
Nitrogen, nitrate + nitrite, as N	mg/l							
Nitrogen, total kjeldahl (TKN)	mg/l							
pH, field	pH units	**6.86**	**7.15**	**7.25**	**7.05**	**7.14**	**7.38**	**7.19**
Redox (oxidation potential), field	mV	**24.8**	**31**	**19**	**100**	**66.7**	**25**	**150**
Solids, total dissolved	mg/l	**932**	**270**	**421**	**379**	**282**	**281**	**298**
Solids, total suspended	mg/l							
Specific conductance @ 25 ºC, field	umhos/cm	**1560**	**442**	**746**	**702**	**475**	**518**	**520**
Sulfate, as SO4	mg/l	**10.4**	**27.7**	**63.7**	**44.3**	**13.8**	**15.8**	**12.1**
Sulfide, as S^{2-}	mg/l							
Temperature, field	deg C	**9.7**	**7.7**	**8.8**	**9**	**10.7**	**10.9**	**11.4**
Turbidity, field	NTU	**24.6**	**90.6**	**77.7**	**34**	**0.6**	**1.5**	**1**
Dissolved Metals								
Arsenic	ug/l	< 1.00 U	< 1.00 U	< 2.00 U	< 2.00 U	< 1.00 U	< 2.00 U	< 2.00 U
Boron	ug/l	< 100 U	< 100 U	< 200 U	< 200 U	< 100 U	< 200 U	< 200 U
Cadmium	ug/l							
Calcium	mg/l	**145**	**50.5**	**96.5**	**81.7**	**65.3**	**73.1**	**75.7**
Chromium	ug/l	**8.96**	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U	< 4.00 U
Copper	ug/l							
Iron	ug/l	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U	< 100 U
Lead	ug/l							
Magnesium	mg/l	**40.9**	**29.1**	**24.6**	**39.3**	**22.6**	**49.3**	**24.6**
Manganese	ug/l							
Mercury	ug/l							
Potassium	mg/l	**3.33**	**3.45**	**1.58**	**1.36**	< 1 U	**1.05**	< 1 U
Sodium	mg/l	**127**	**7.89**	**7.79**	**6.87**	**5.26**	**5.83**	**5.44**
Zinc	ug/l	< 10.0 U	< 10.0 U	**16.1**	< 10.0 U	< 10.0 U	**15.4**	< 10.0 U



Property Boundary

Groundwater Compliance Boundary

Lower Outwash Monitoring Well

Lower Outwash Monitoring Well (Not Used for Groundwater Contours)

Groundwater Contour (feet MSL)

Flow Line

N

Feet

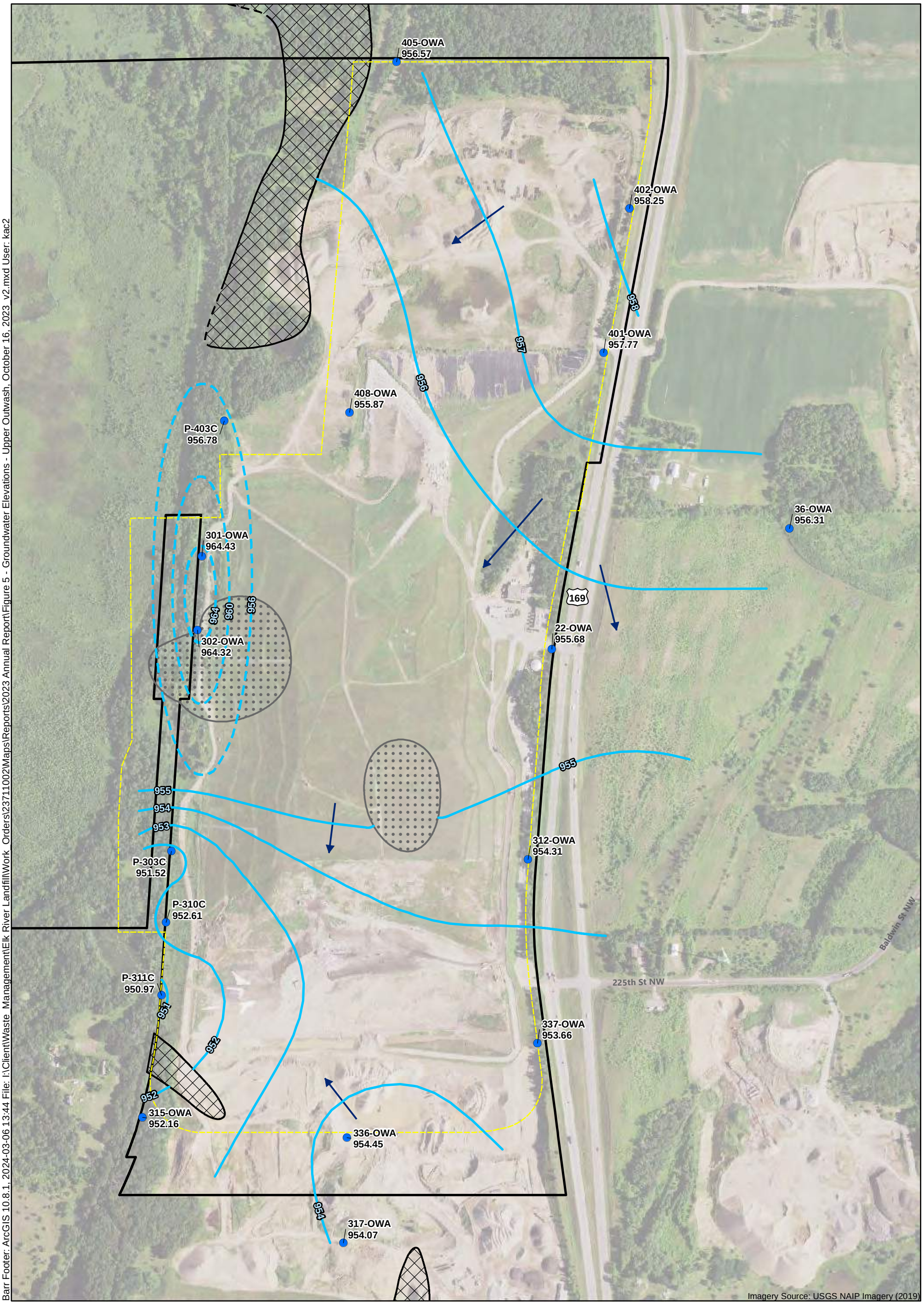
0 750 1,500

Figure 4

GROUNDWATER ELEVATIONS - LOWER OUTWASH
October 16, 2023
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.8.1, 2024-02-15 14:24 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711002\Maps\Reports\2023 Annual Report\Figure 4 - Groundwater Elevations - Lower Outwash, October 16, 2023.mxd User: kac2



Barr Footer: ArcGIS 10.8.1, 2024-03-06 13:44 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711002\Maps\Reports\2023 Annual Report\Figure 5 - Groundwater Elevations - Upper Outwash, October 16, 2023 v2.mxd User: kac2

Property Boundary

Groundwater Compliance Boundary

Upper Outwash Monitoring Well

Groundwater Contour (feet MSL)

Flow Line

Till Ridge Delineation

Saturated Upper Outwash Not Present Due to Local Till High

Note: Contour Interval expanded to four feet to represent apparent mounding at 301-OWA and 302-OWA.

N

Feet

0 500 1,000

Figure 5

GROUNDWATER ELEVATIONS - UPPER OUTWASH
October 16, 2023
Elk River Landfill
Elk River, Minnesota

BARR

Appendix B

Hydrographs

Upper OW

Well Location
- 22−OWA
- 301−OWA
- 302−OWA
- 312−OWA
- 315−OWA
- 317−OWA
- 336−OWA
- 337−OWA
- 401−OWA
- 402−OWA
- 405−OWA
- 408−OWA
- P−303C
- P−310C
- P−311C
- P−403C

Groundwater Elevation (feet NGVD)

965
960
955
950

2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025

Lower OW

Well Location
- P−17C
- P−301C
- P−302C
- P−304C
- P−305C
- P−308C
- P−309C
- P−313C
- P−314C
- P−320C
- P320C2

Groundwater Elevation (feet NGVD)

958
955
952
950
948

2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

Lower Outwash, L−Series

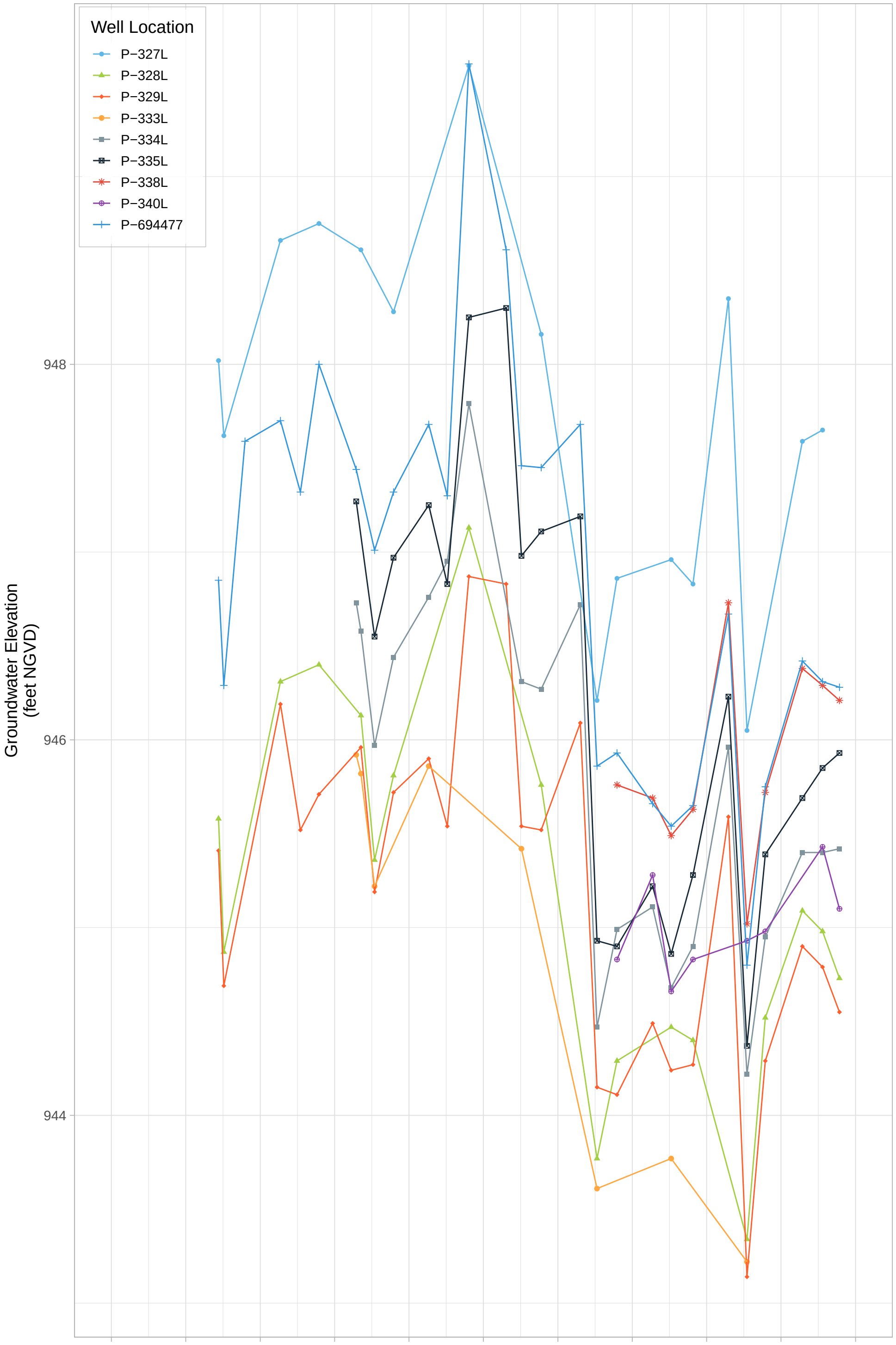
Well Location
- P−22L
- P−29C
- P−301L
- P−308L
- P−311L
- P−315L
- P−317L
- P−320L
- P−321L
- P−322L
- P−323L
- P−324L
- P−325L
- P−326L
- P−337L

Groundwater Elevation (feet NGVD)

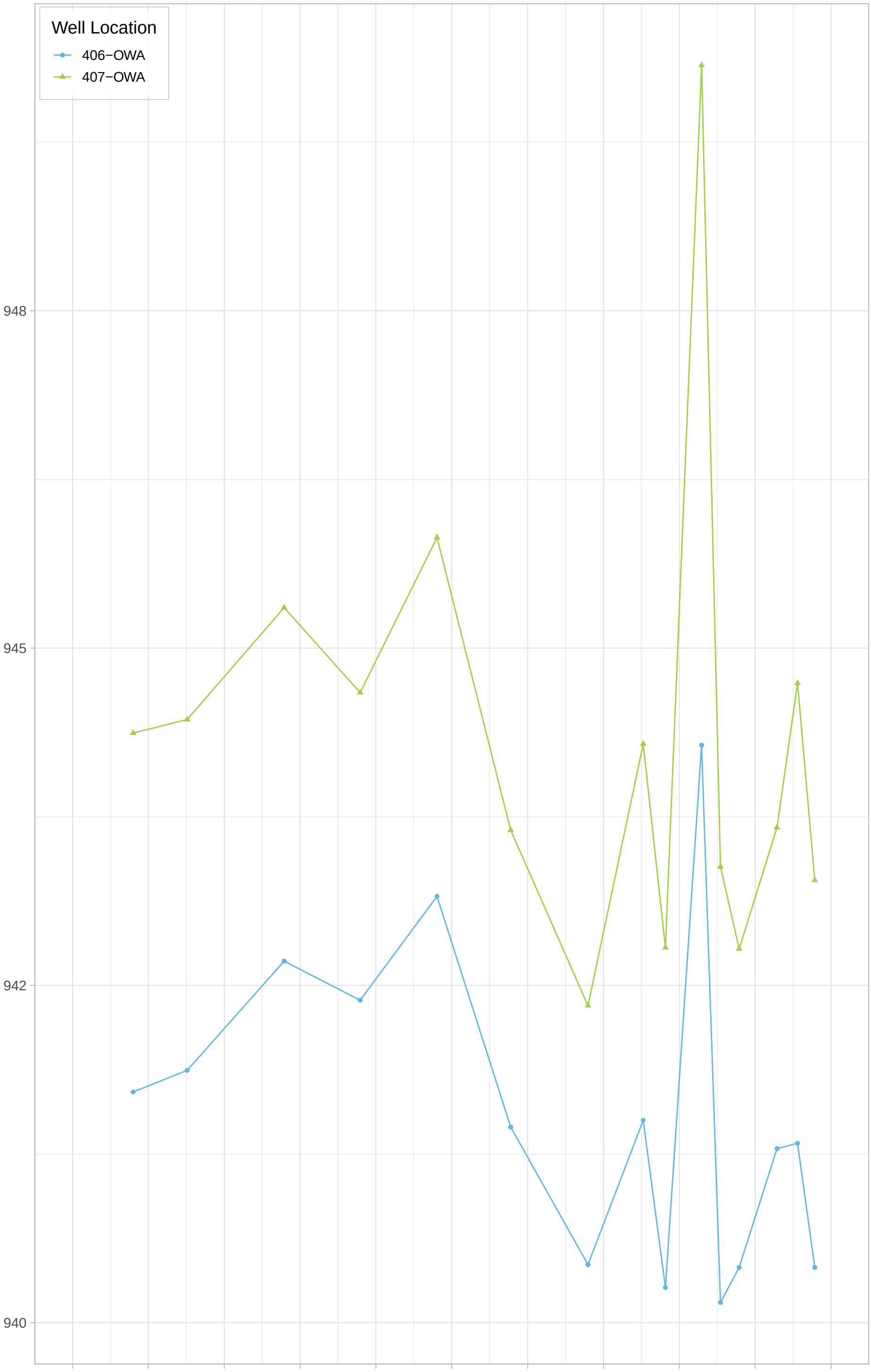
954
952
950
948

2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

Distall Wells



Surficial Outwash



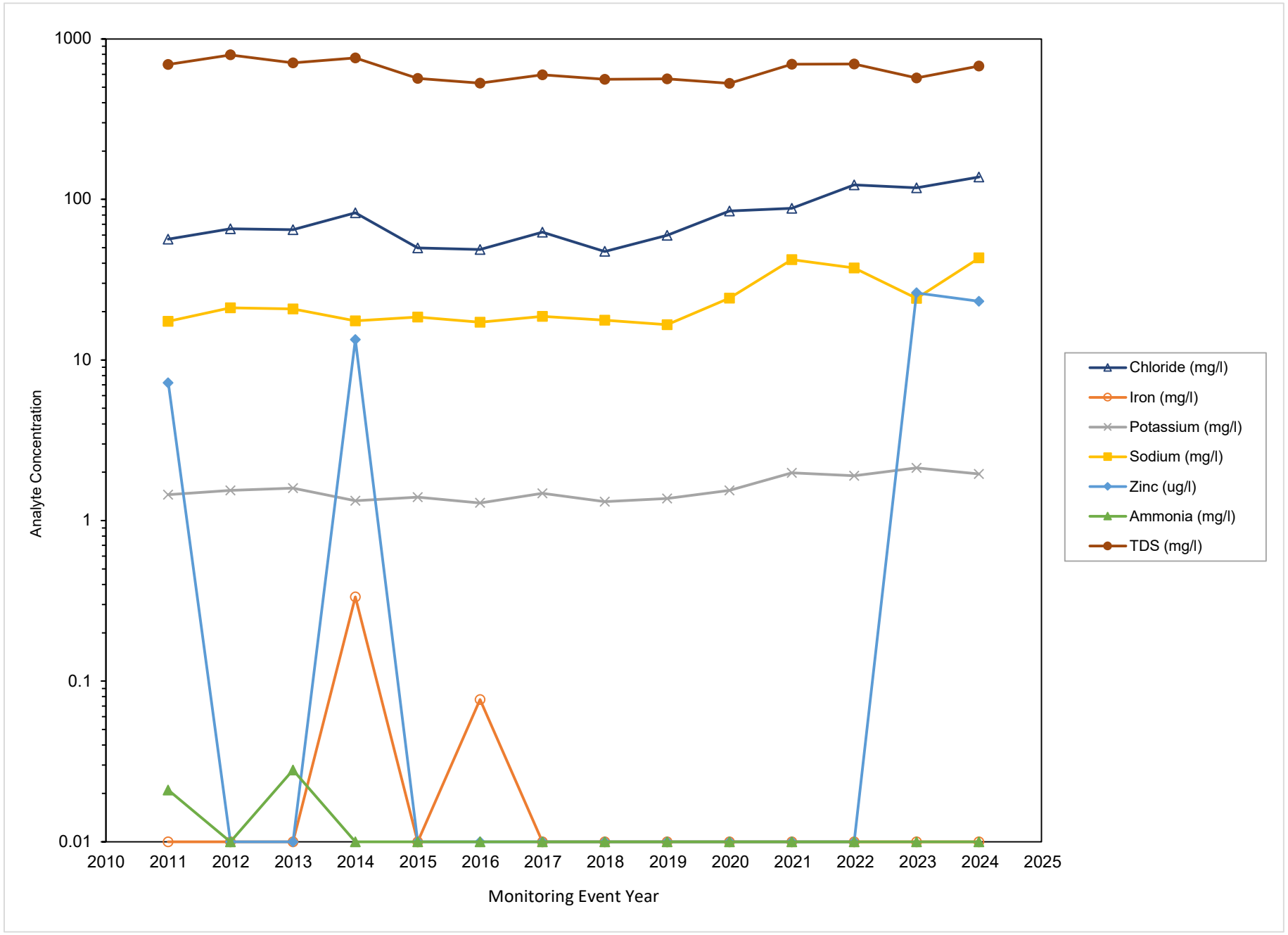
Bedrock Wells



Appendix C

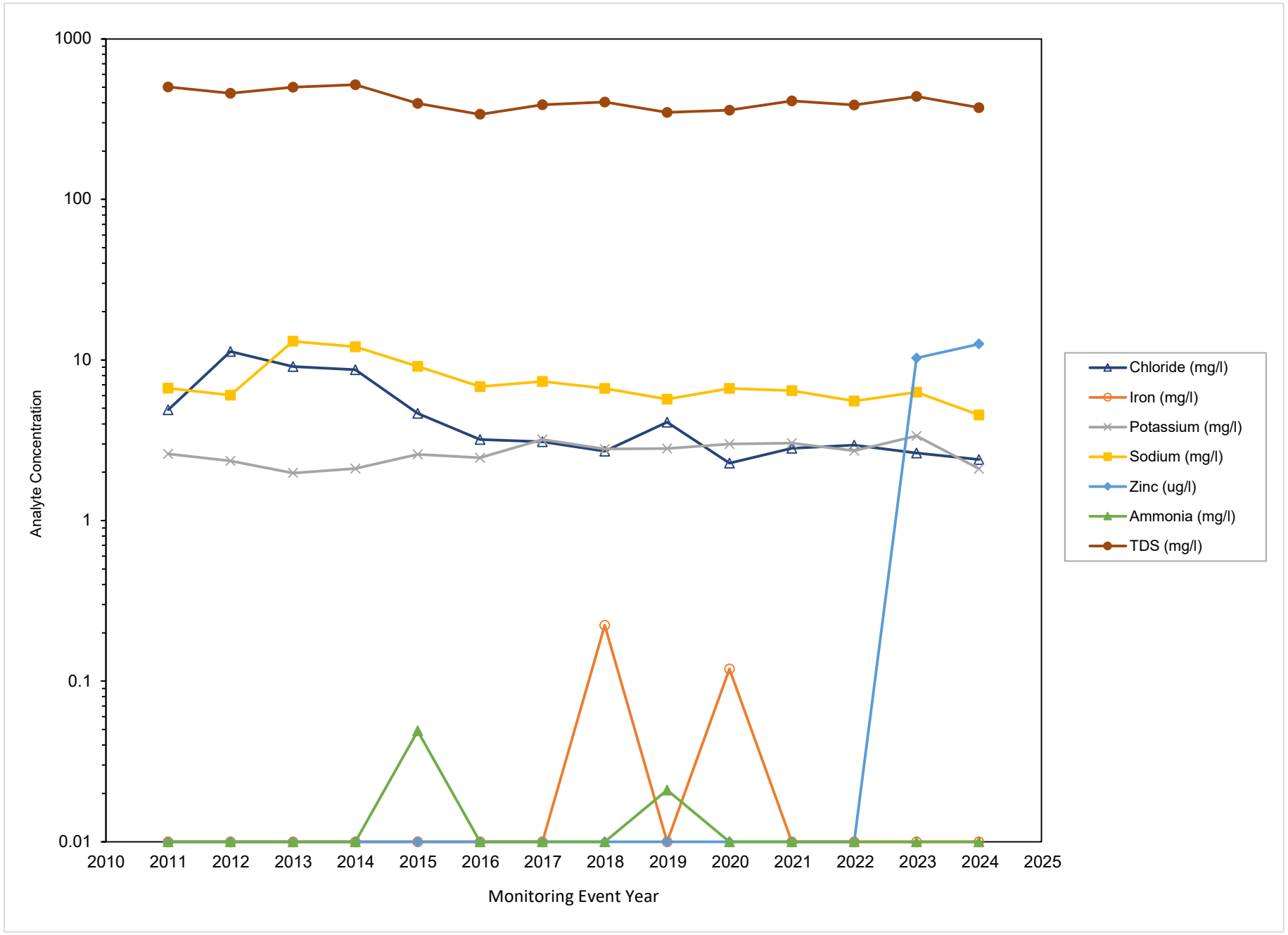
Inorganic Leachate Indicator Trends

22-OWA Leachate Indicator Trends

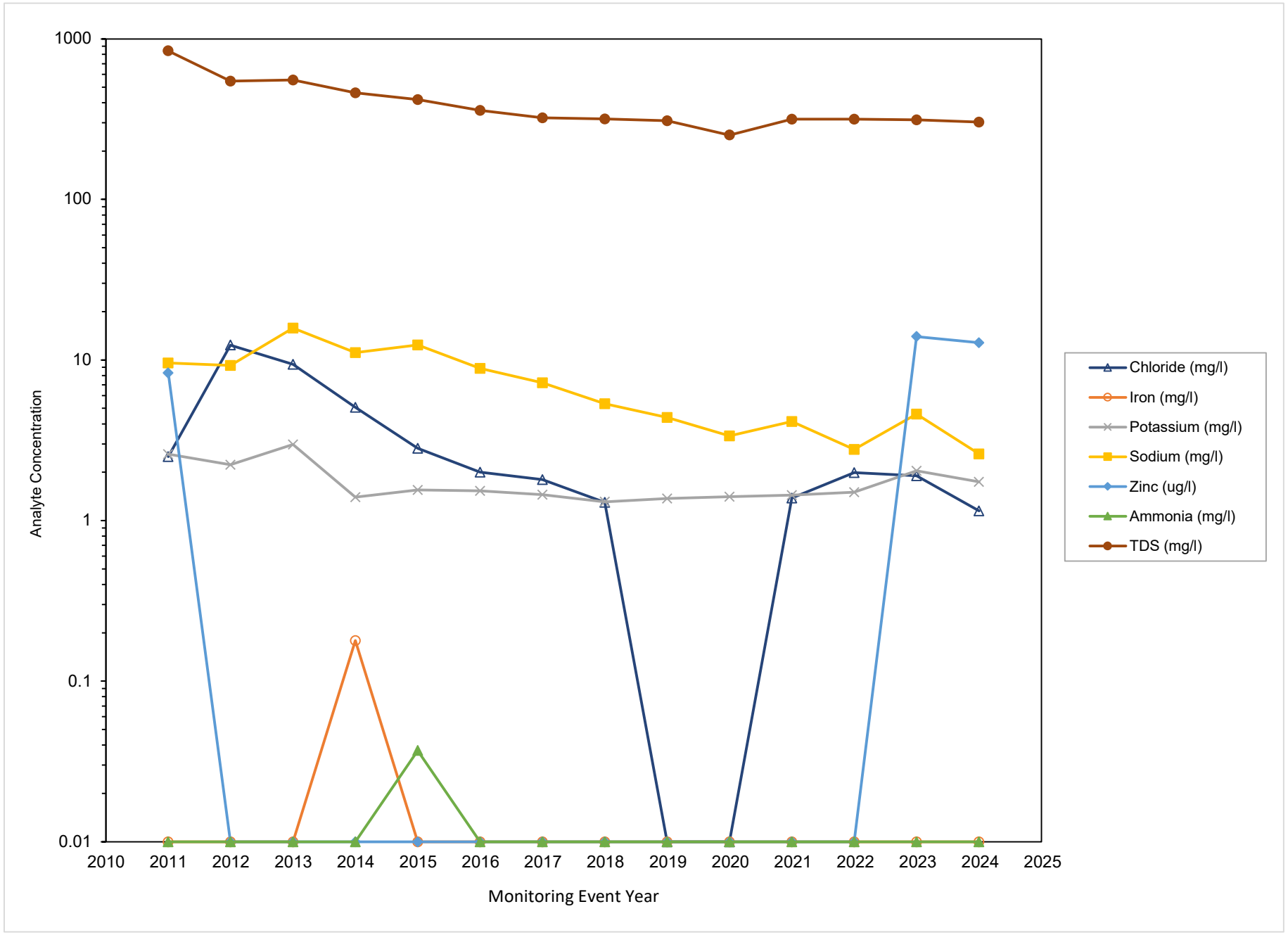


\\barr.com\projects\Mpls\23 MN\71\23711002 EMS Administration Elk River Landfill\2024\WorkFiles\MPCA GW Reports\Annual\Appendix C - LITs\2024_Leachate_Indicator_Plots.xlsx

301-OWA Leachate Indicator Trends

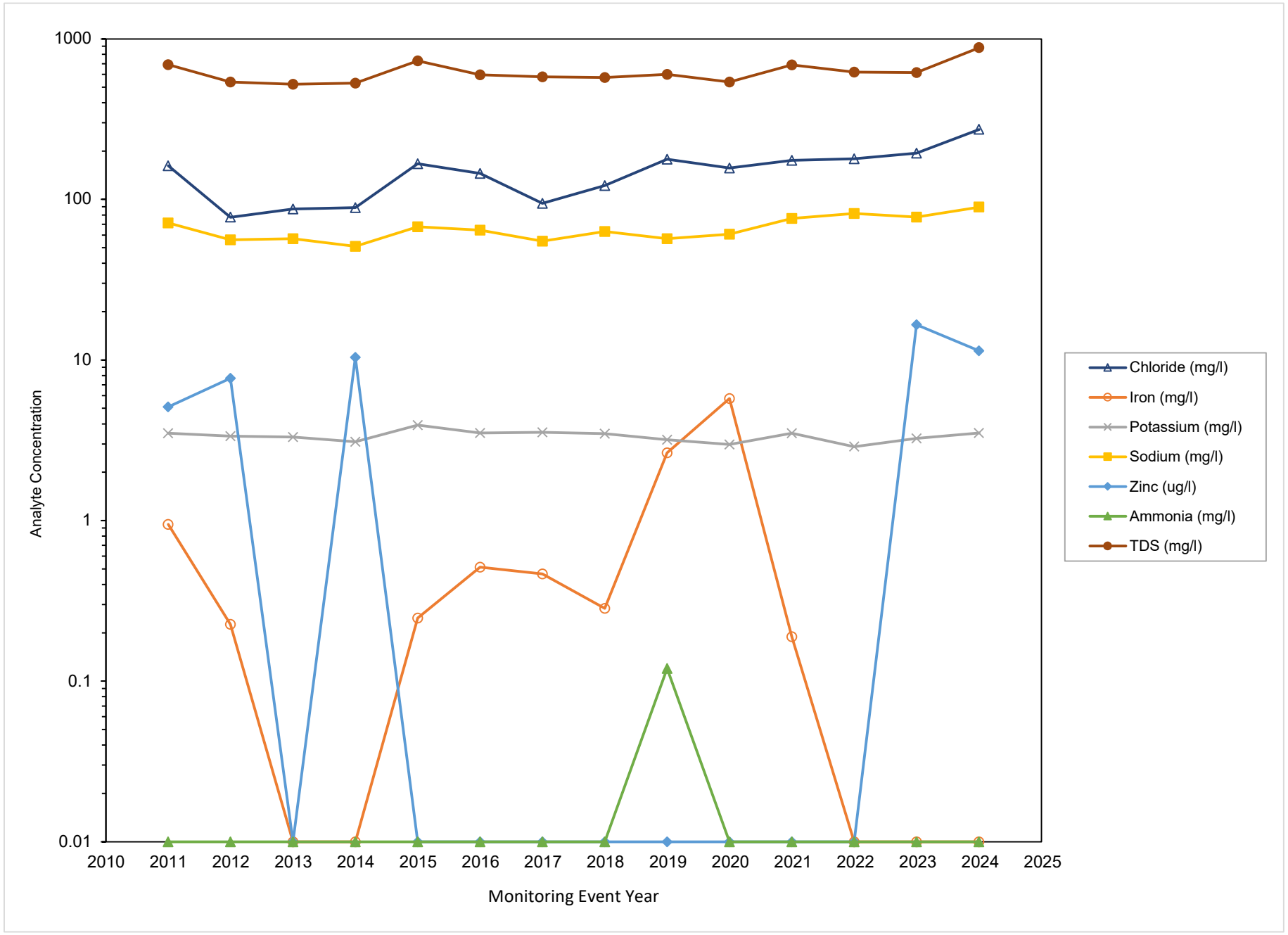


302-OWA Leachate Indicator Trends

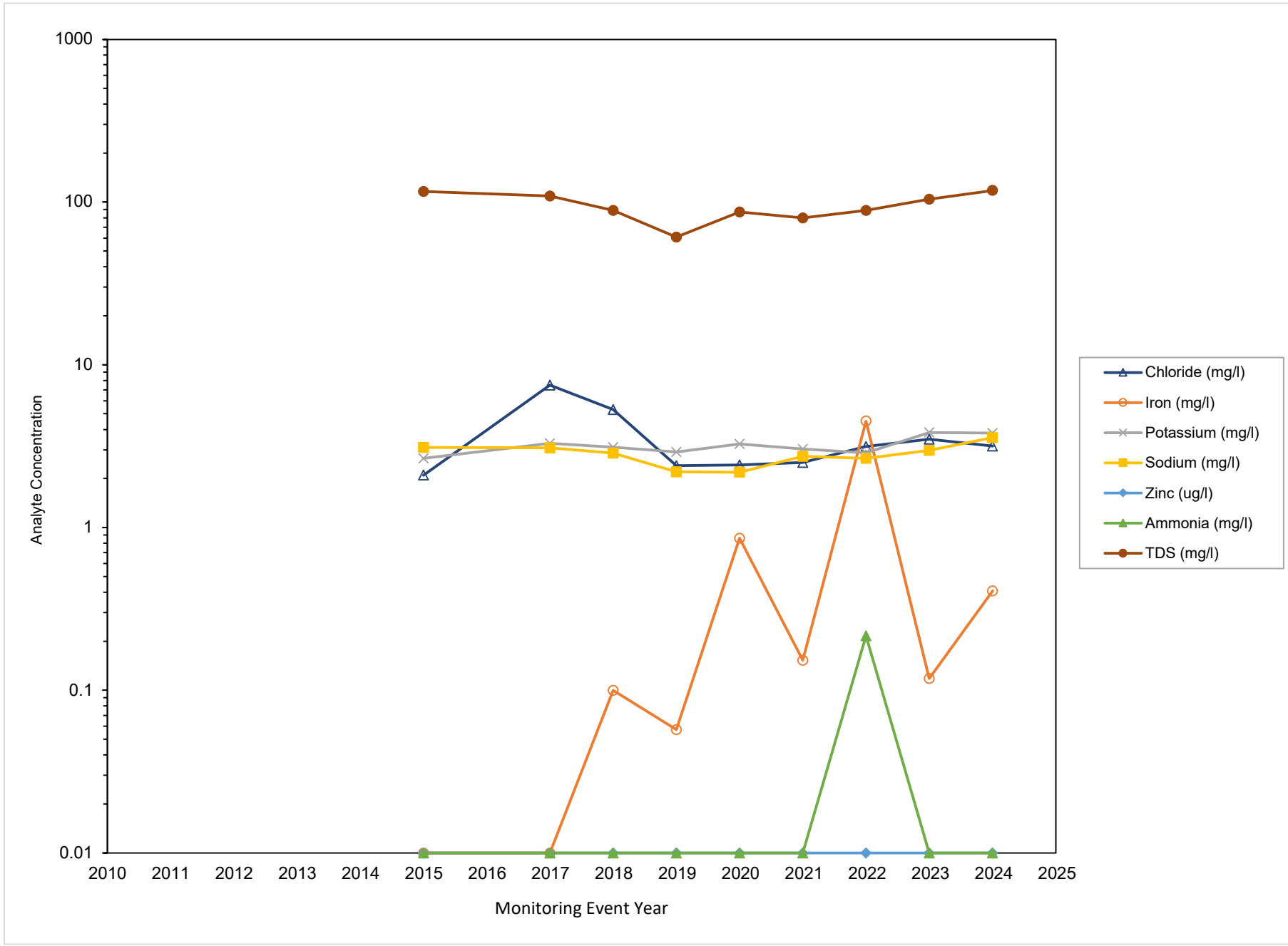


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312-OWA Leachate Indicator Trends

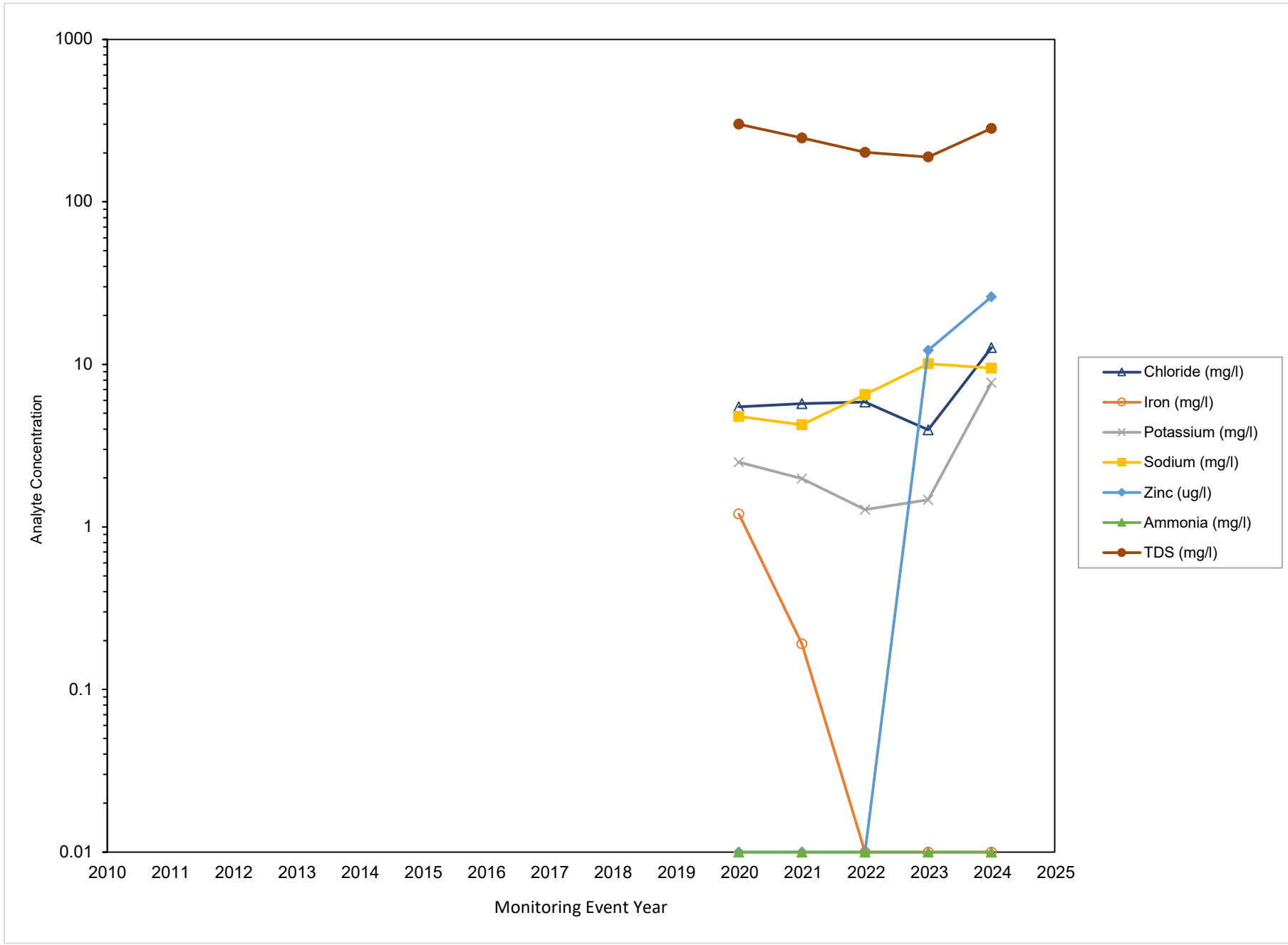


315-OWA Leachate Indicator Trends

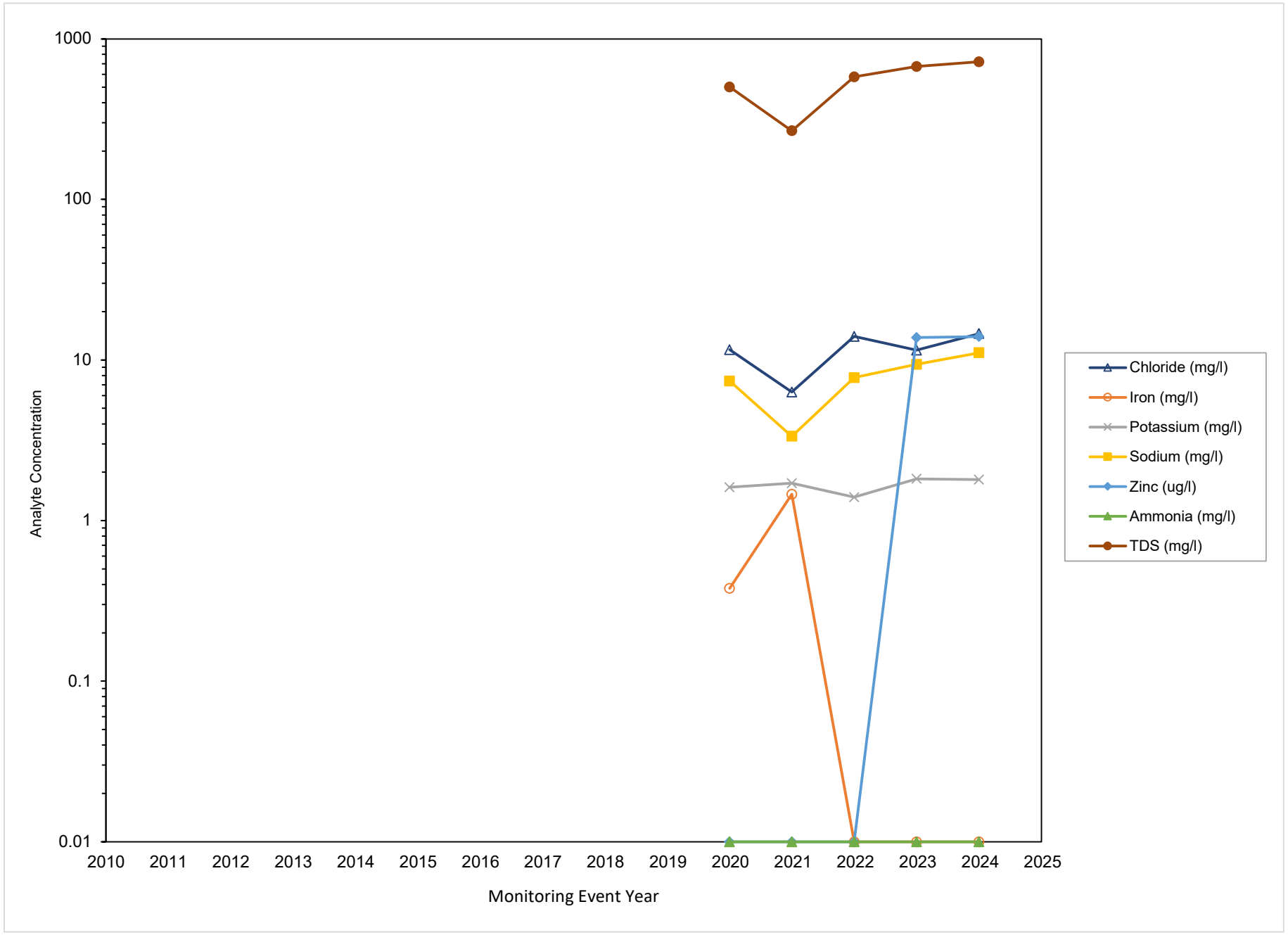


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336-OWA Leachate Indicator Trends

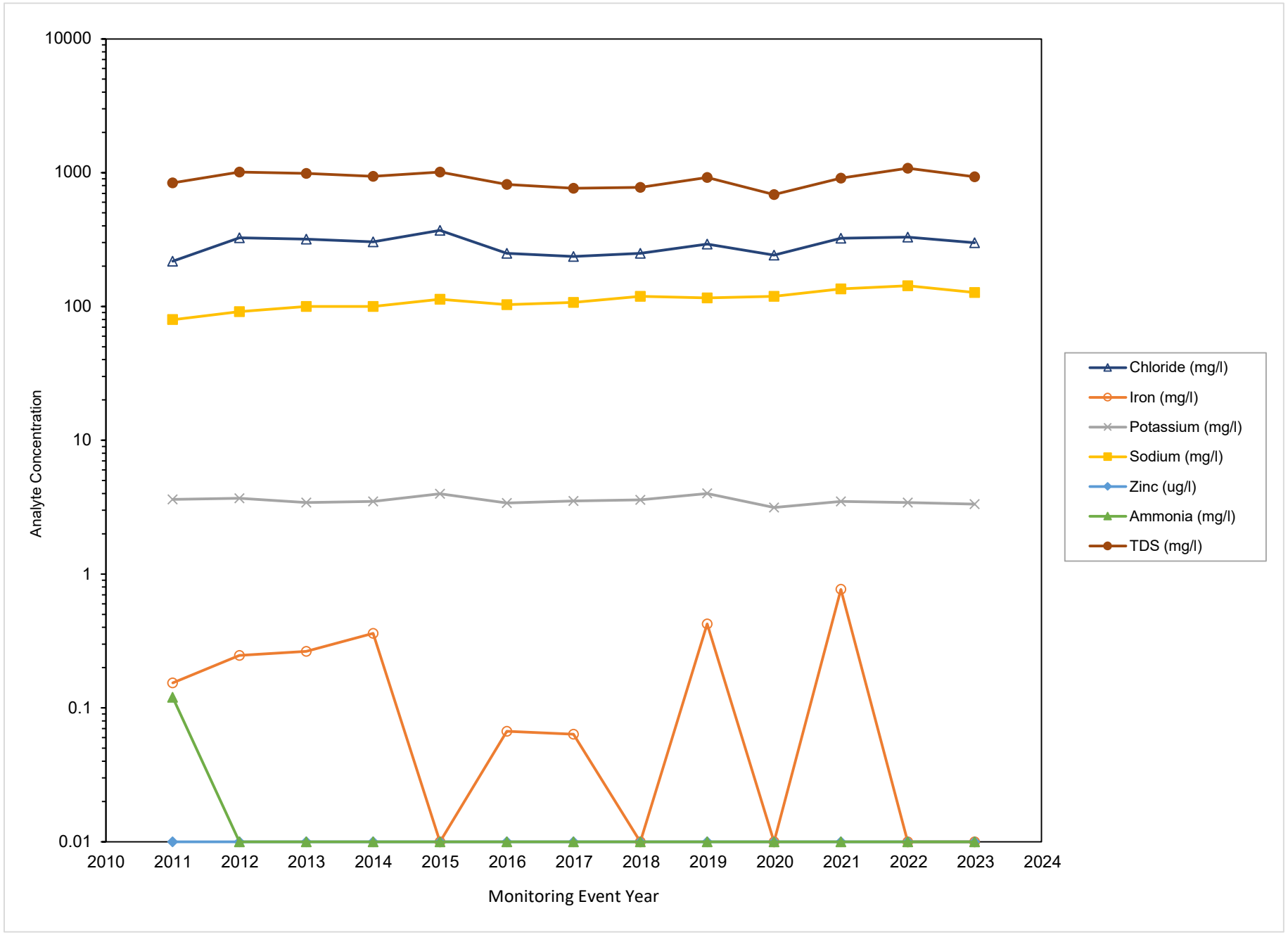


337-OWA Leachate Indicator Trends

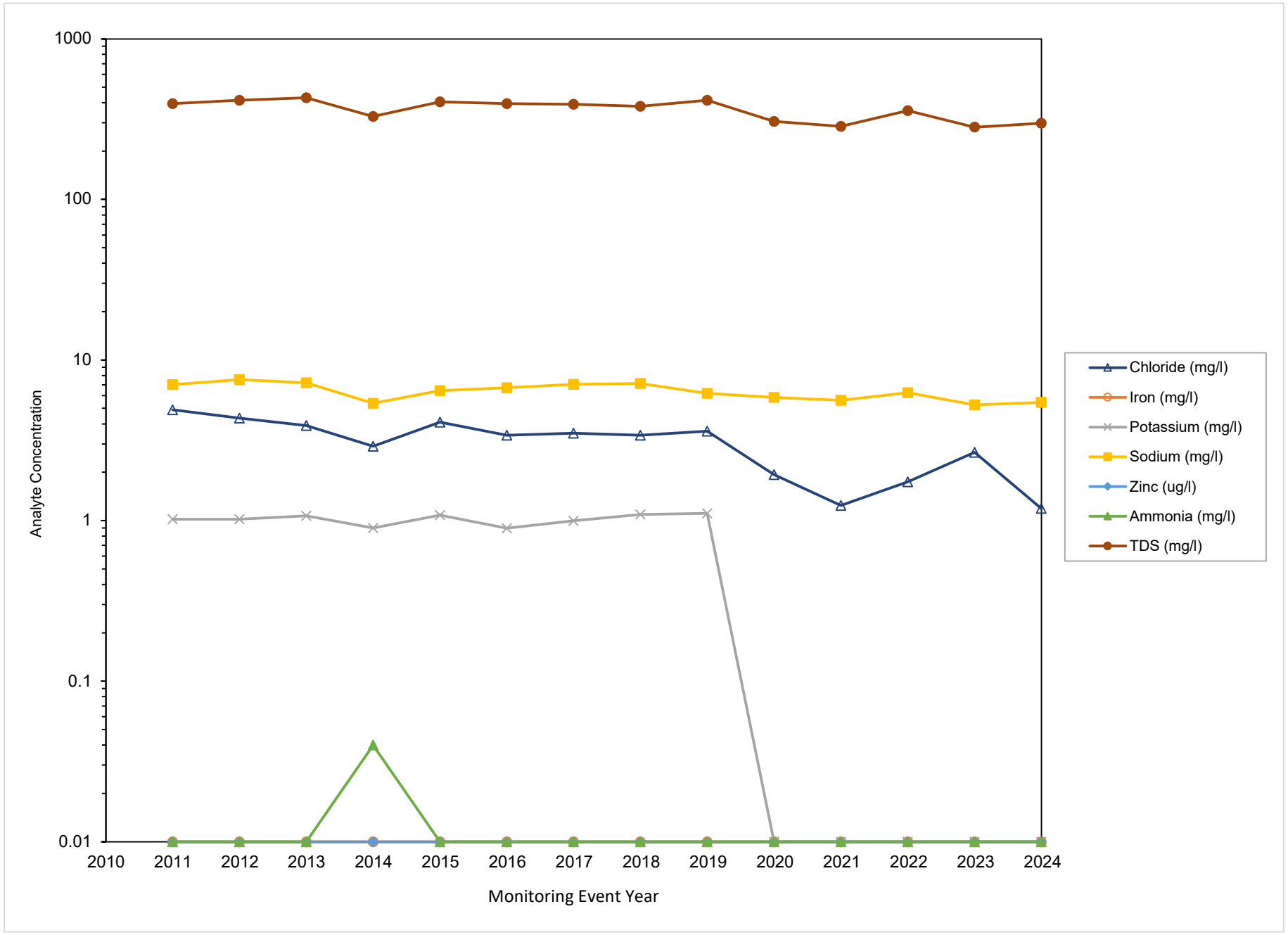


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401-OWA Leachate Indicator Trends

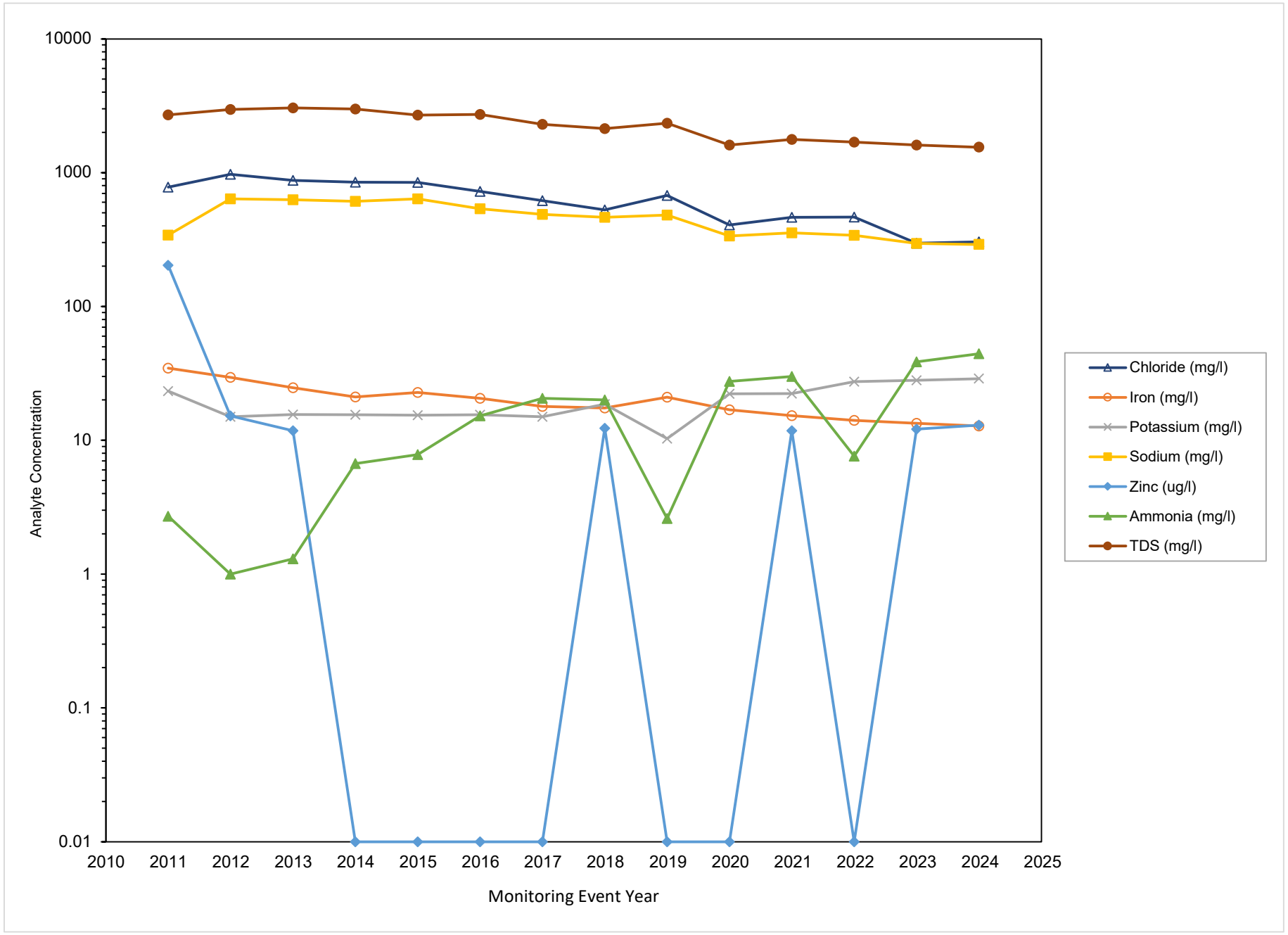


408-OWA Leachate Indicator Trends

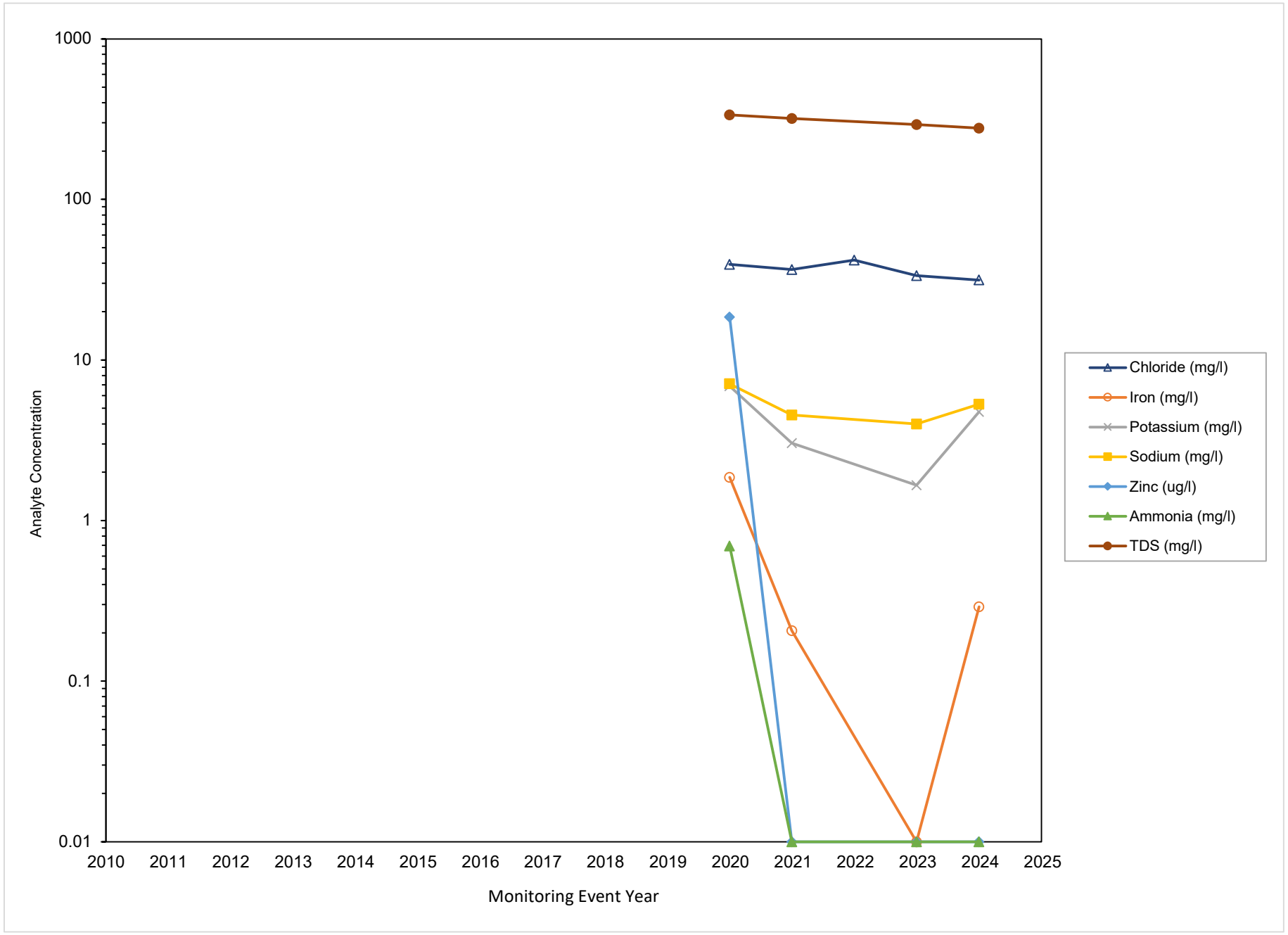


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P-17C Leachate Indicator Trends

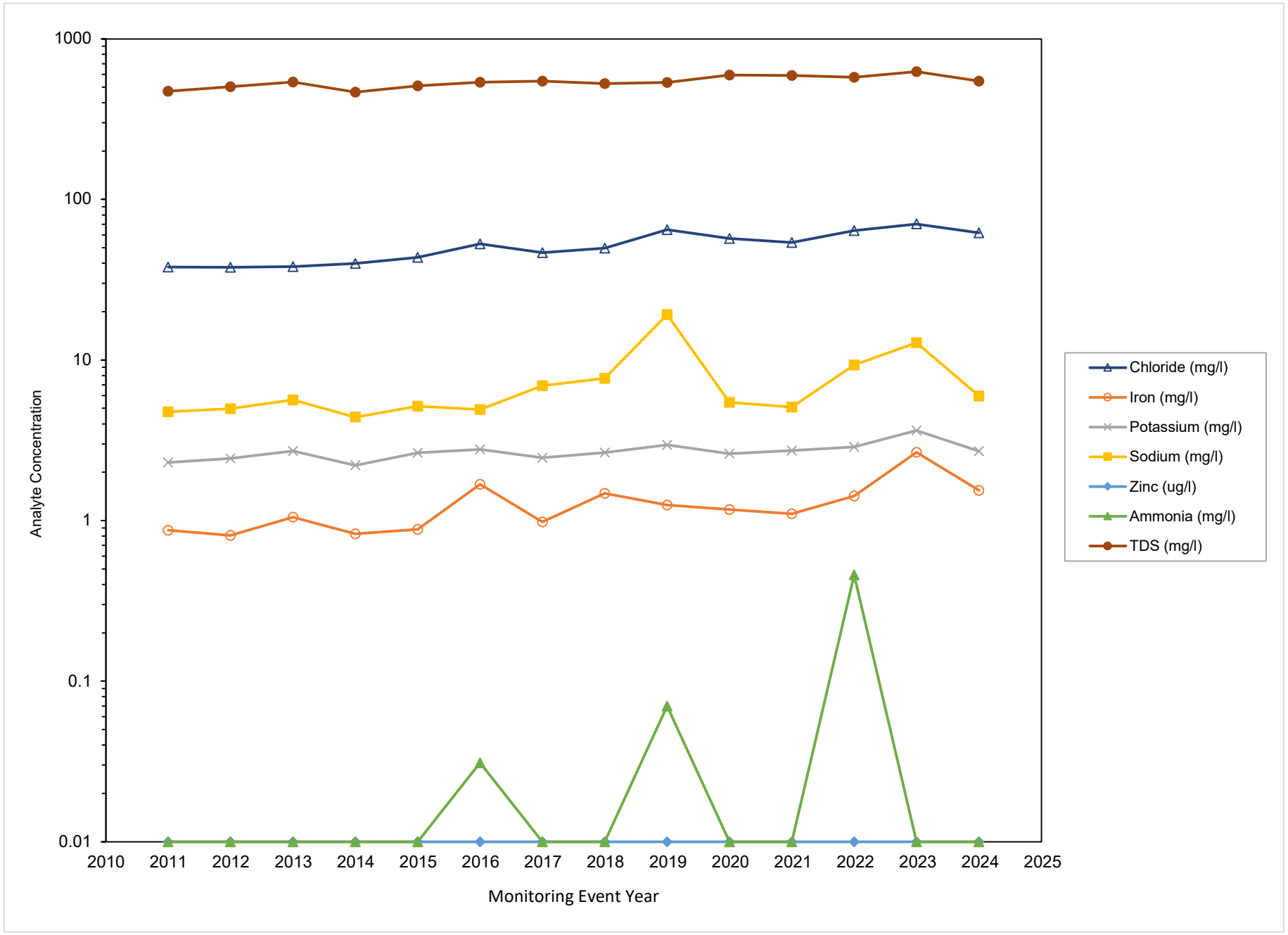


P-22L Leachate Indicator Trends



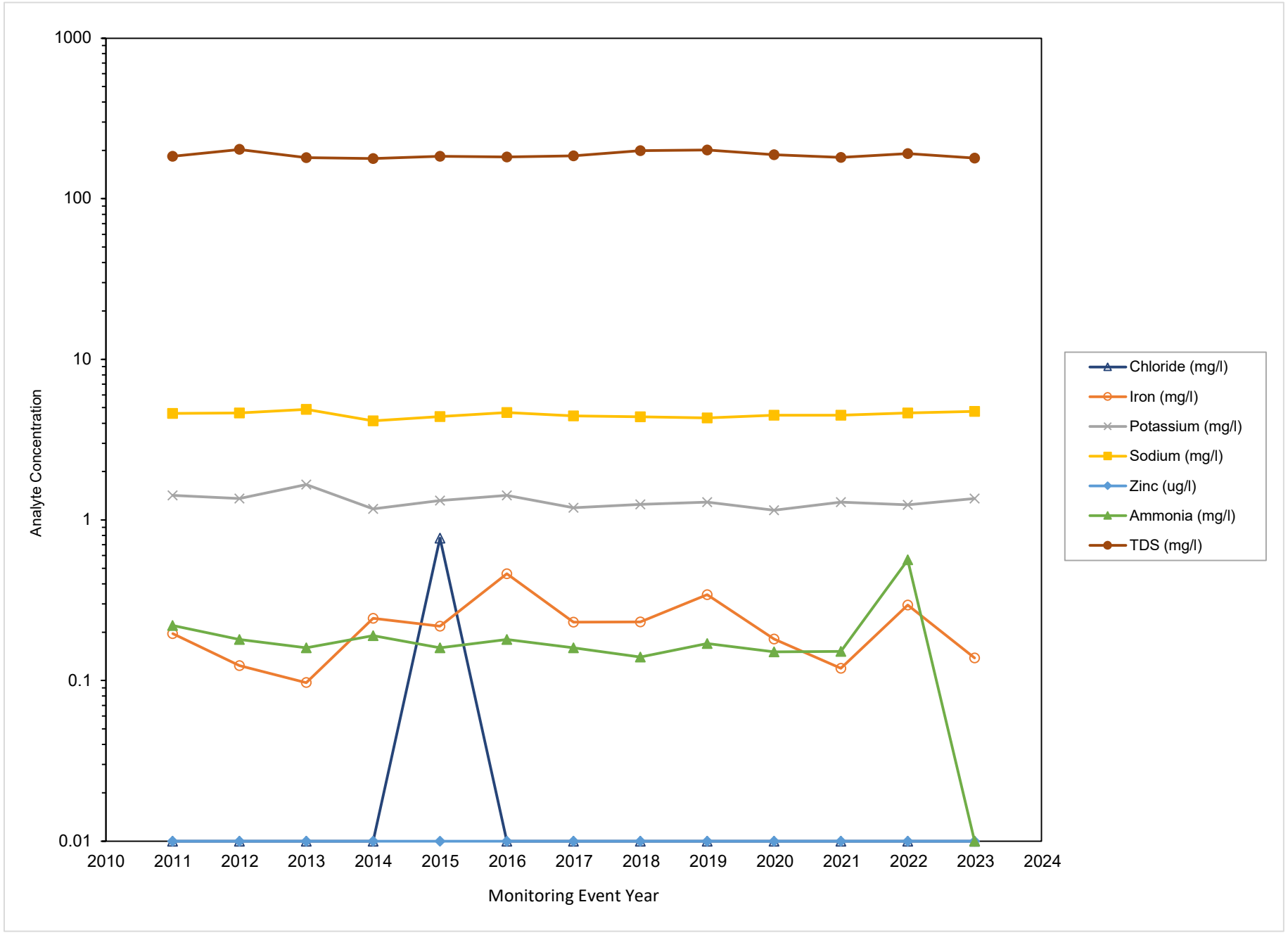
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P-29C Leachate Indicator Trends



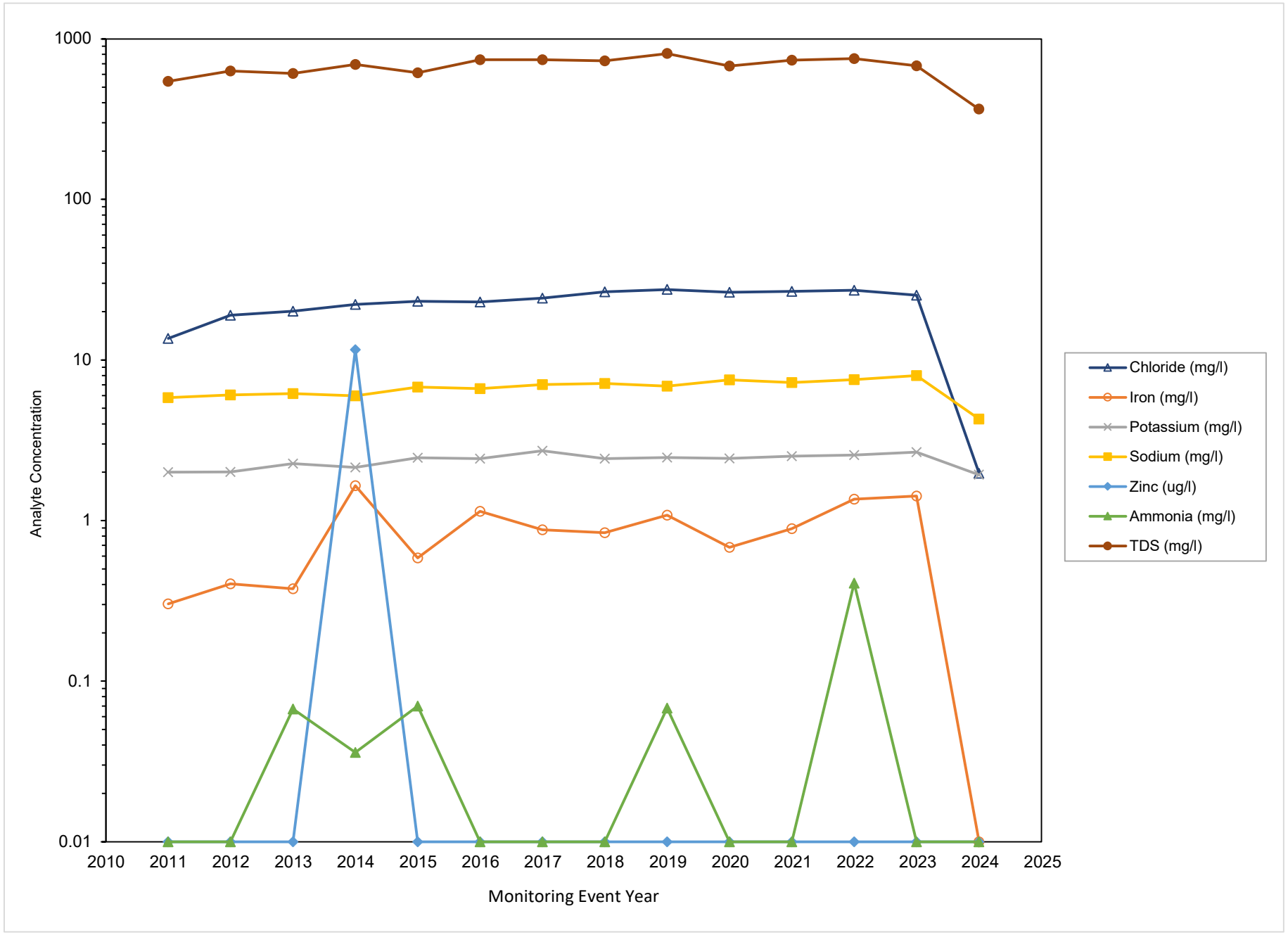
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P-29D Leachate Indicator Trends

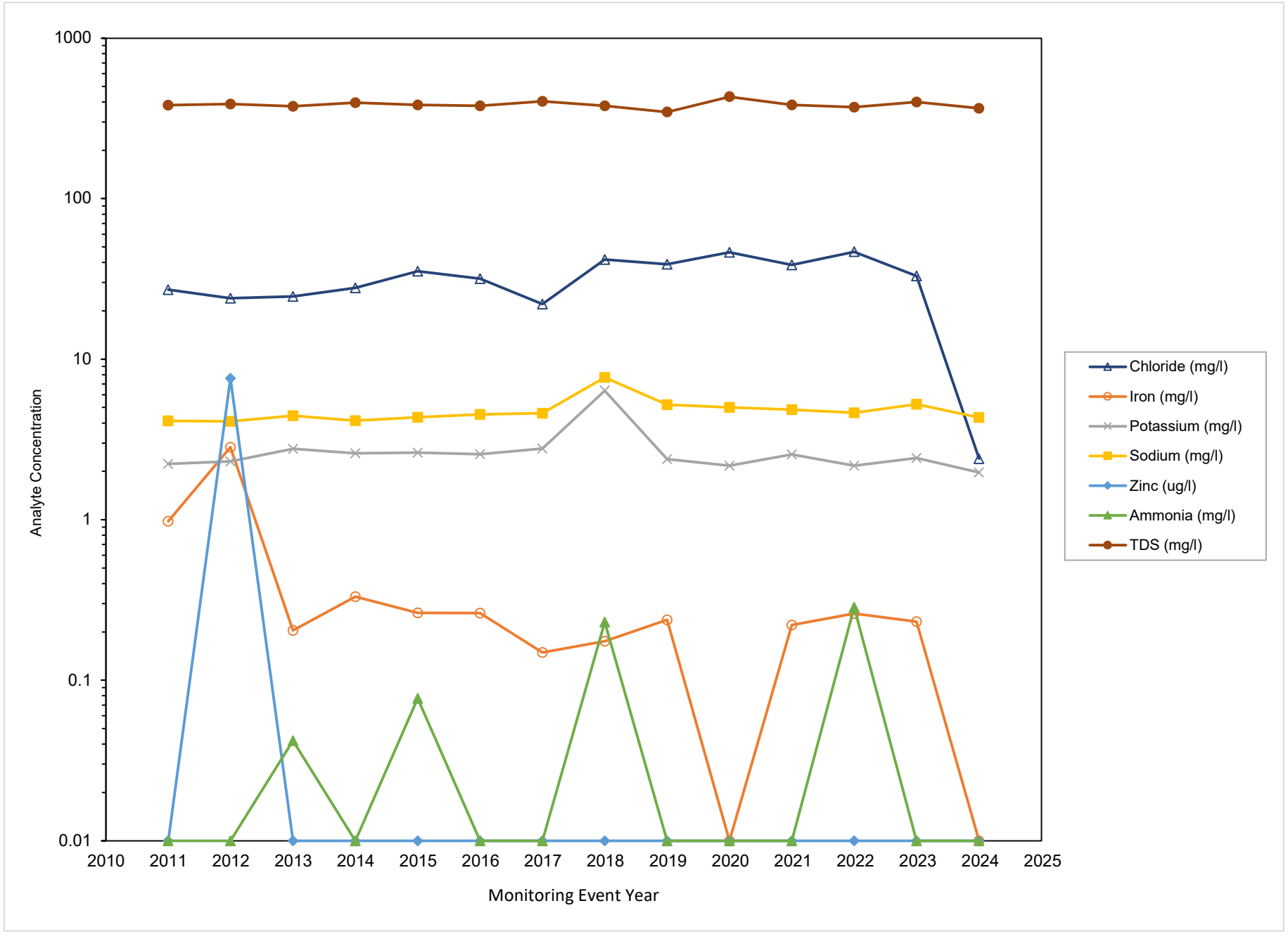


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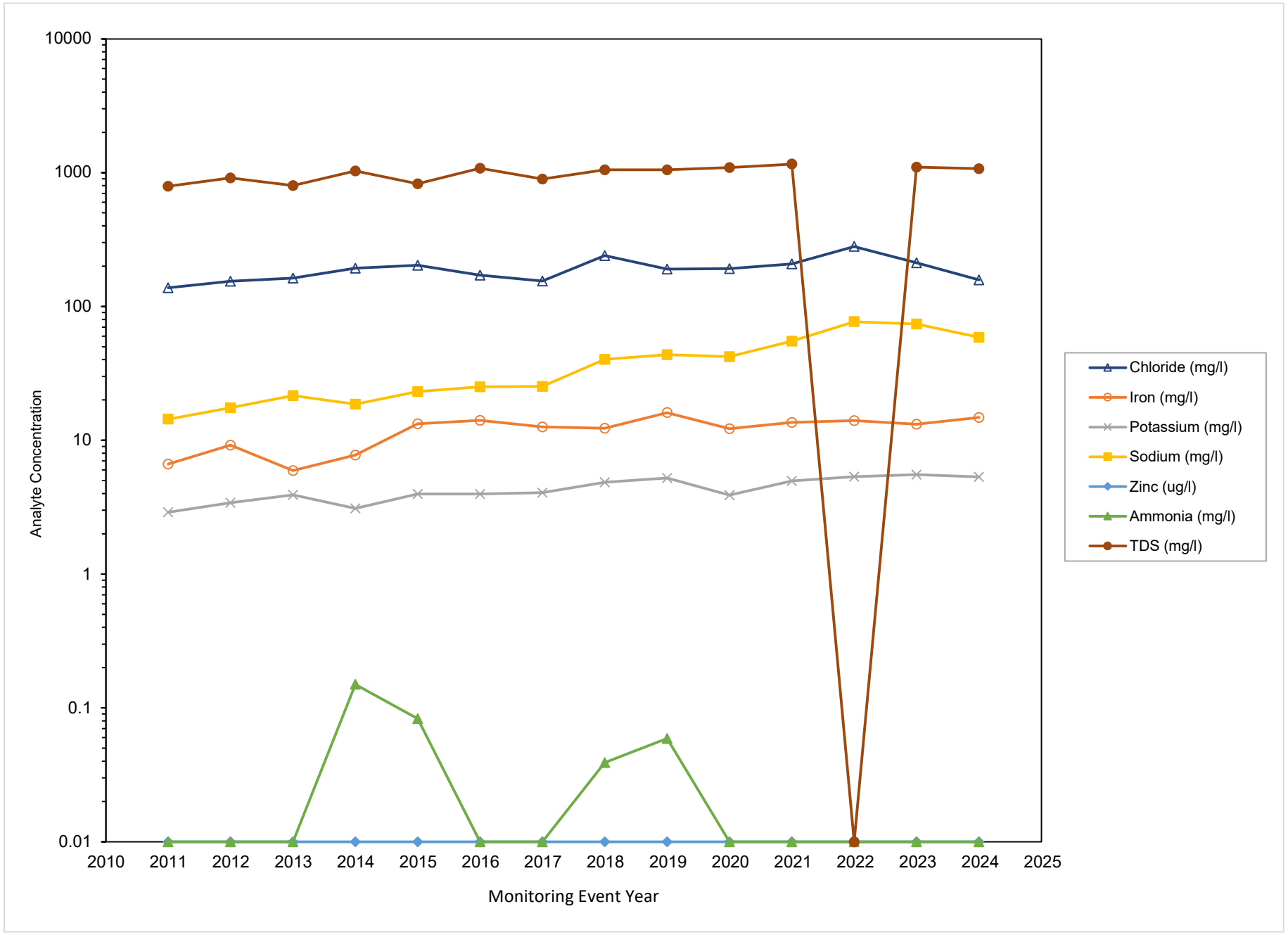
P-301C Leachate Indicator Trends



P-301L Leachate Indicator Trends

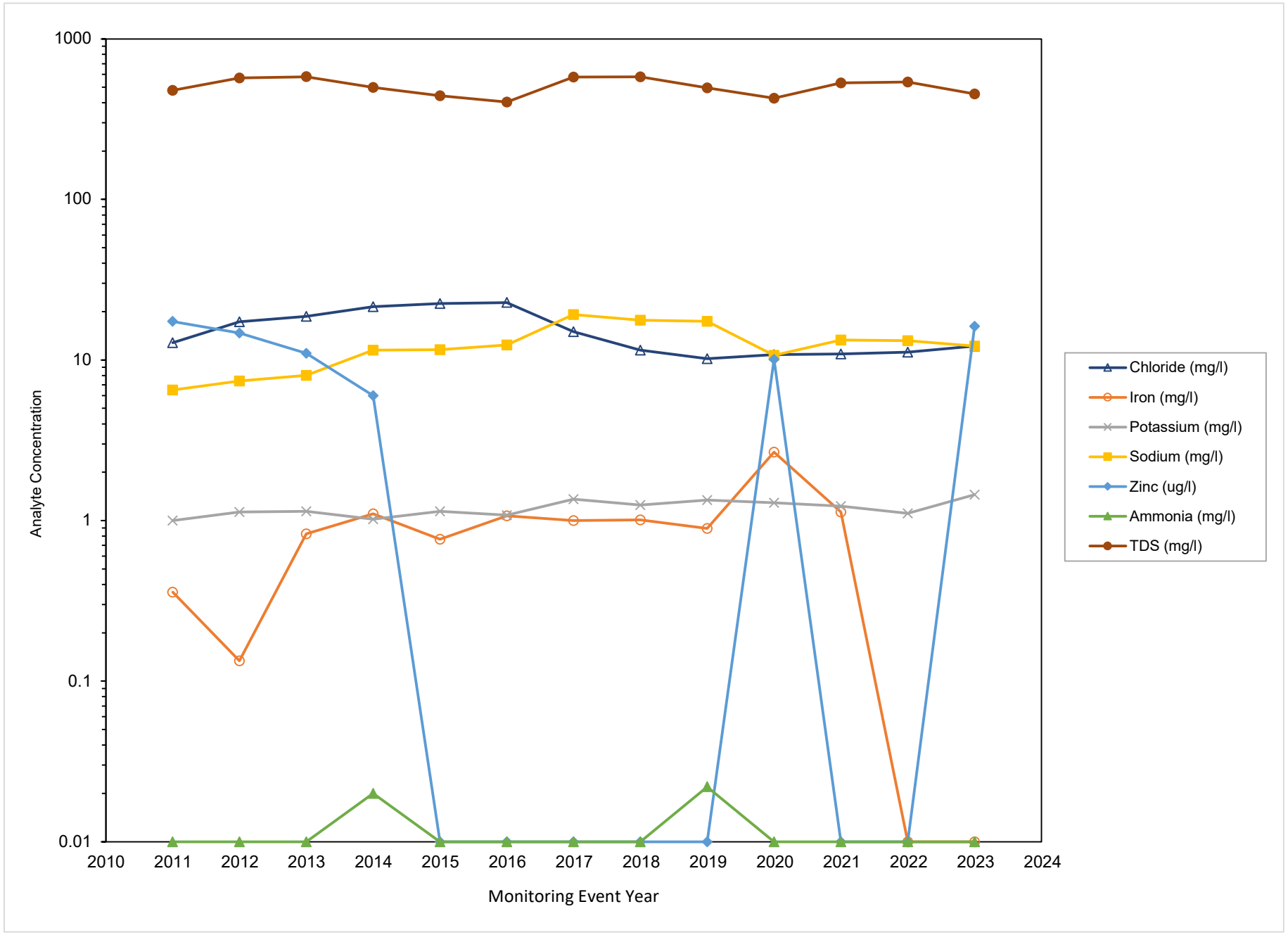


P-302C Leachate Indicator Trends

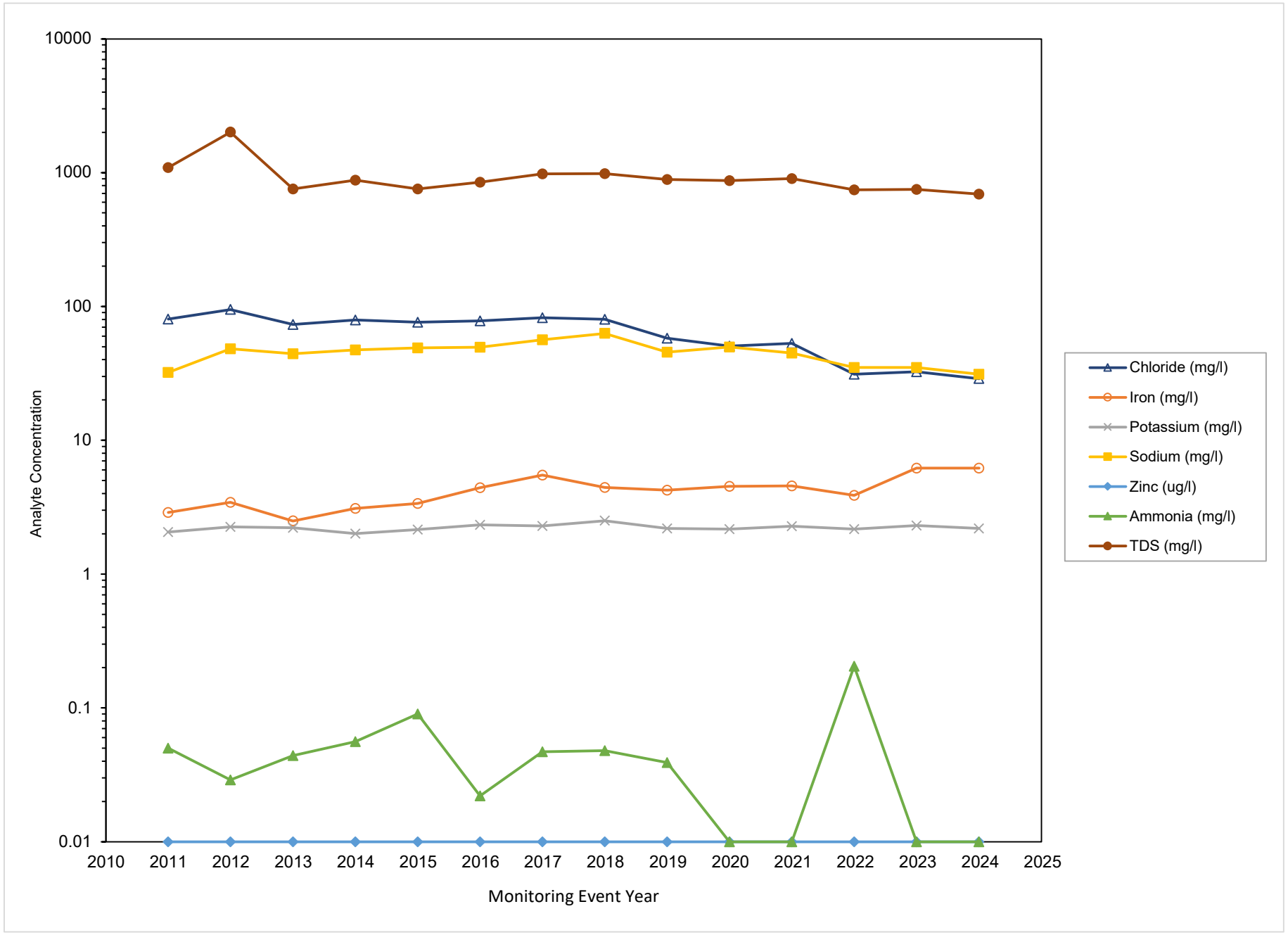


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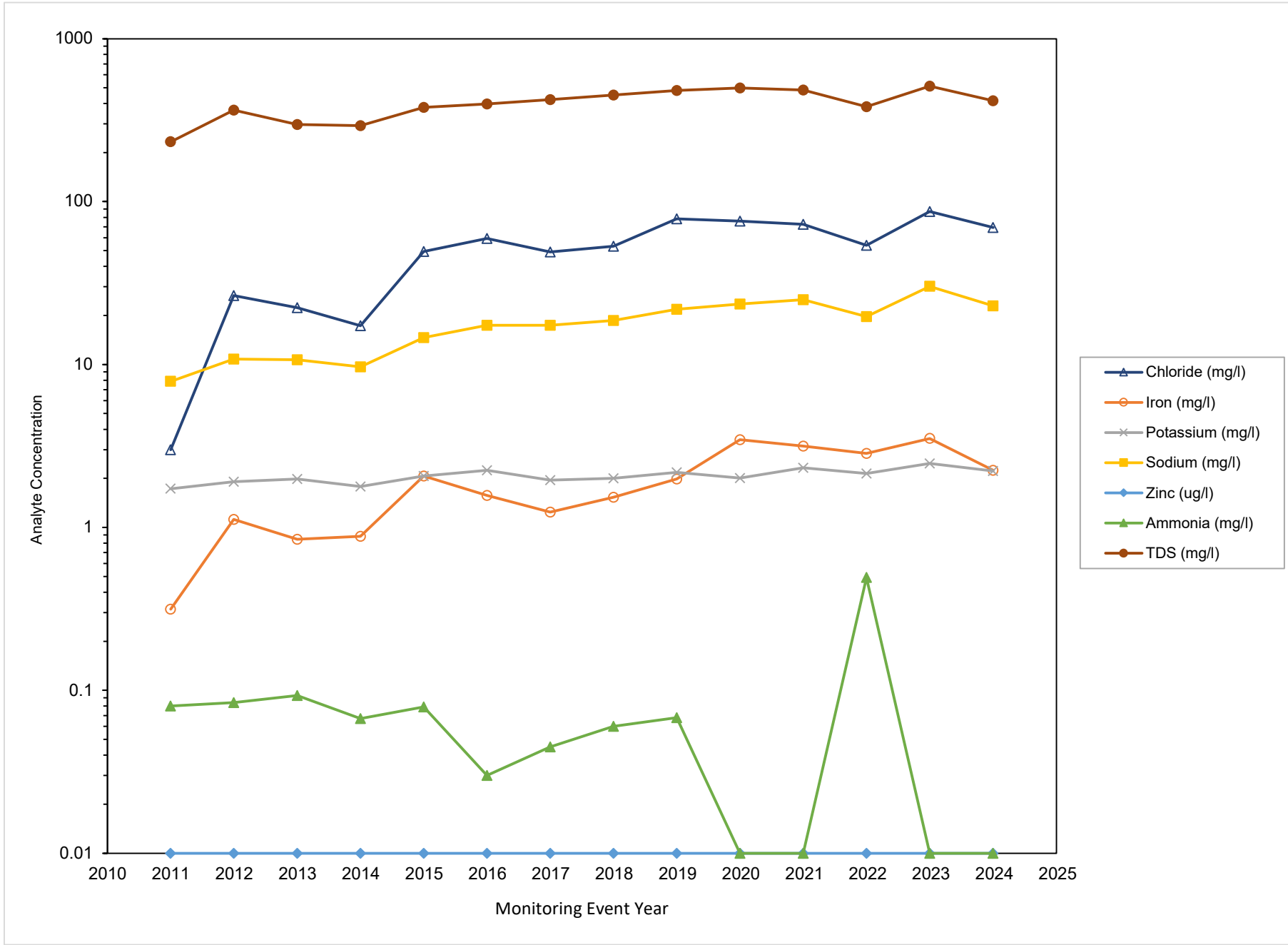
P-303C Leachate Indicator Trends



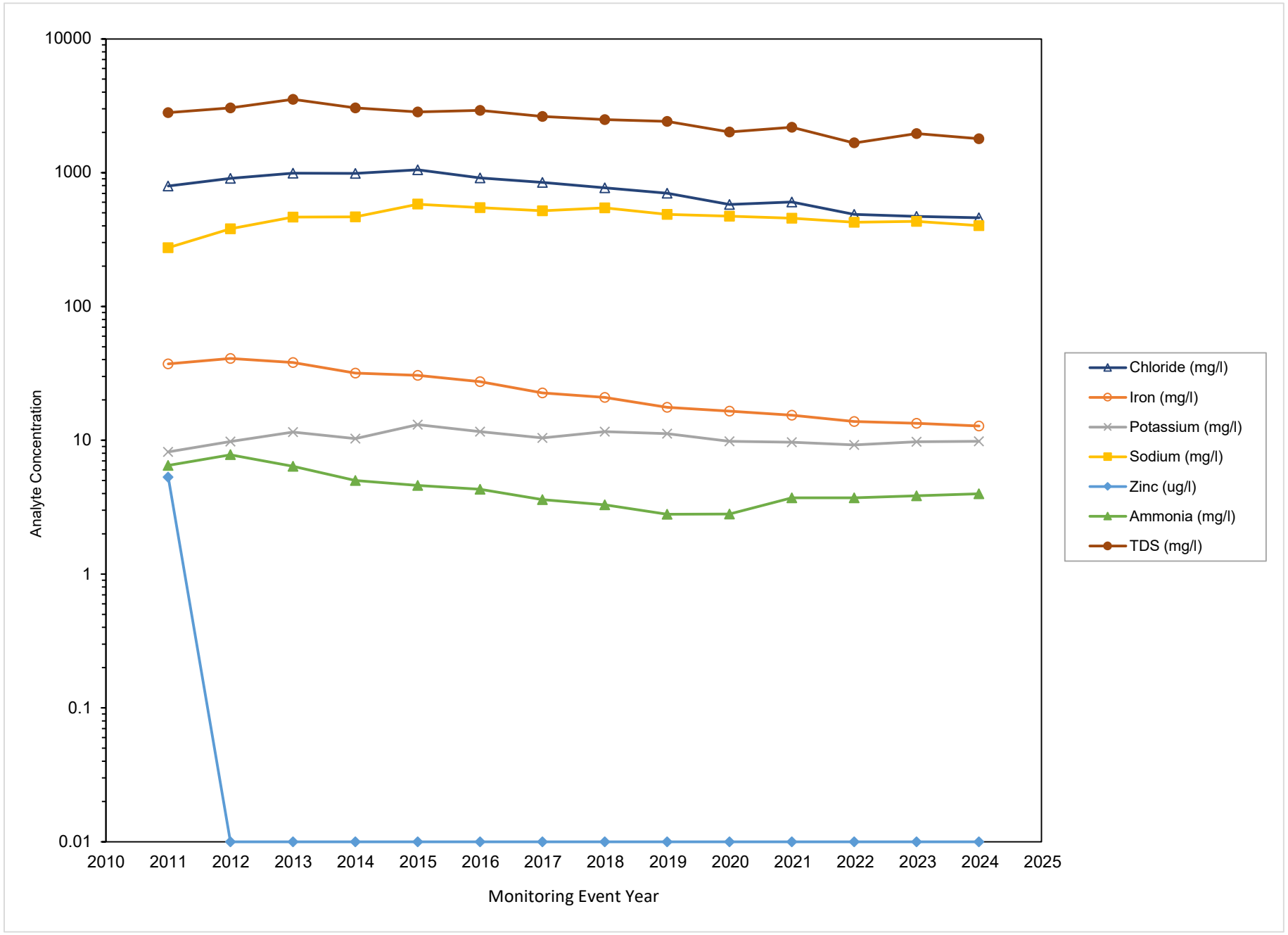
P-304C Leachate Indicator Trends



P-305C Leachate Indicator Trends

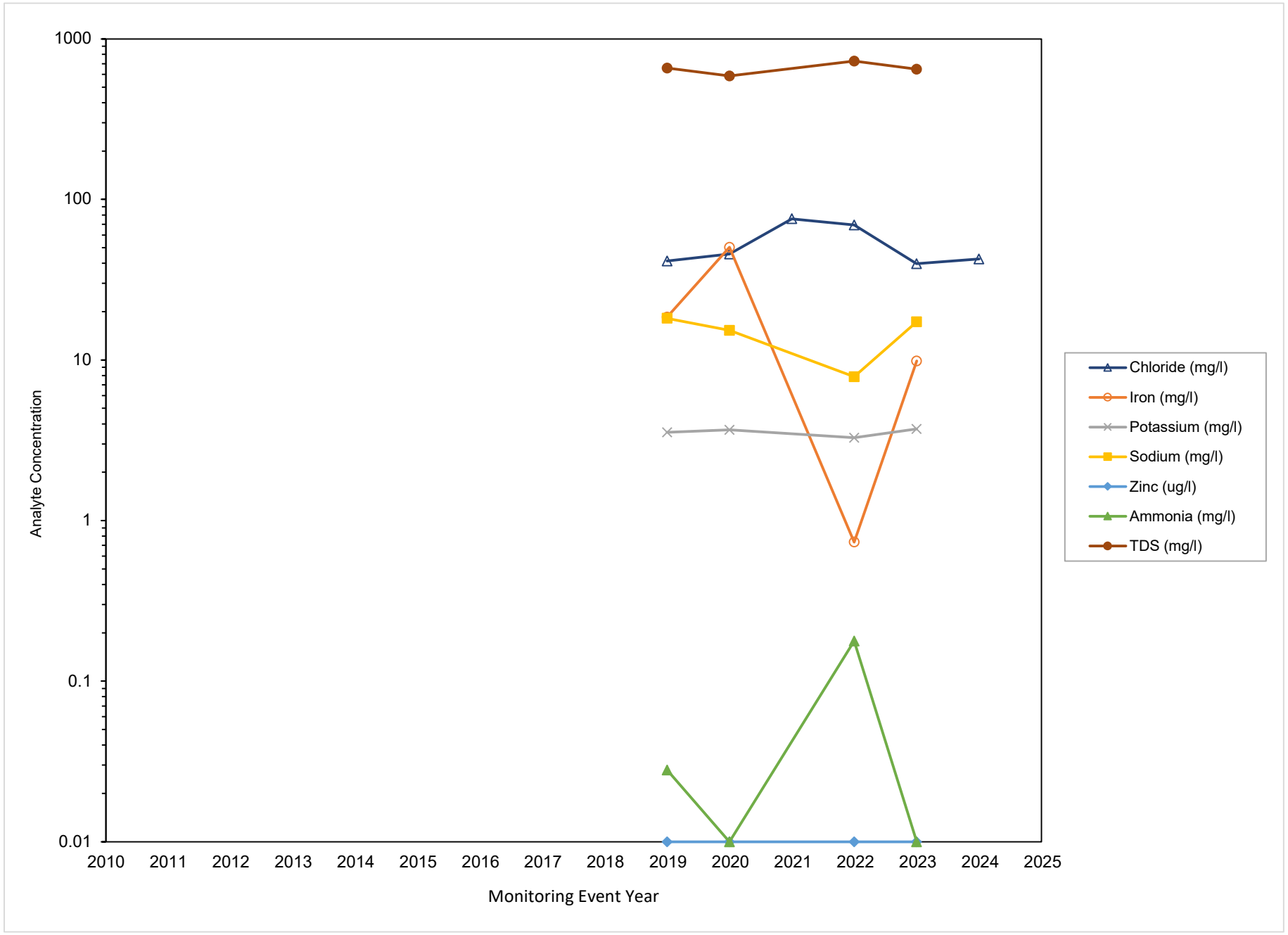


P-308C Leachate Indicator Trends

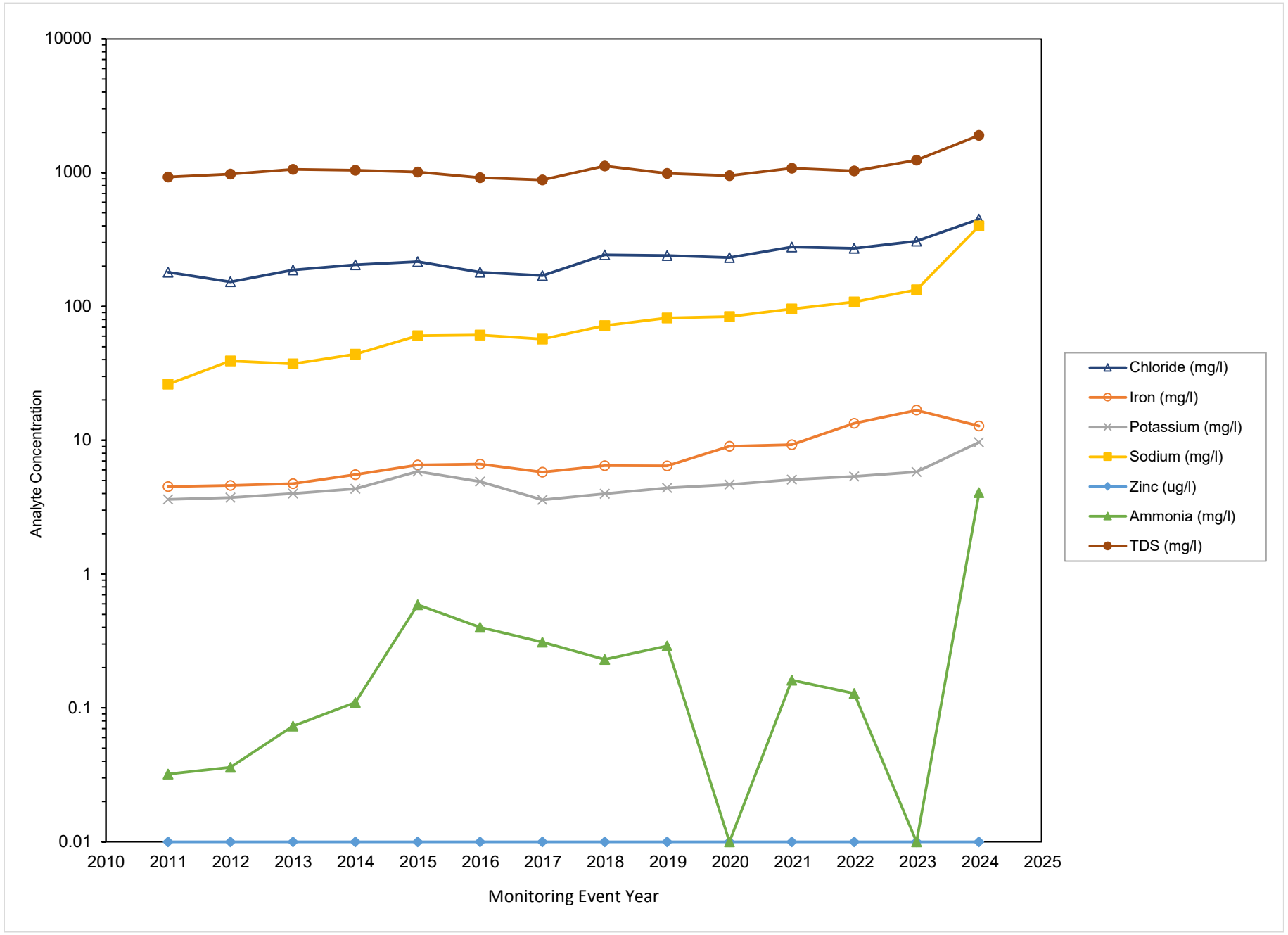


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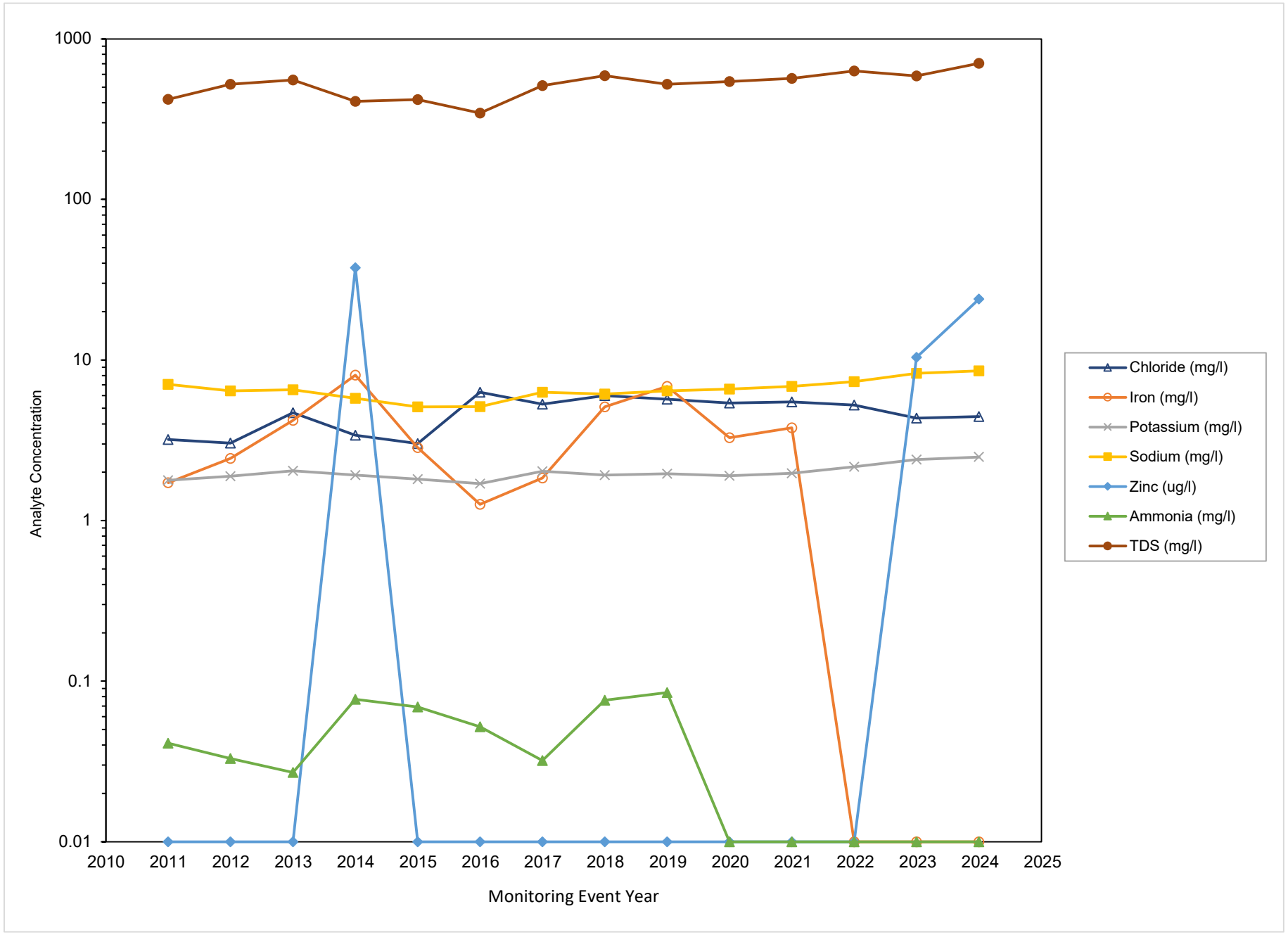
P-308L Leachate Indicator Trends



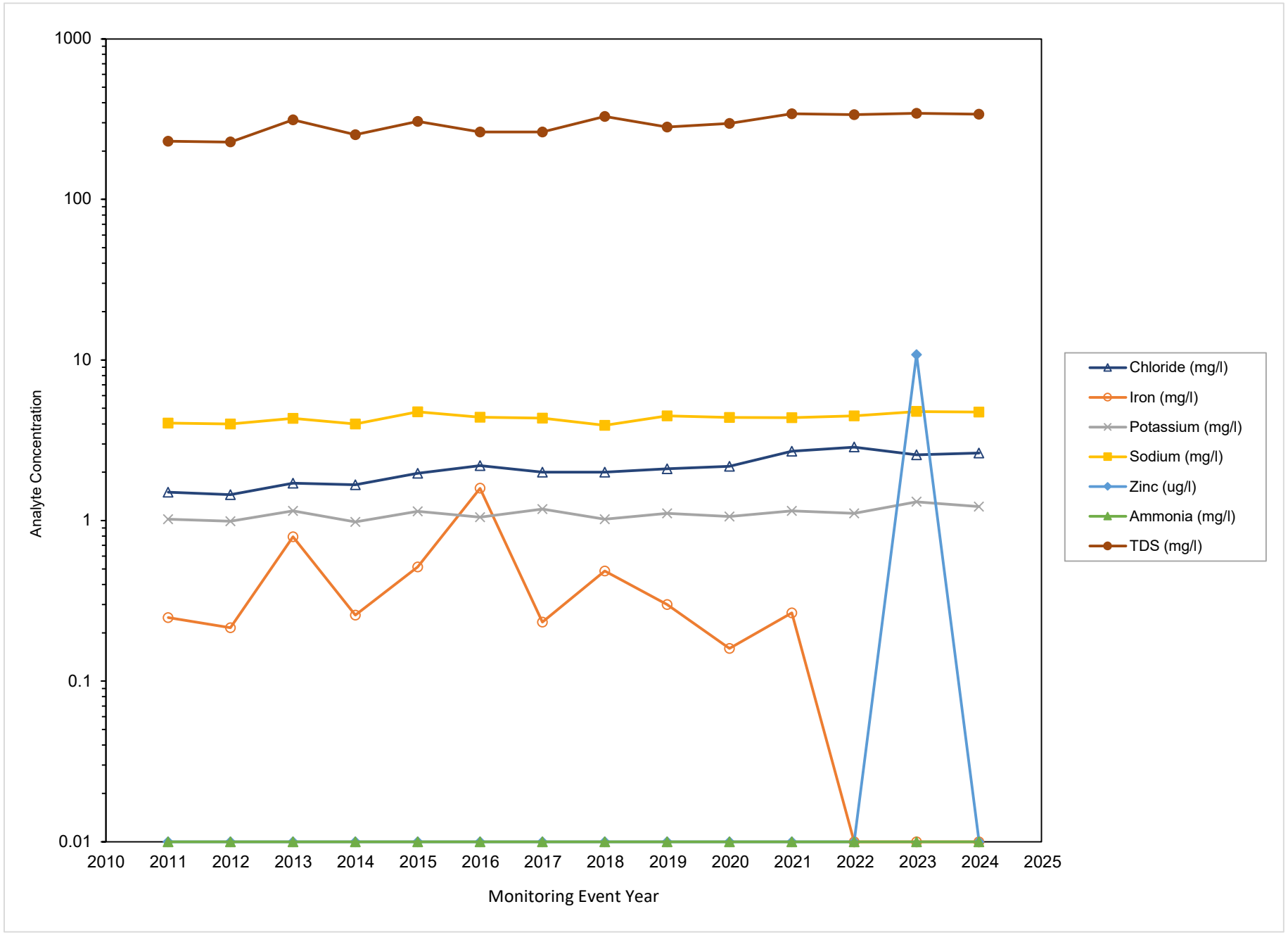
P-309C Leachate Indicator Trends



P-310C Leachate Indicator Trends

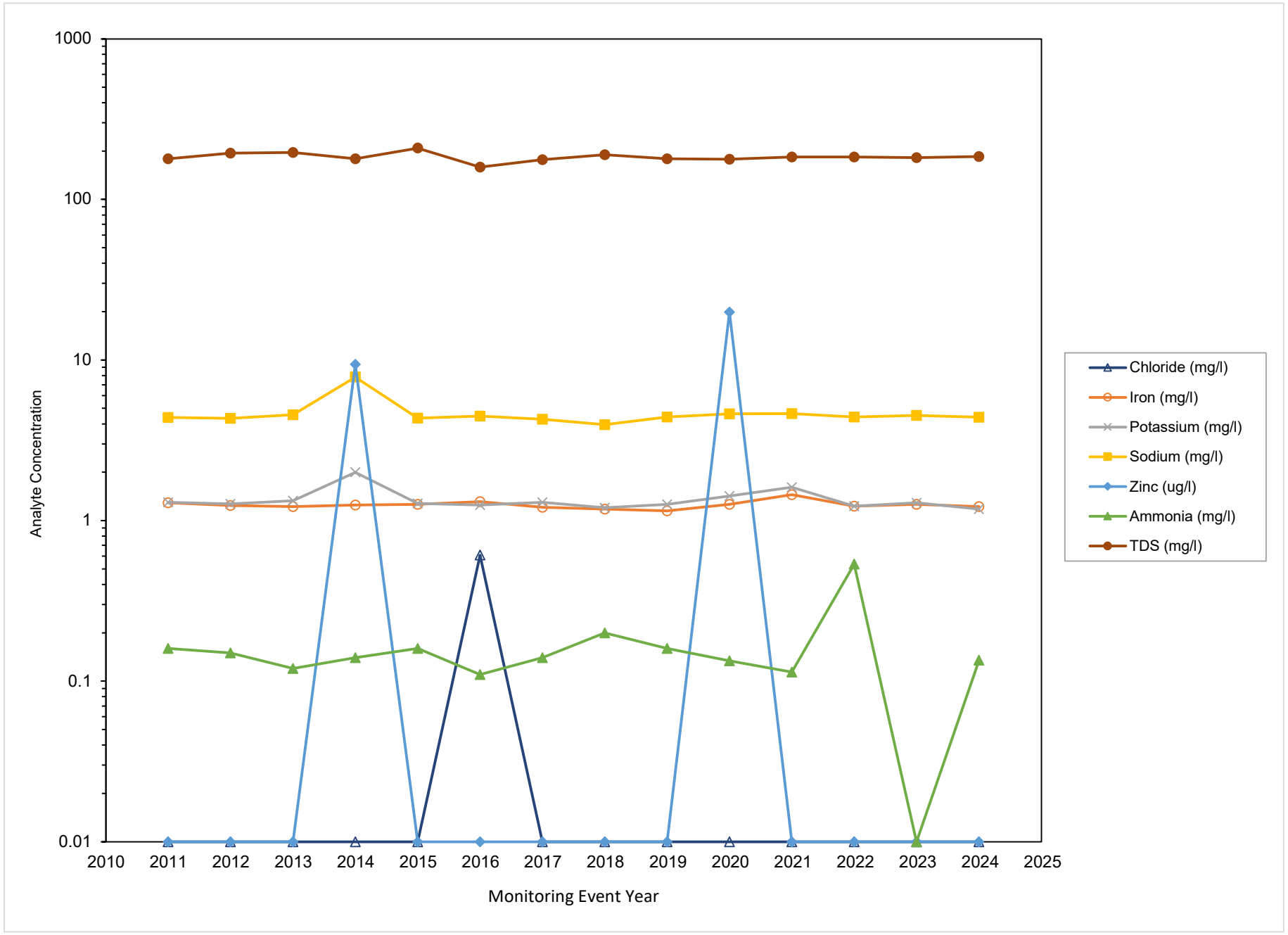


P-311C Leachate Indicator Trends



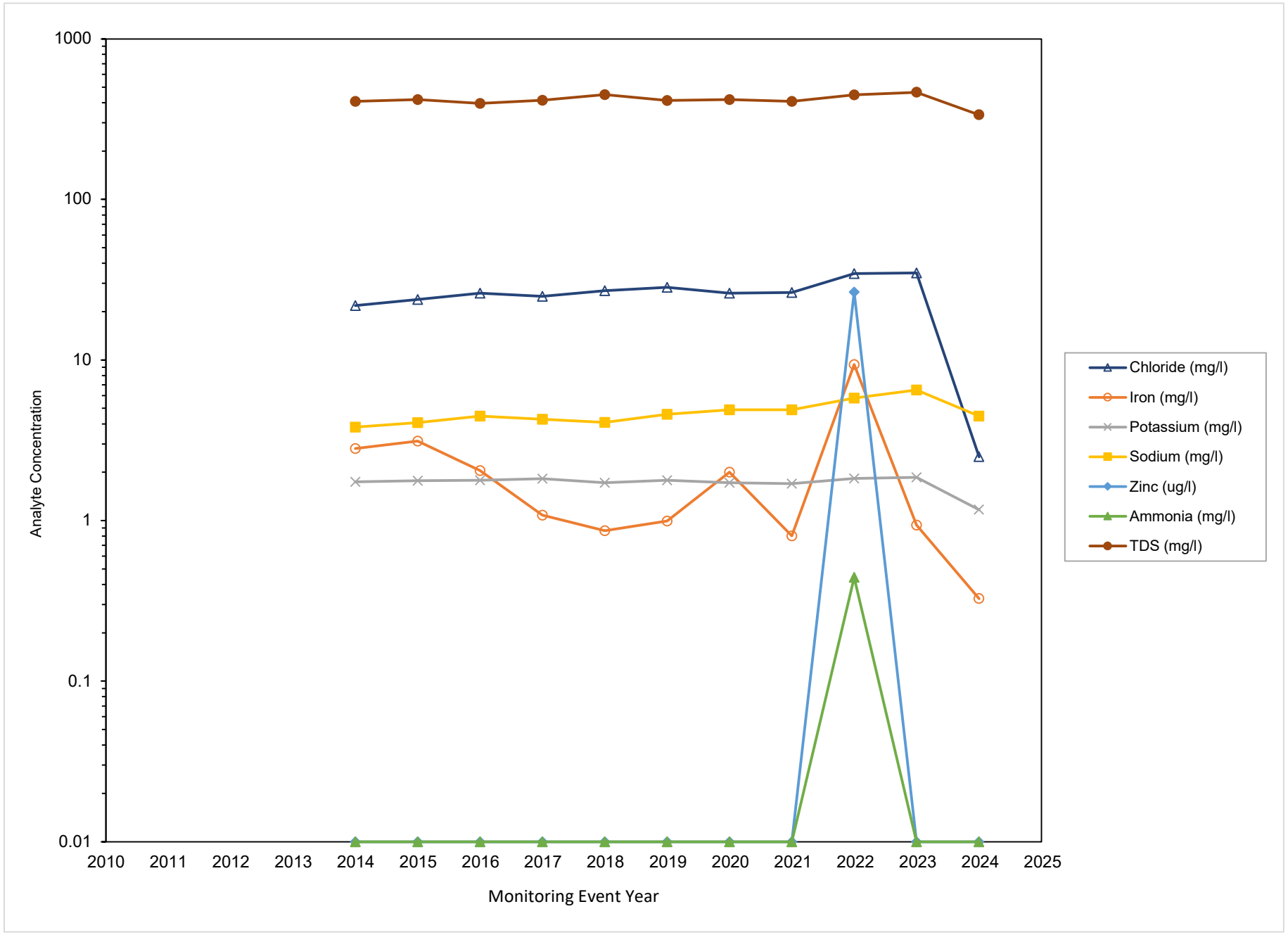
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P-311D Leachate Indicator Trends



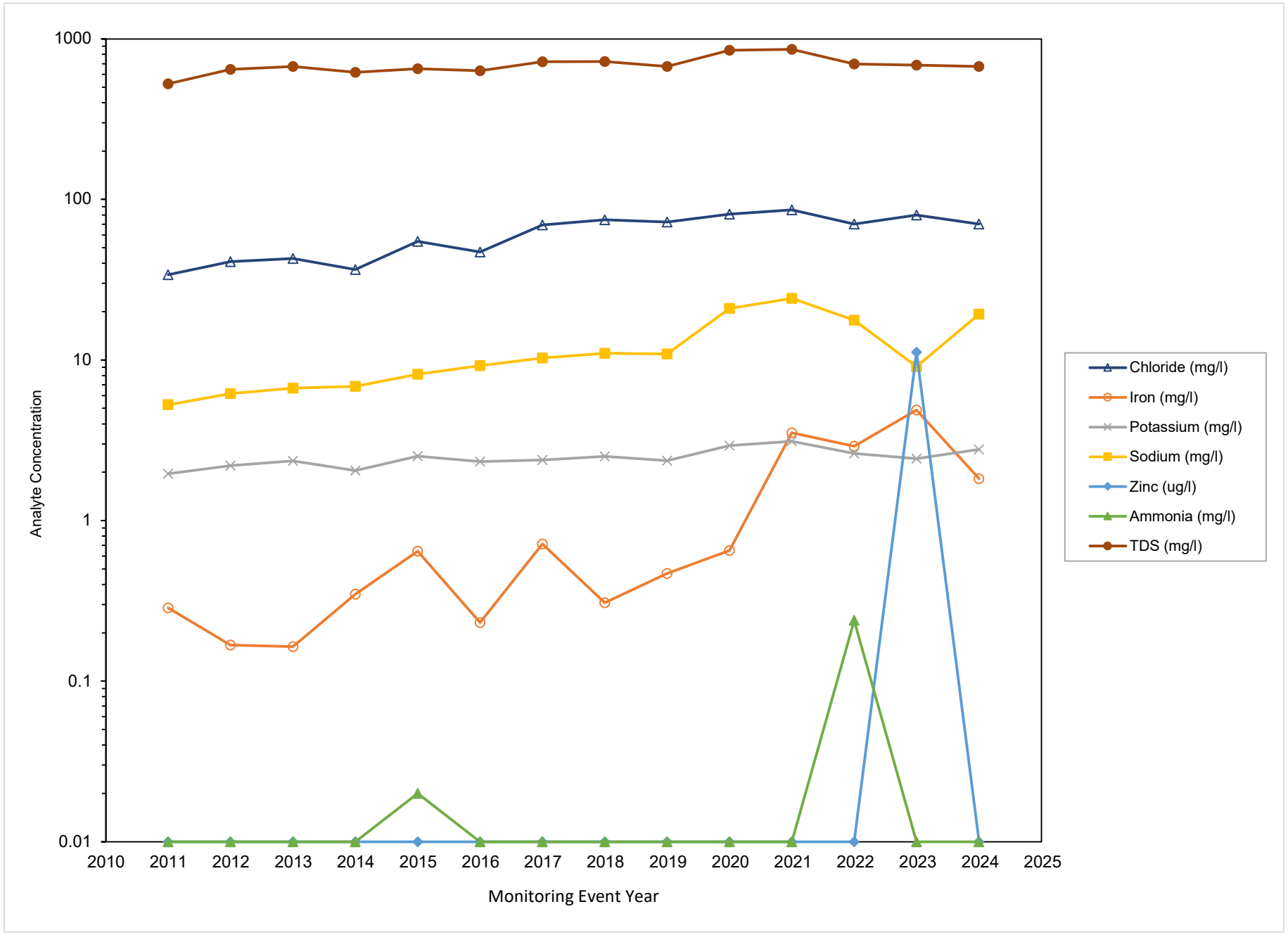
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P-311L Leachate Indicator Trends



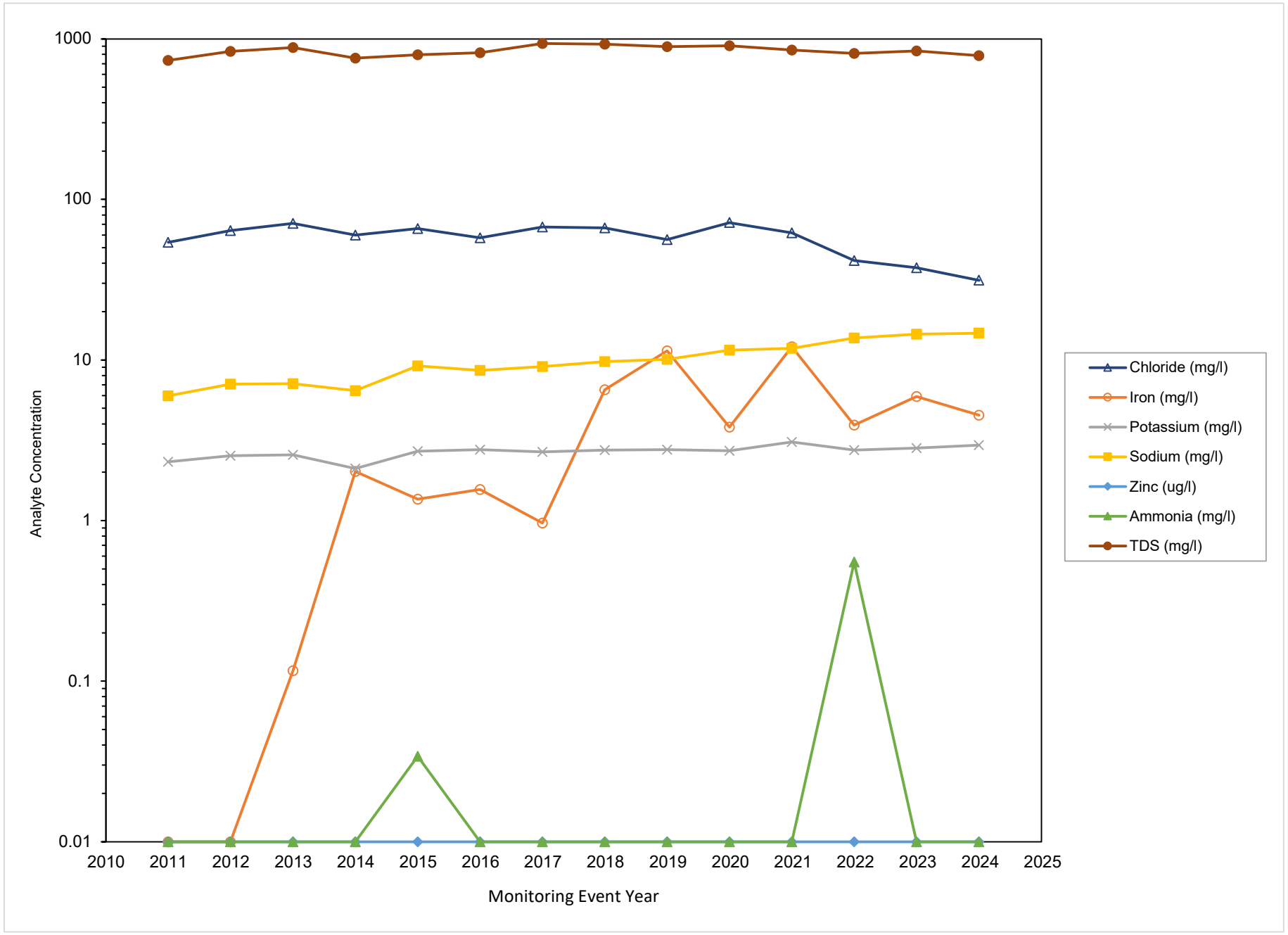
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P-313C Leachate Indicator Trends

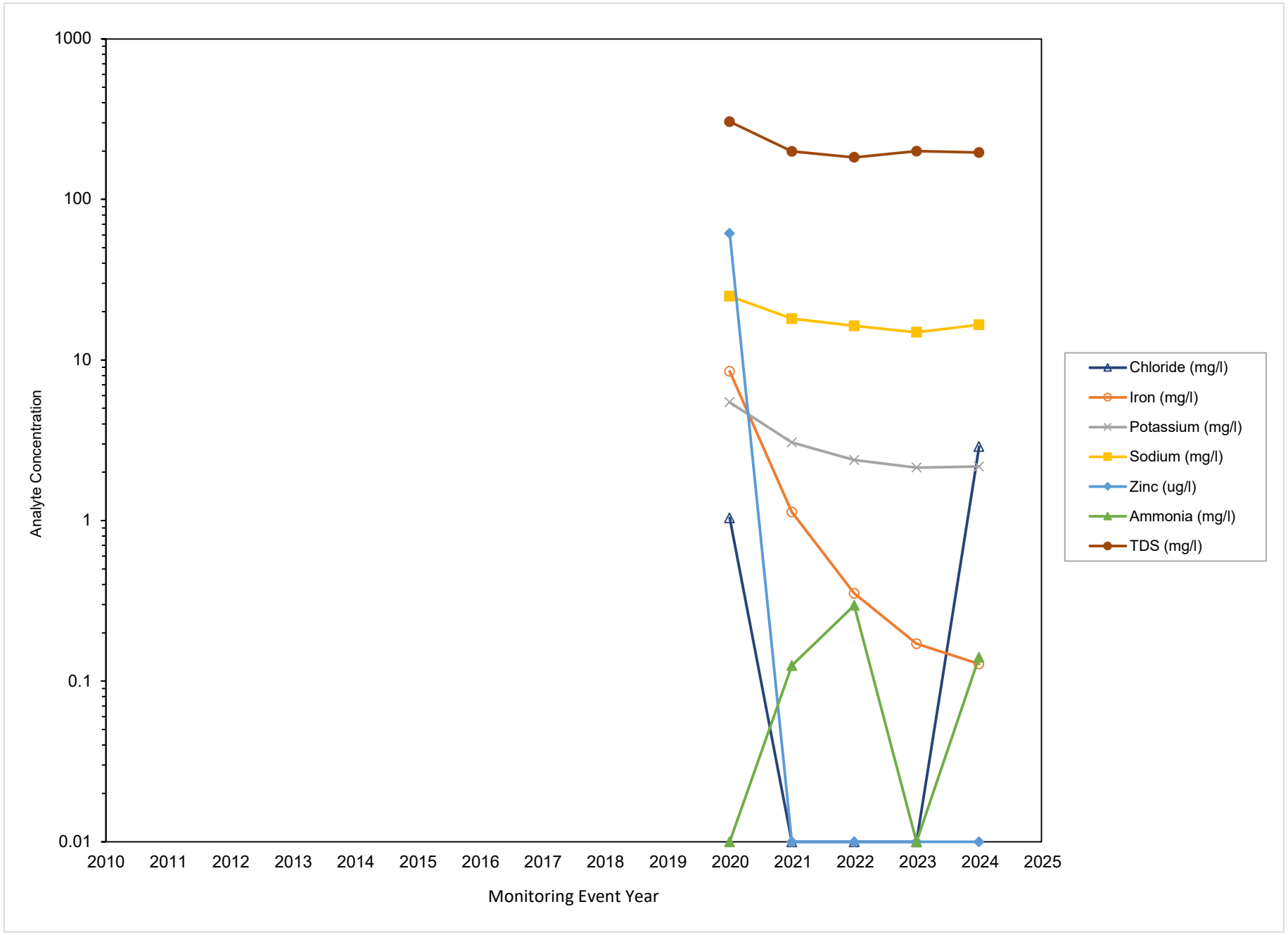


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P-314C Leachate Indicator Trends

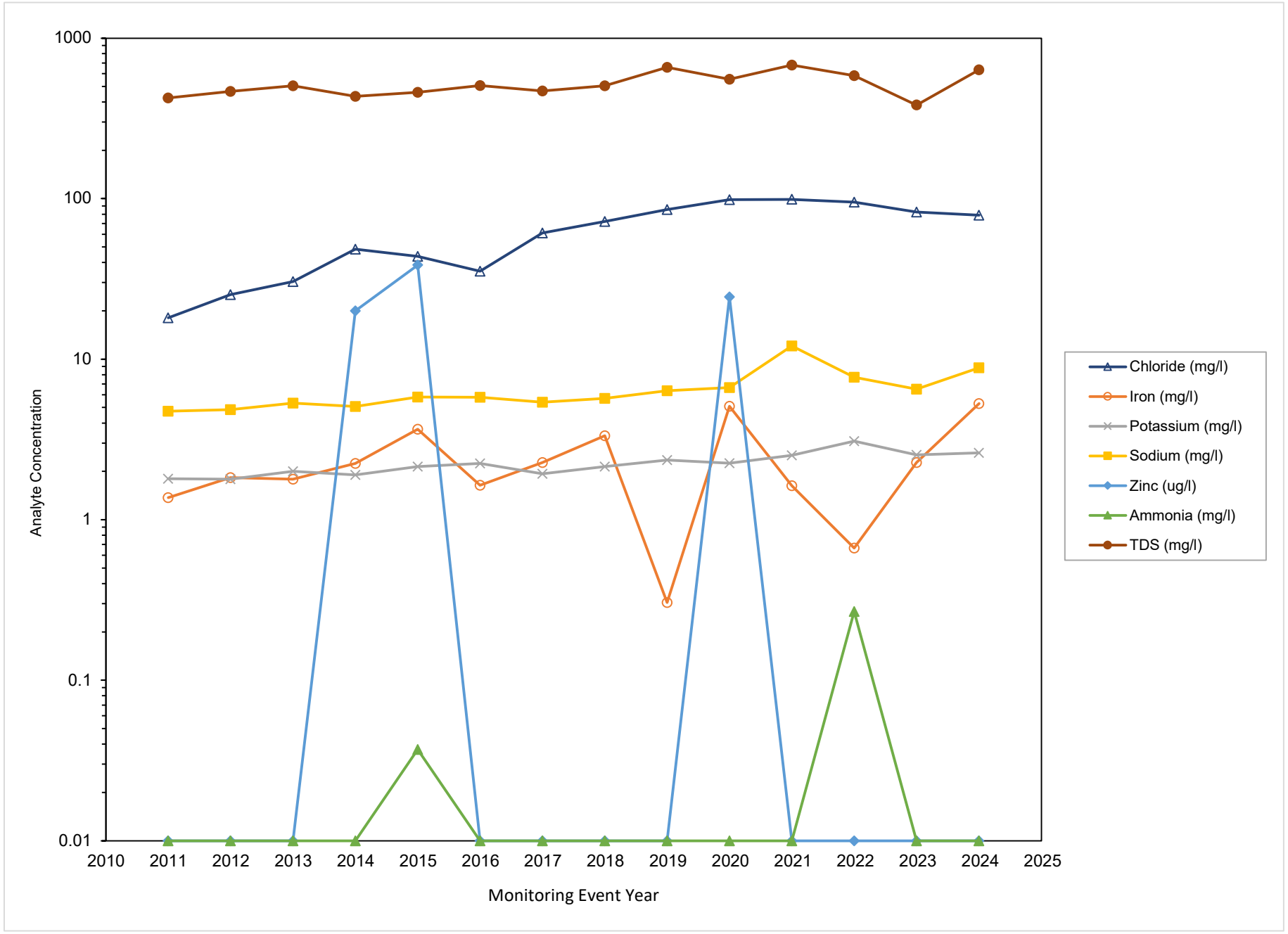


P-315L Leachate Indicator Trends

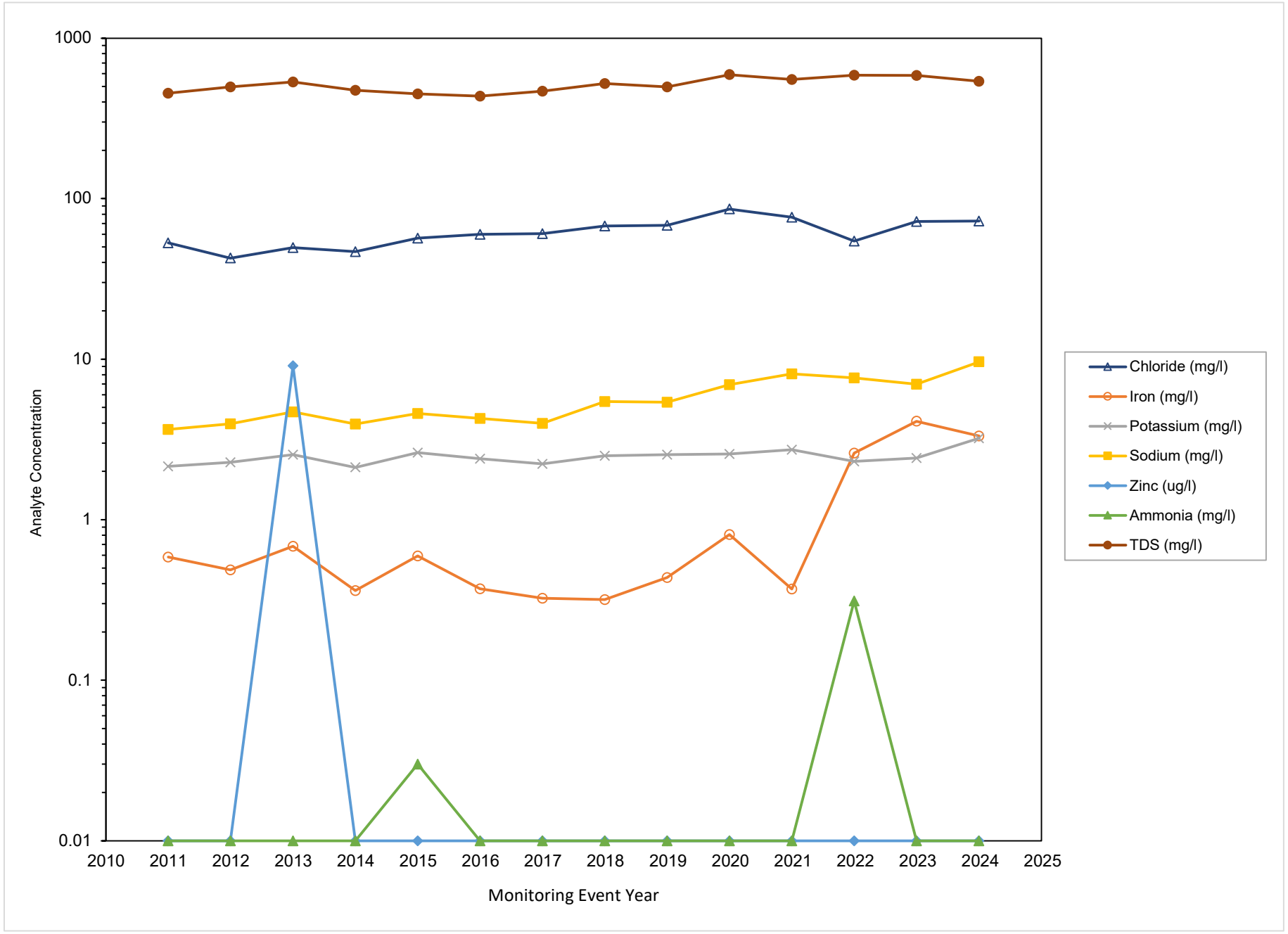


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P-320C Leachate Indicator Trends

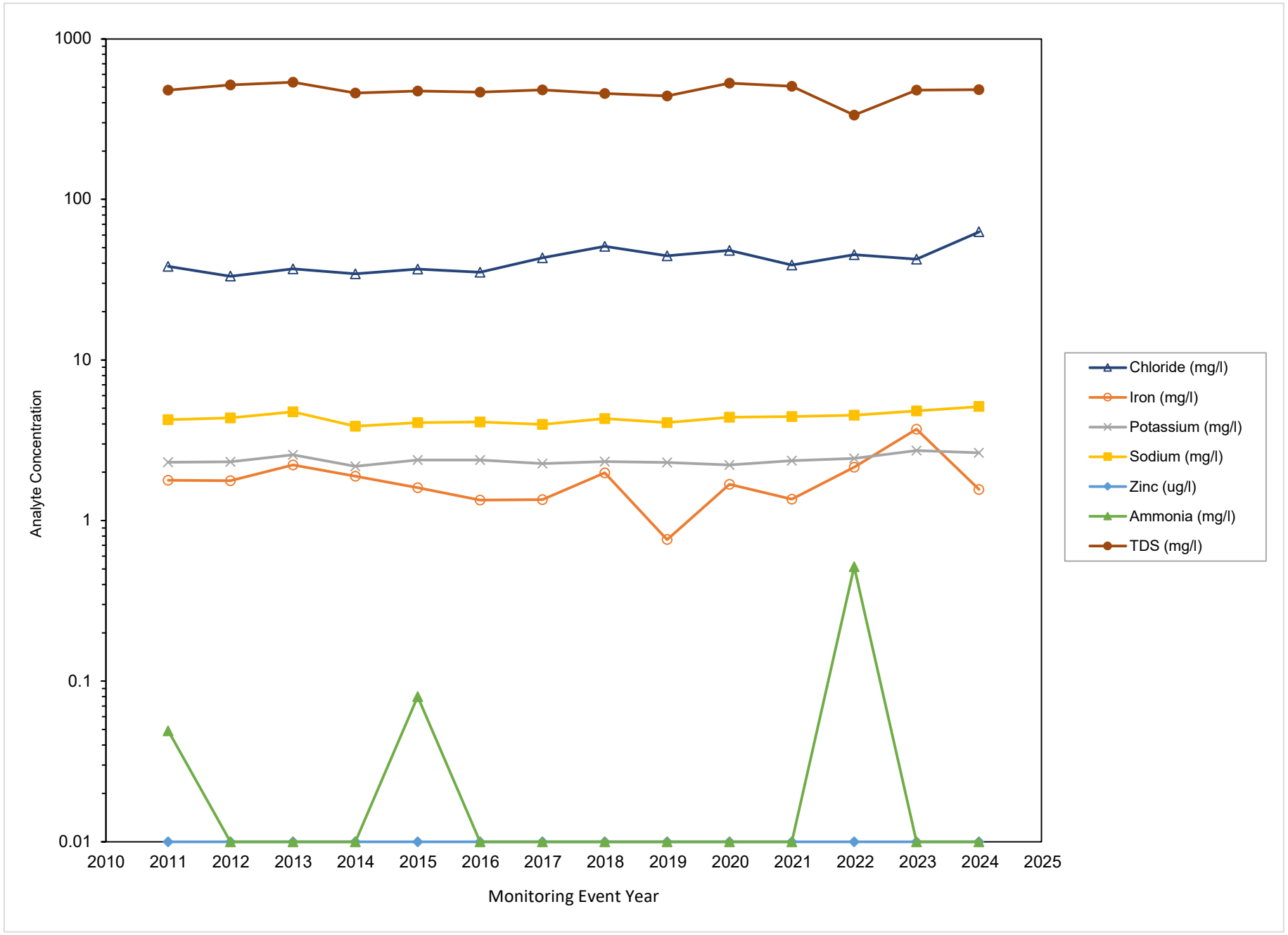


P-320C2 Leachate Indicator Trends

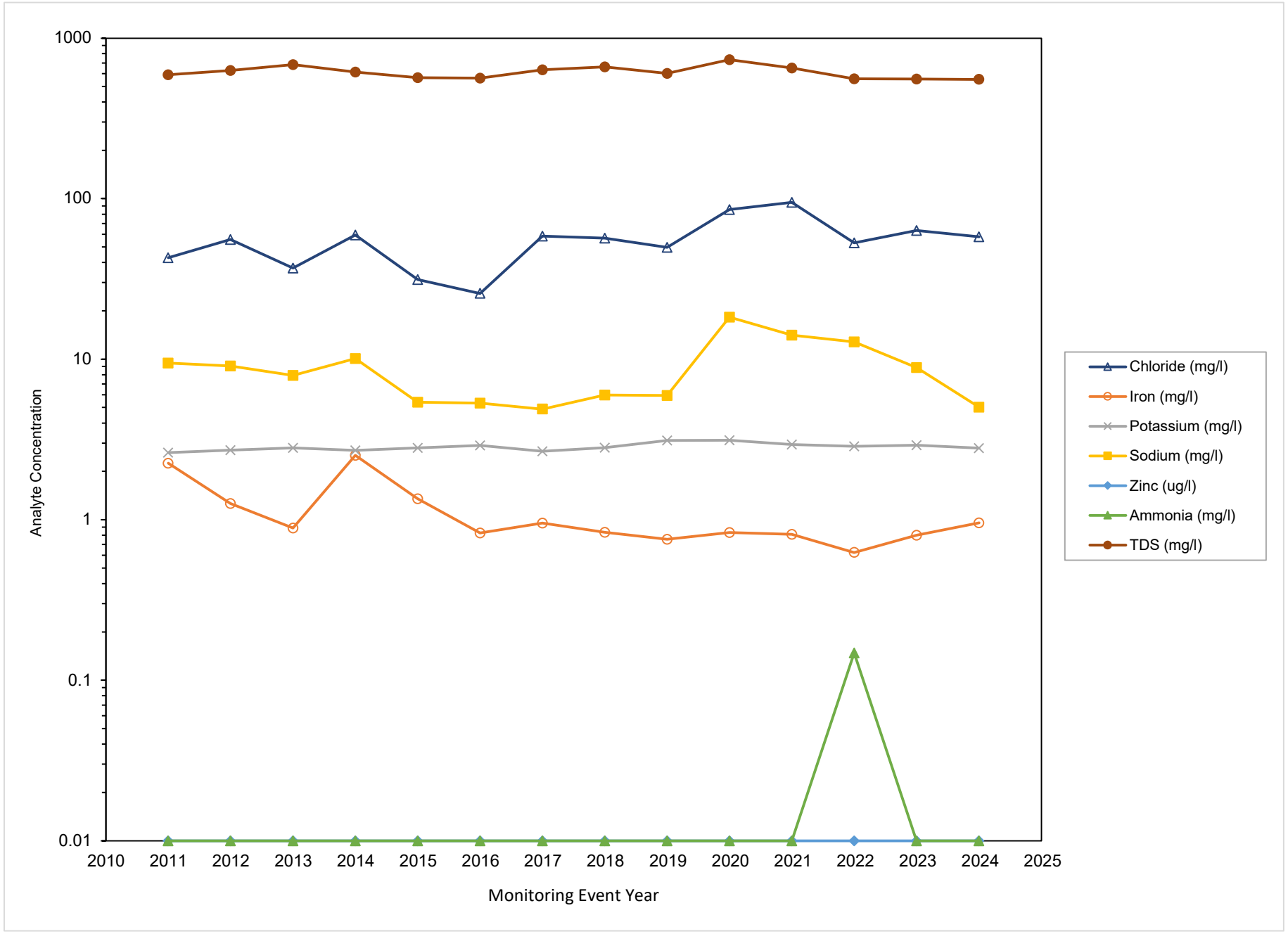


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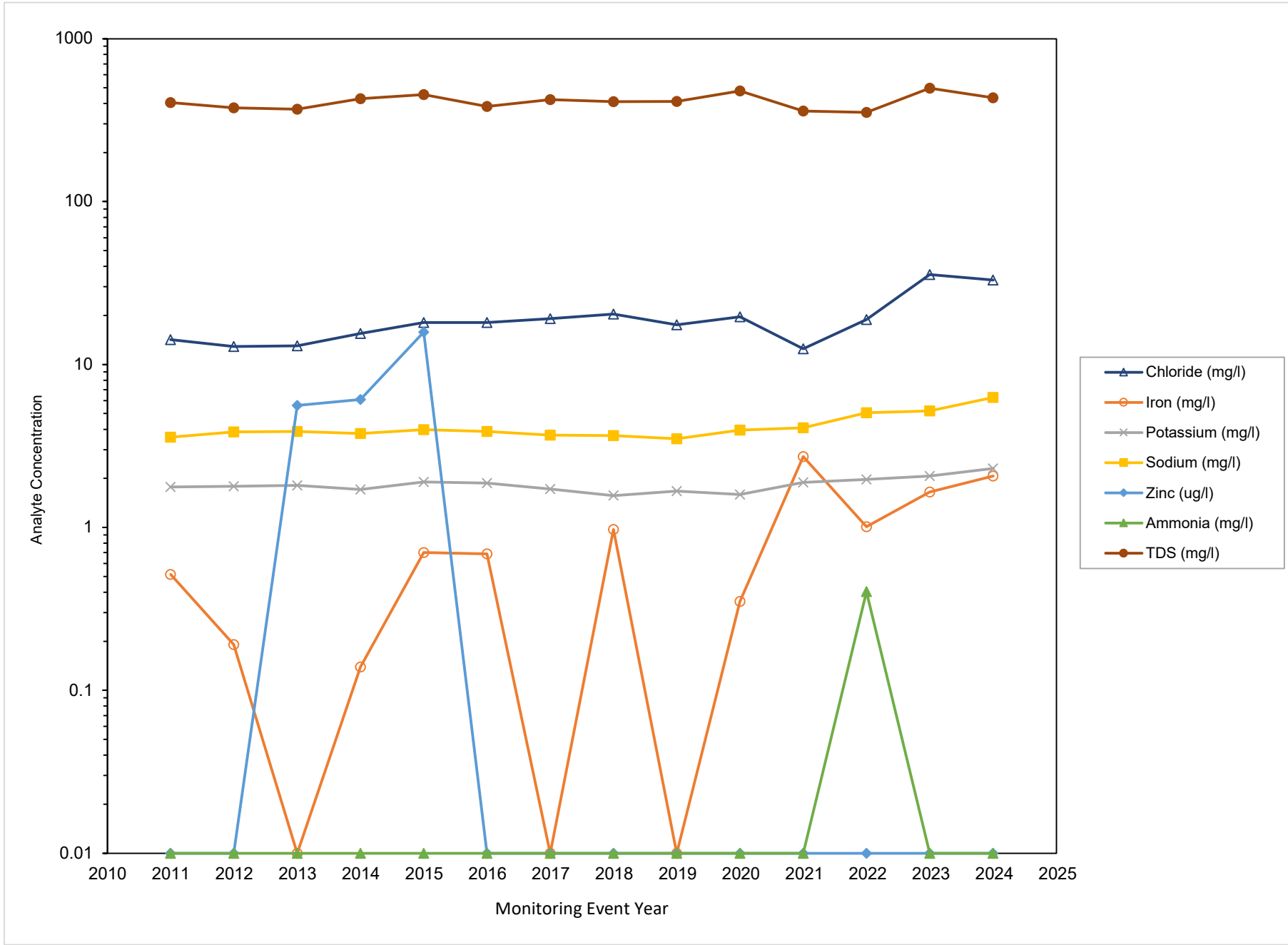
P-320L Leachate Indicator Trends



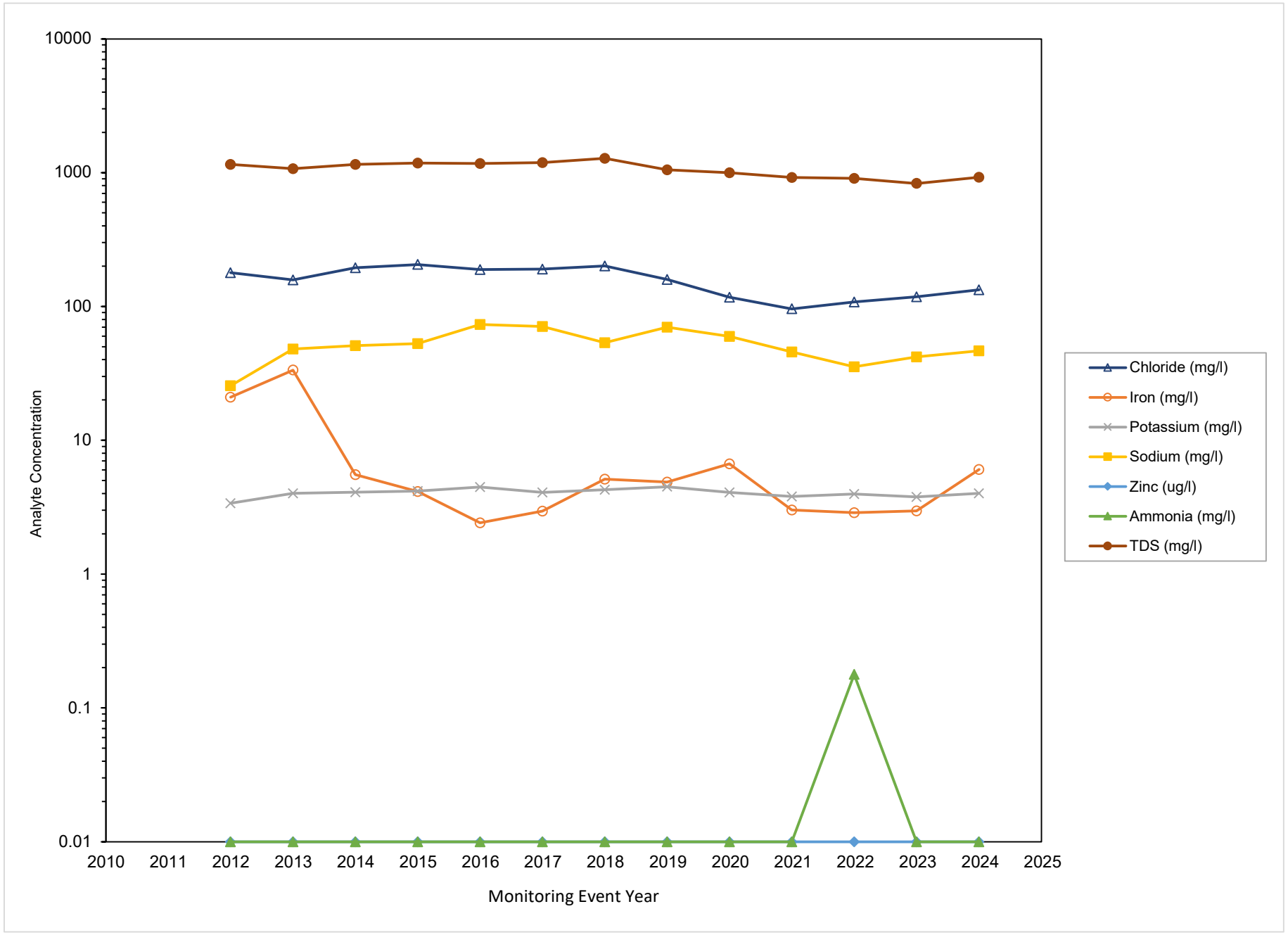
P-321L Leachate Indicator Trends



P-322L Leachate Indicator Trends

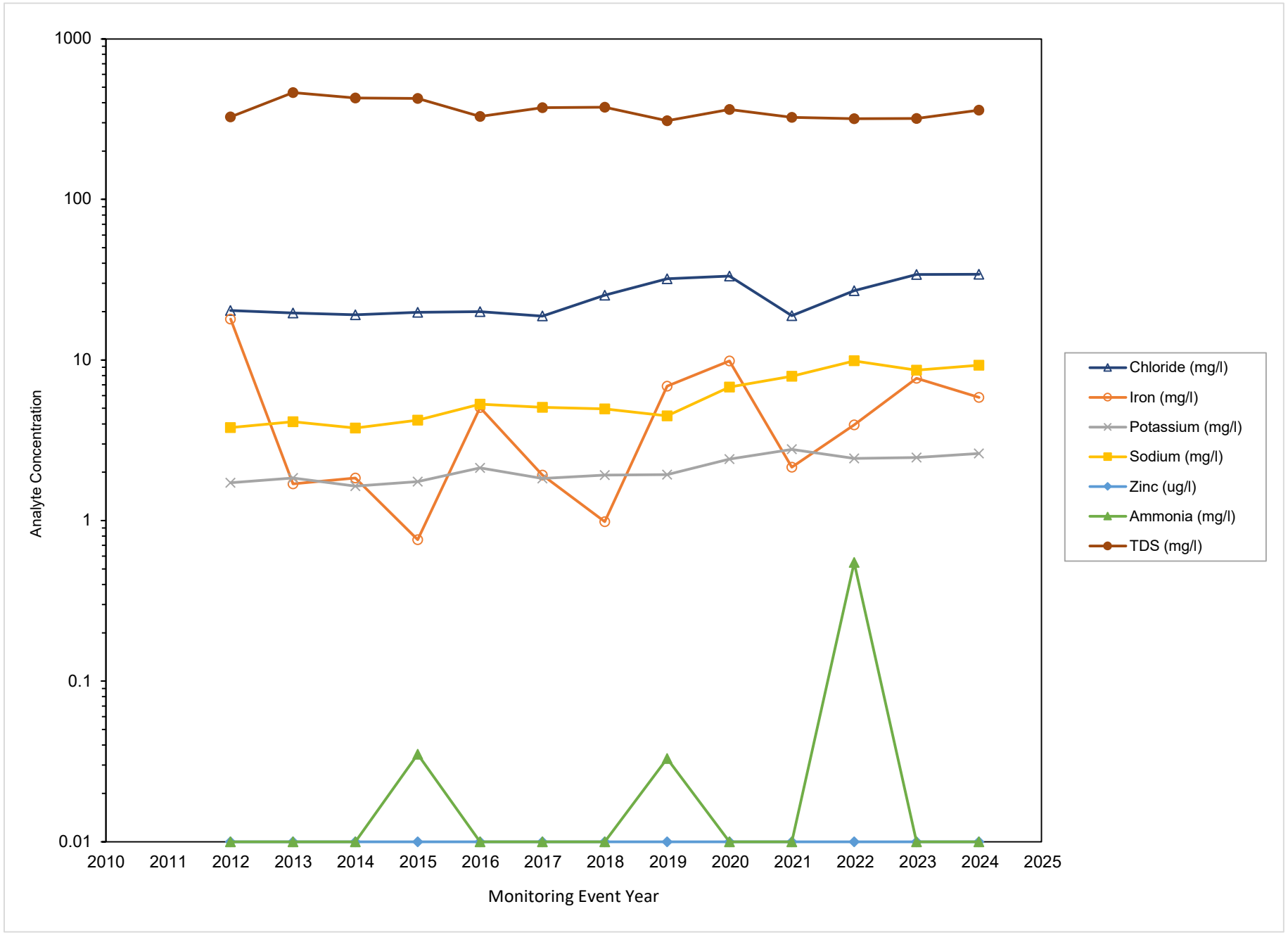


P-323L Leachate Indicator Trends

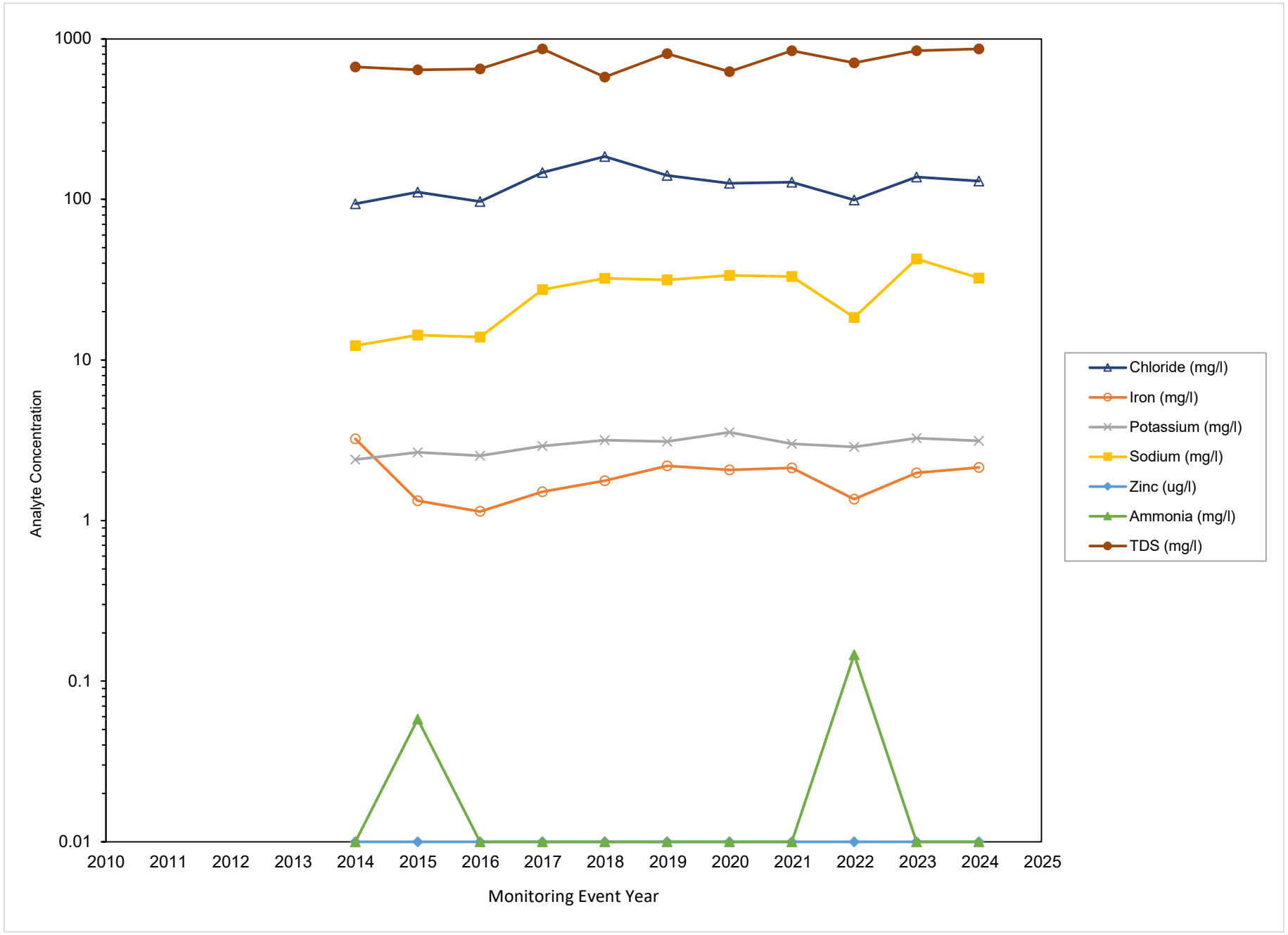


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P-324L Leachate Indicator Trends

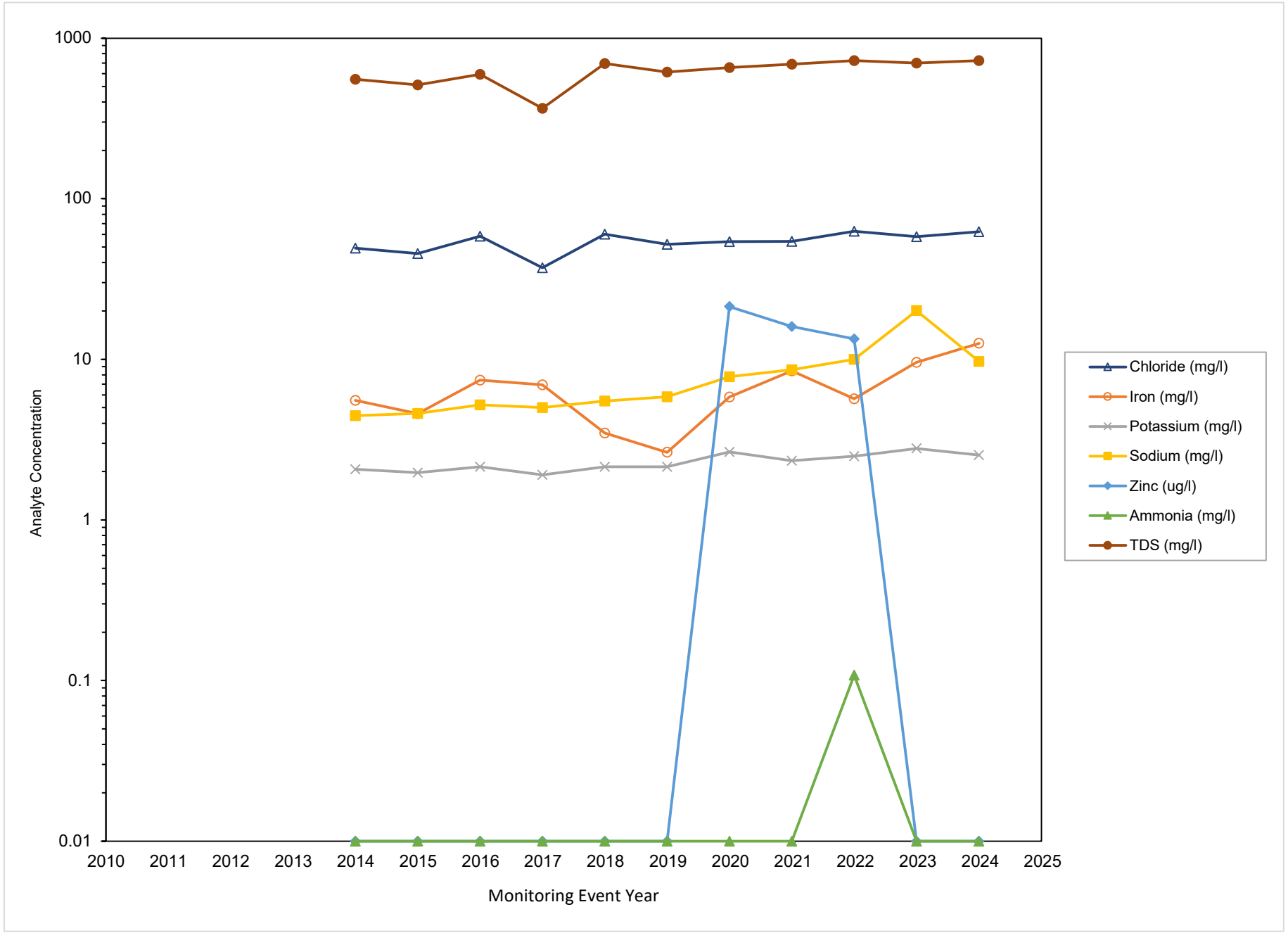


P-325L Leachate Indicator Trends



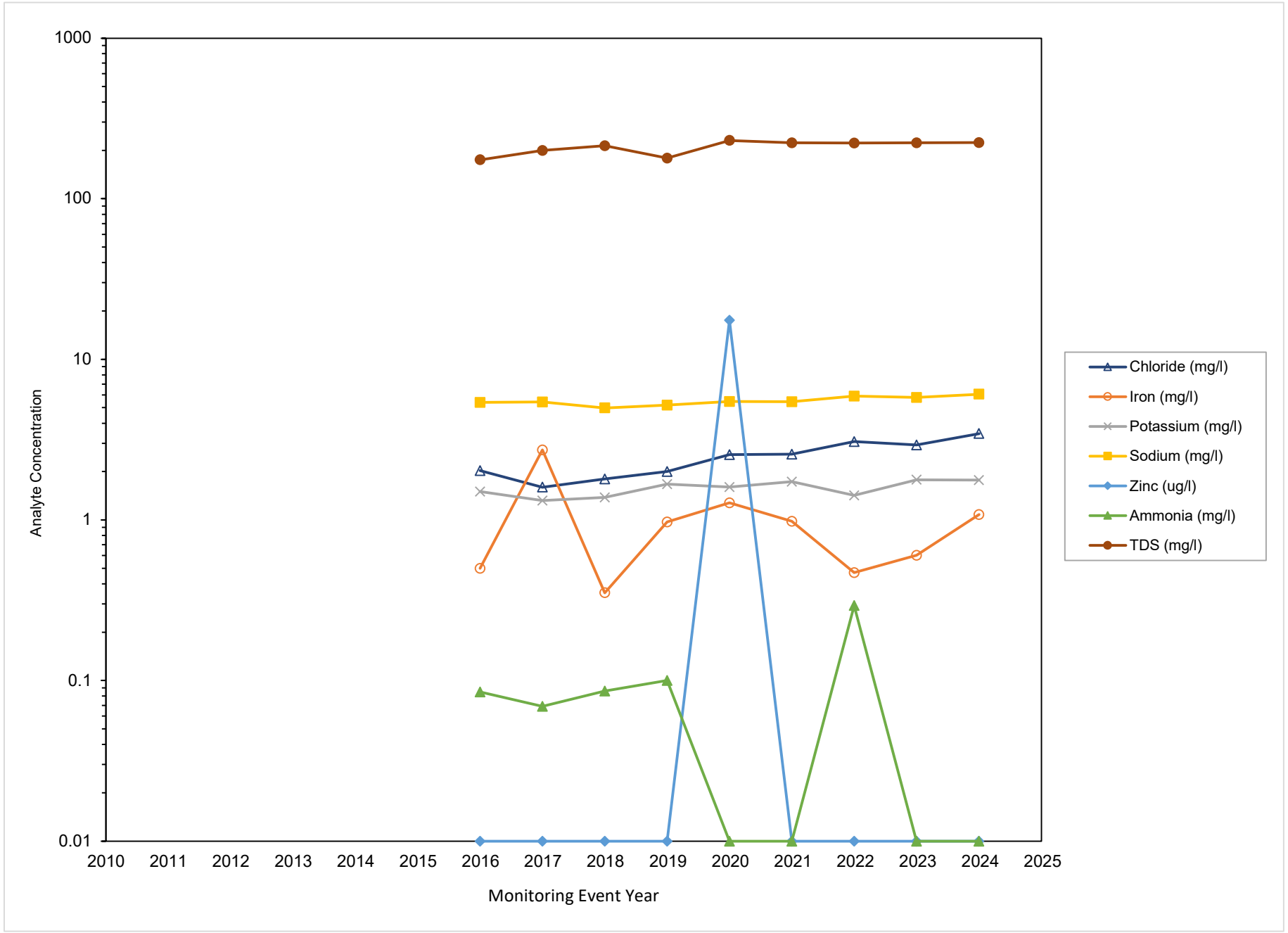
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P-326L Leachate Indicator Trends

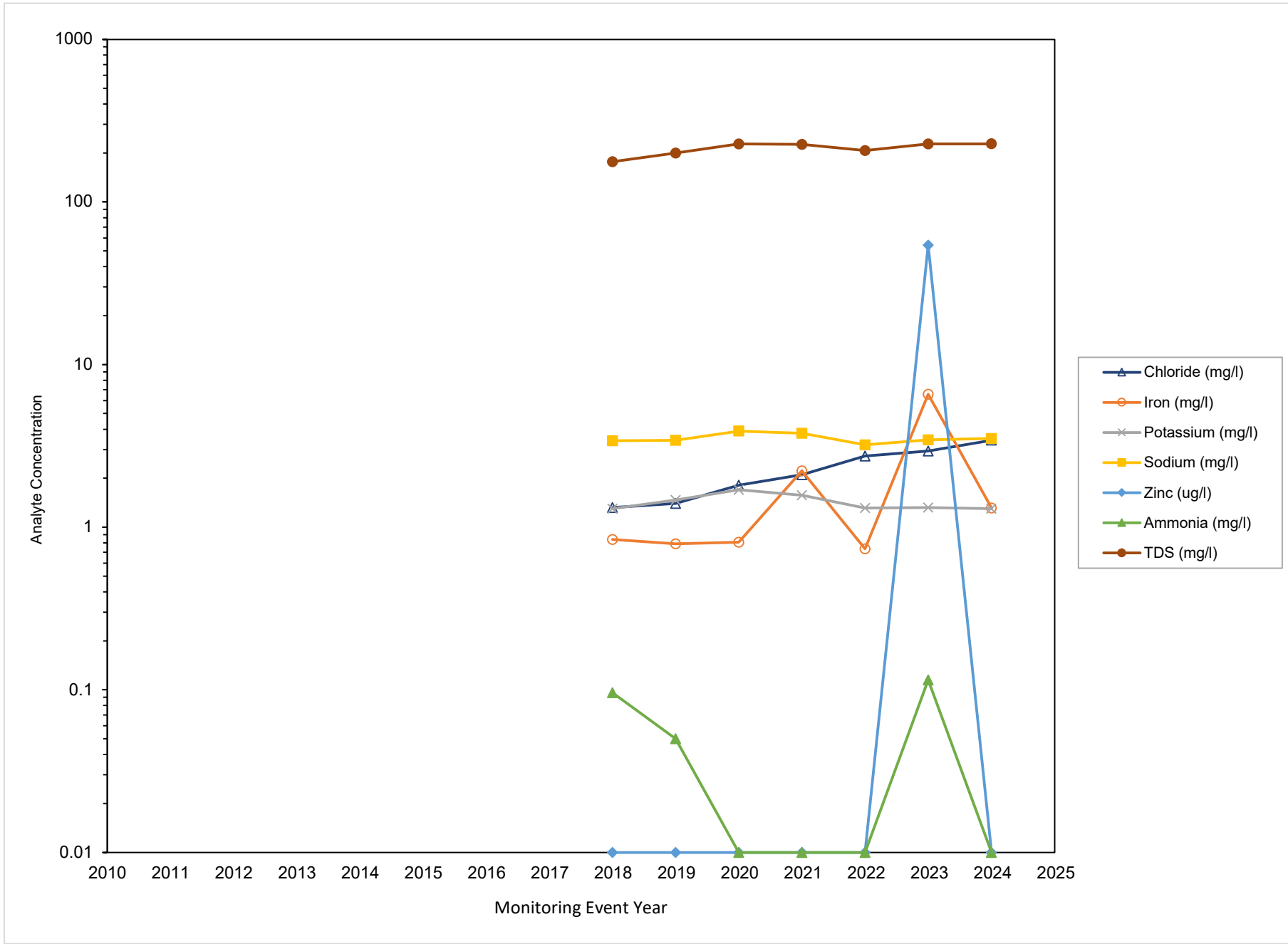


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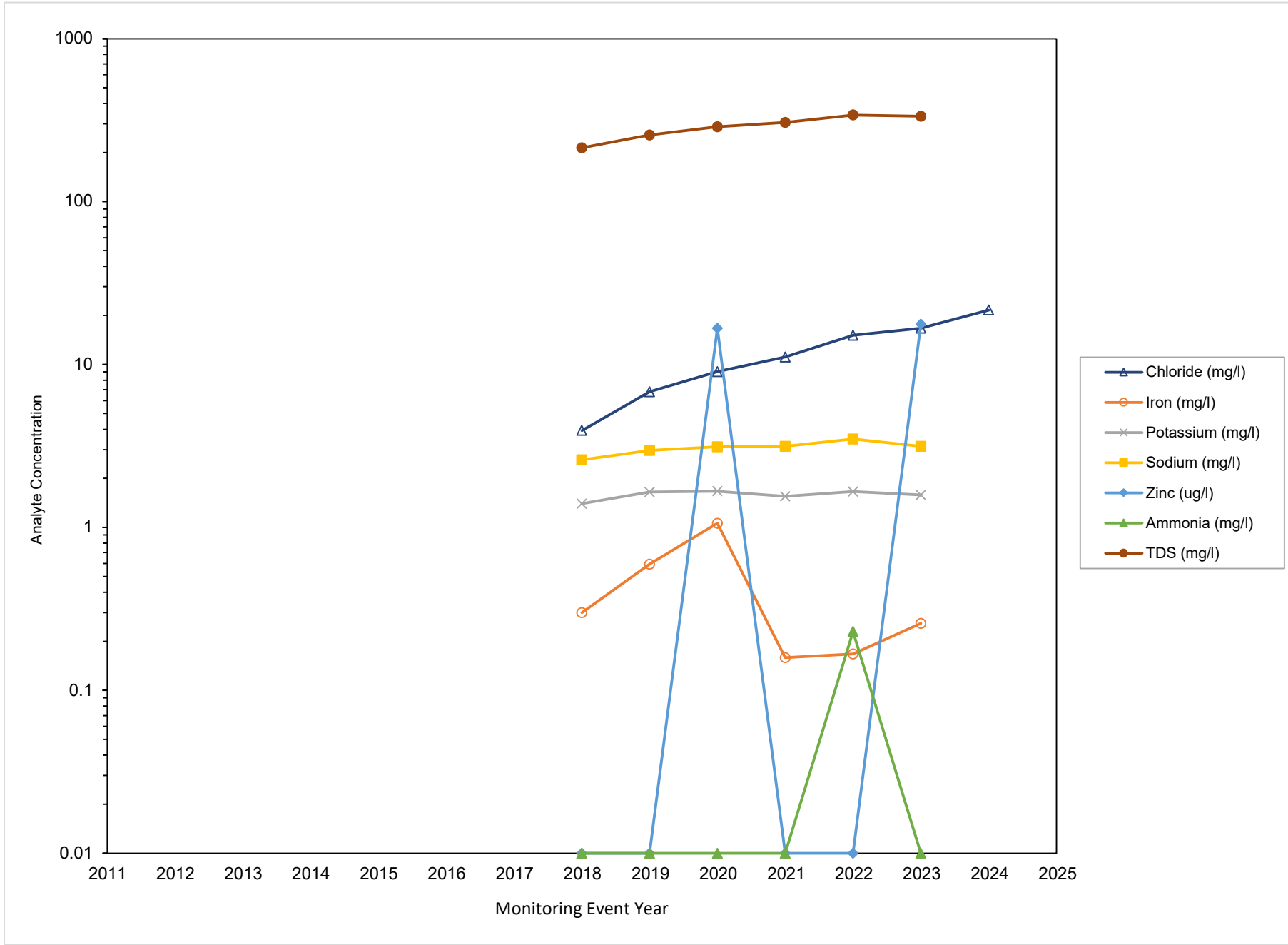
P-329L Leachate Indicator Trends



P-333L Leachate Indicator Trends

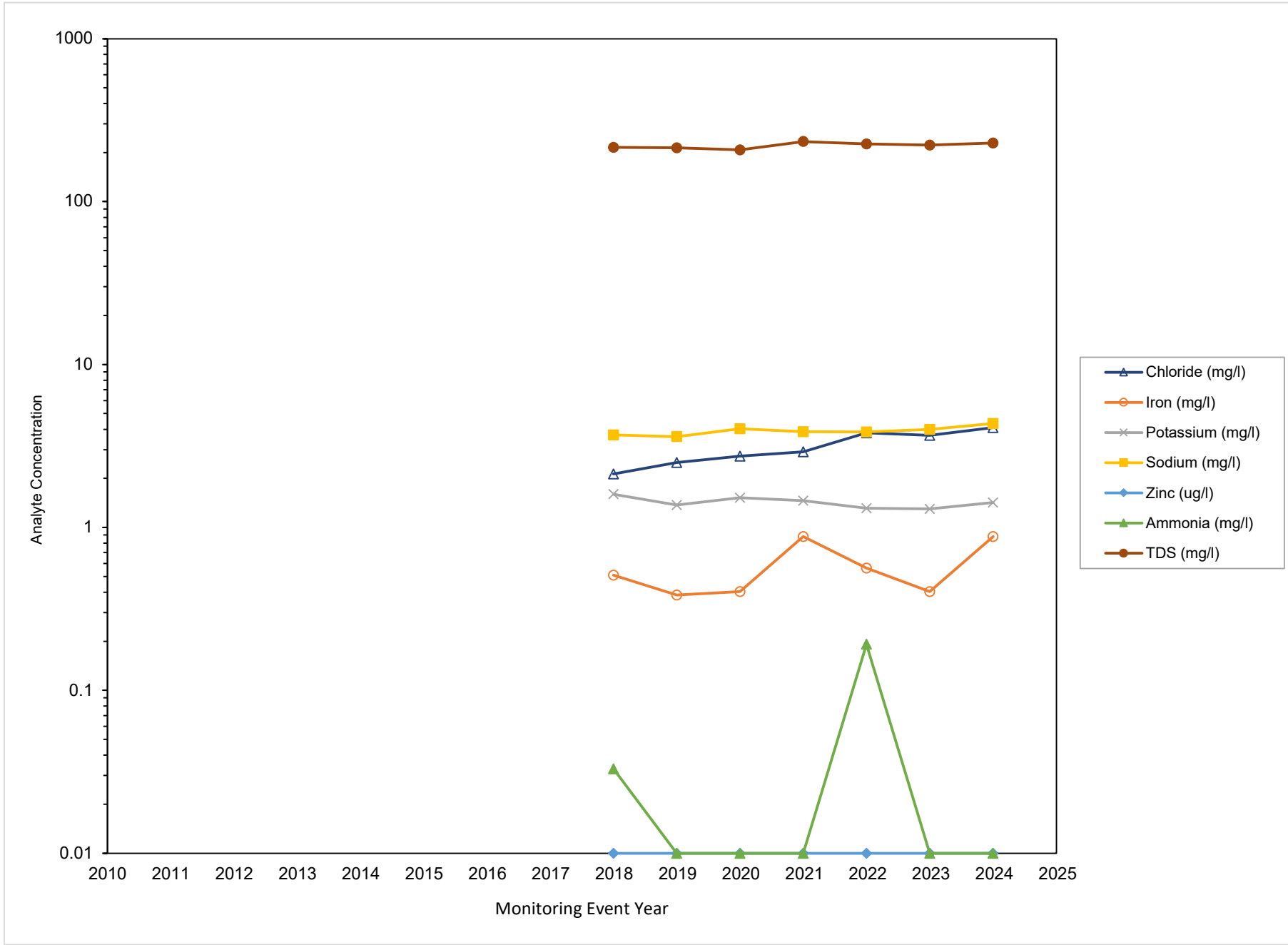


P-334L Leachate Indicator Trends

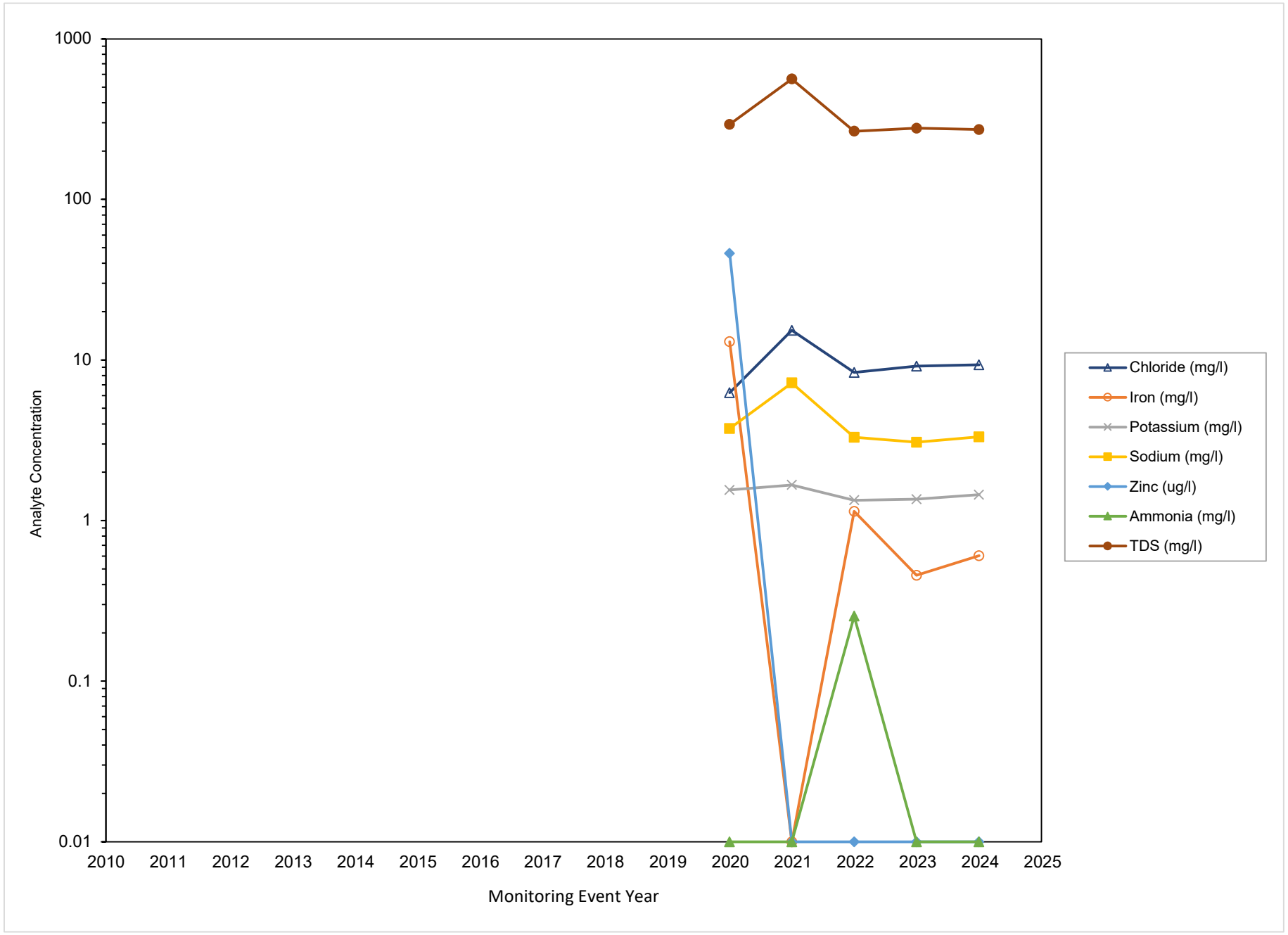


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P-335L Leachate Indicator Trends

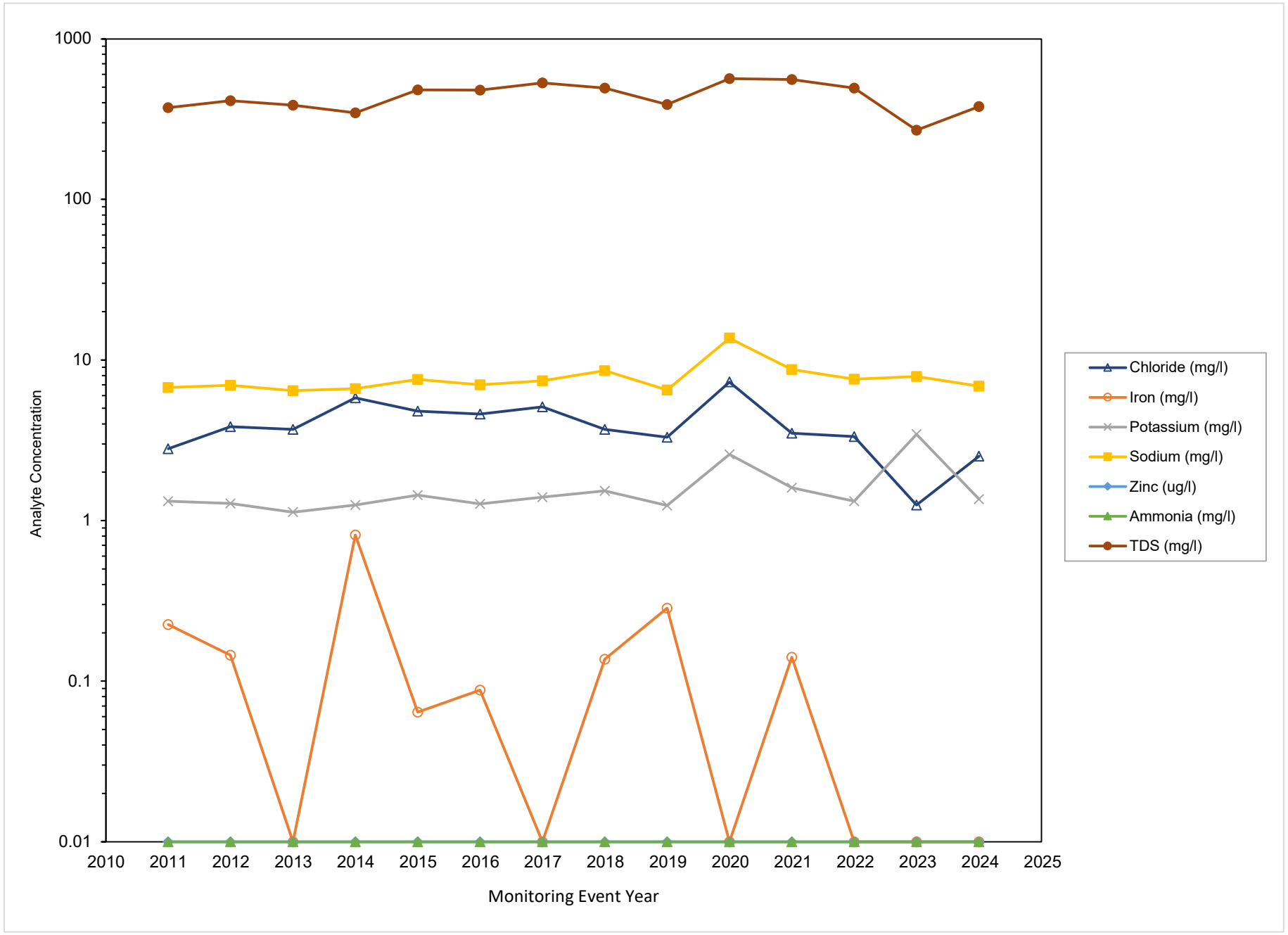


P-337L Leachate Indicator Trends

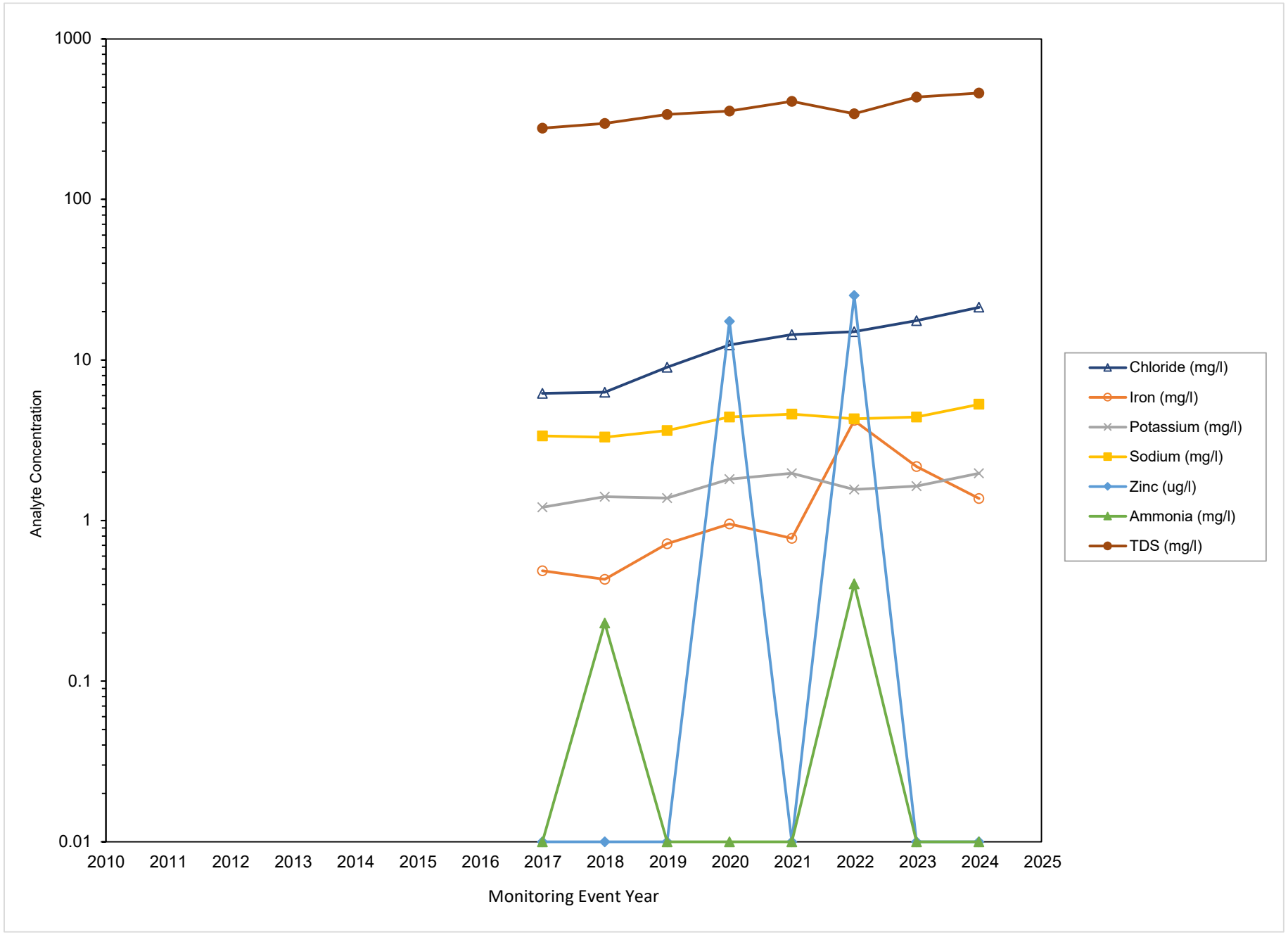


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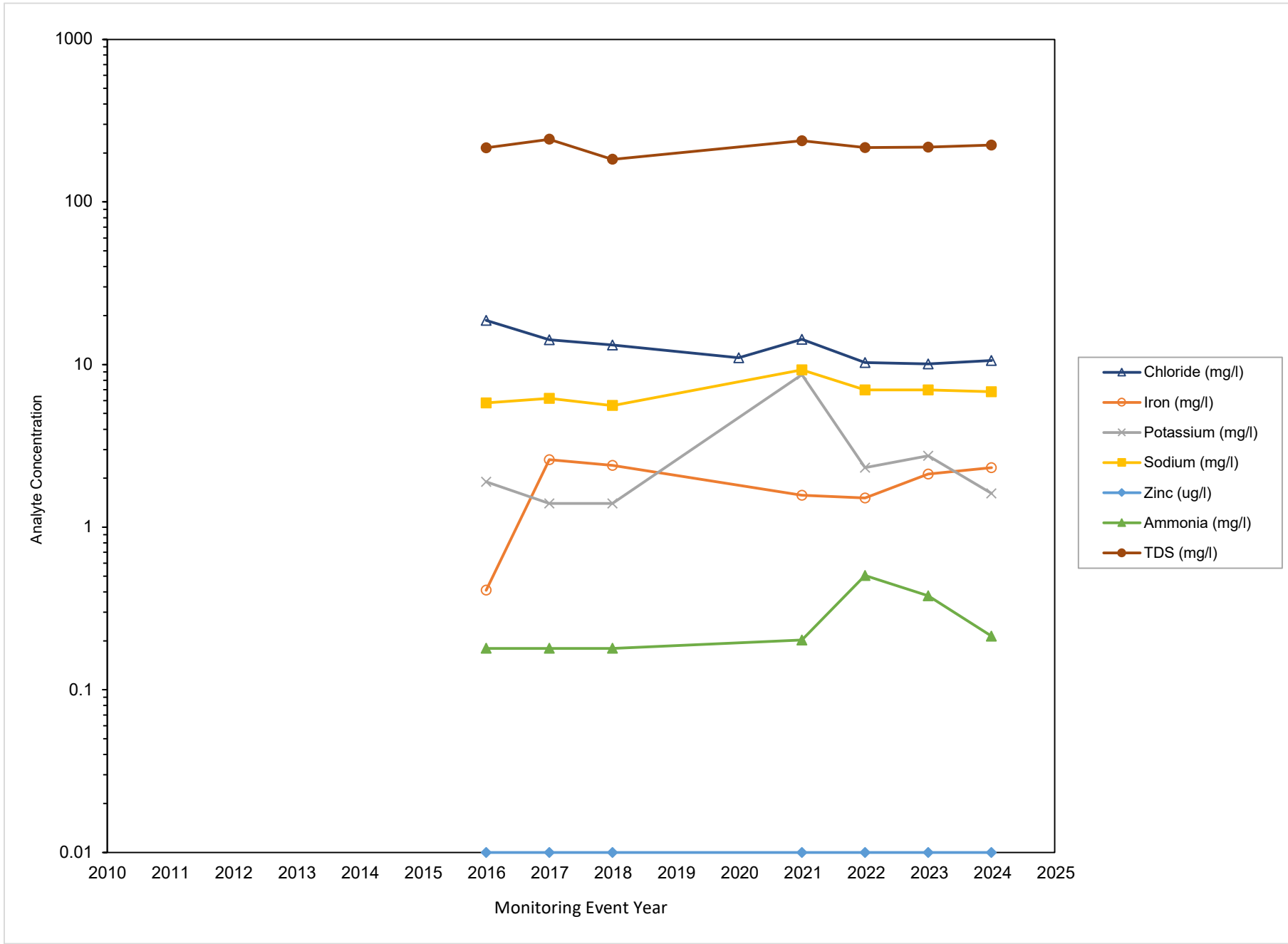
P-403C Leachate Indicator Trends



P694477 Leachate Indicator Trends

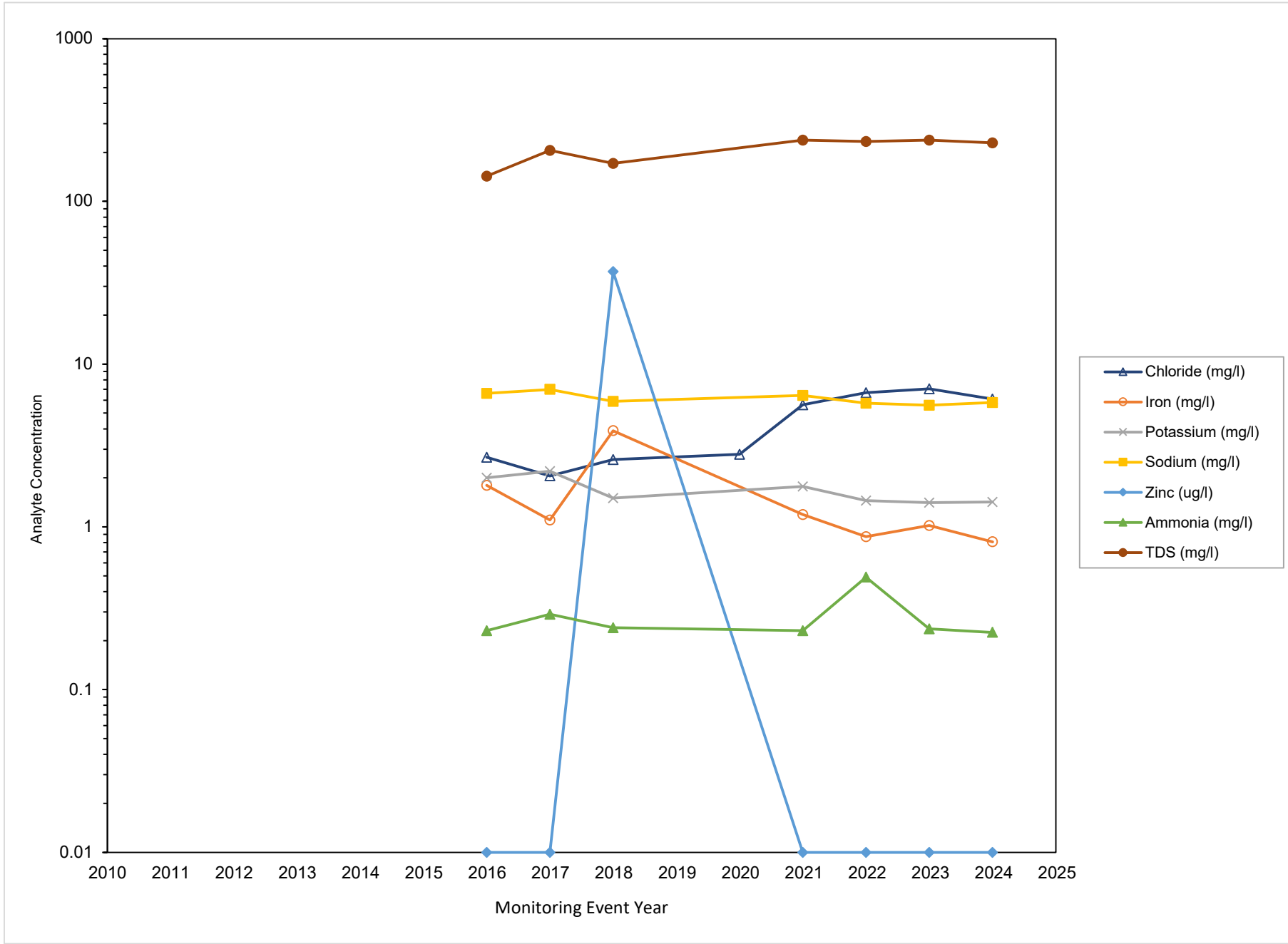


P-327L Leachate Indicator Trends

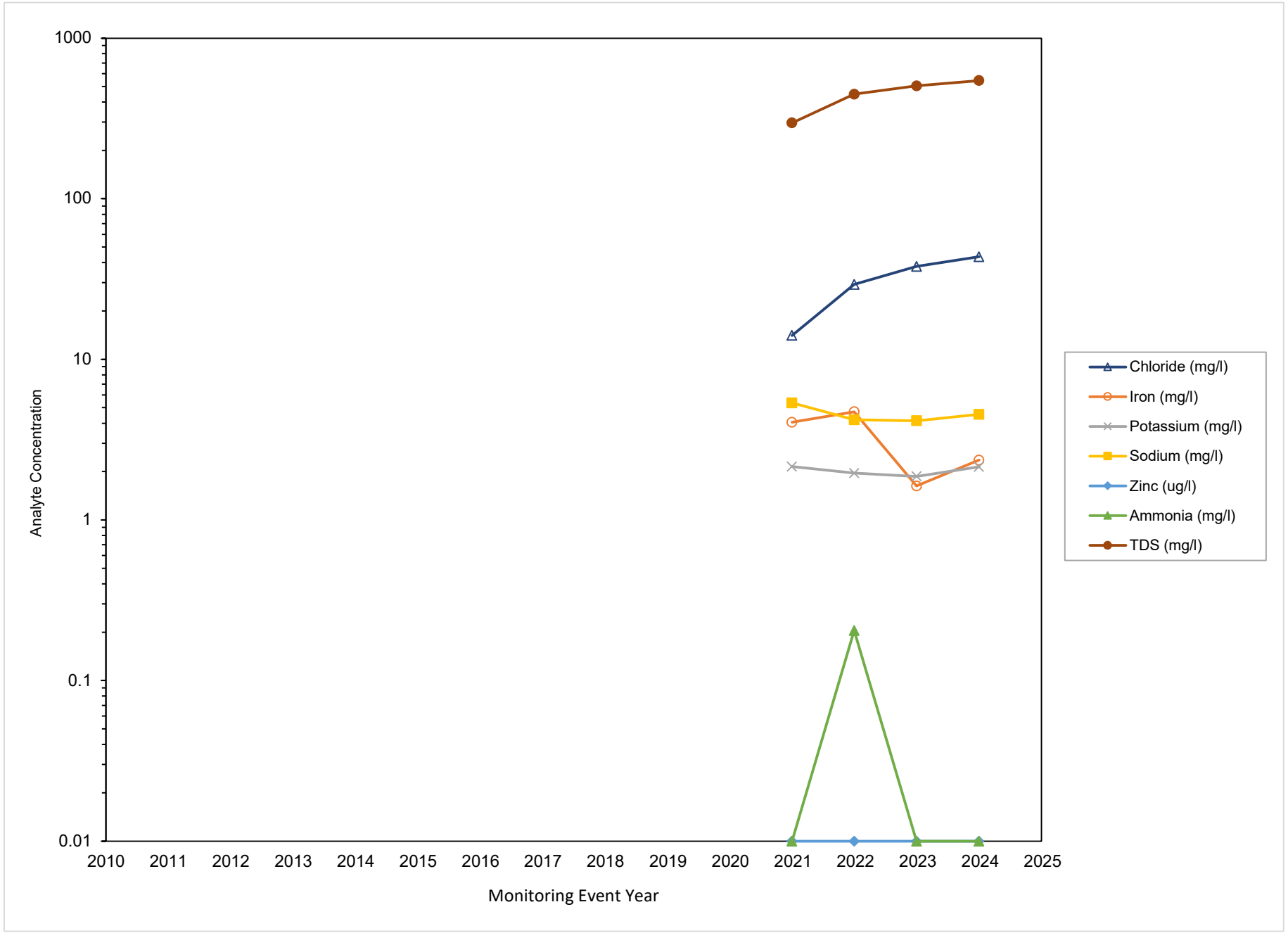


\\barr.com\projects\Mpls\23 MN\71\23711002 EMS Administration Elk River Landfill\2024\WorkFiles\MPCA GW Reports\Annual\Appendix C - LITs\2024_Leachate_Indicator_Plots.xlsx

P-328L Leachate Indicator Trends

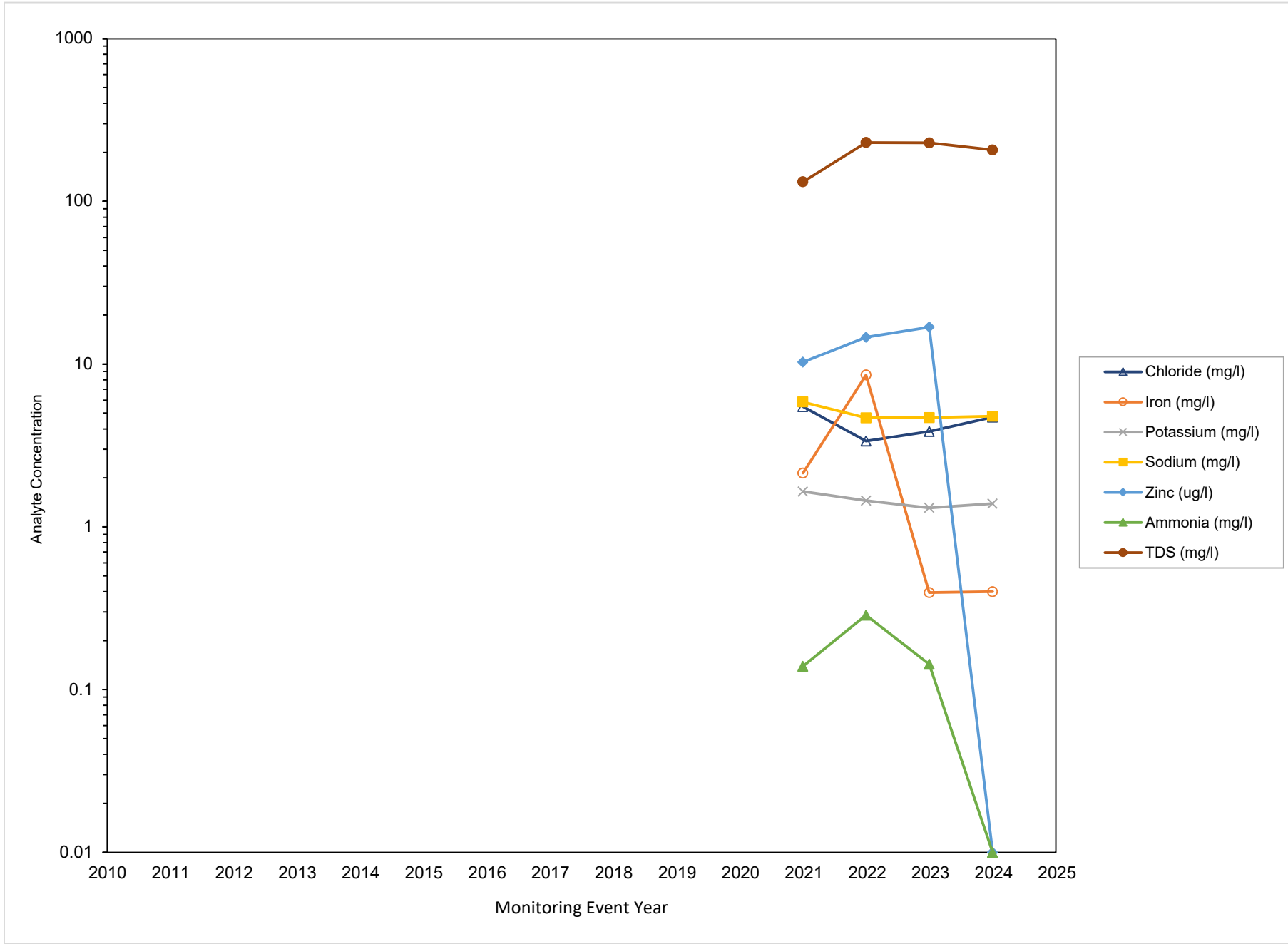


P-338L Leachate Indicator Trends



\\barr.com\projects\Mpls\23 MN\71\23711002 EMS Administration Elk River Landfill\2024\WorkFiles\MPCA GW Reports\Annual\Appendix C - LITs\2024_Leachate_Indicator_Plots.xlsx

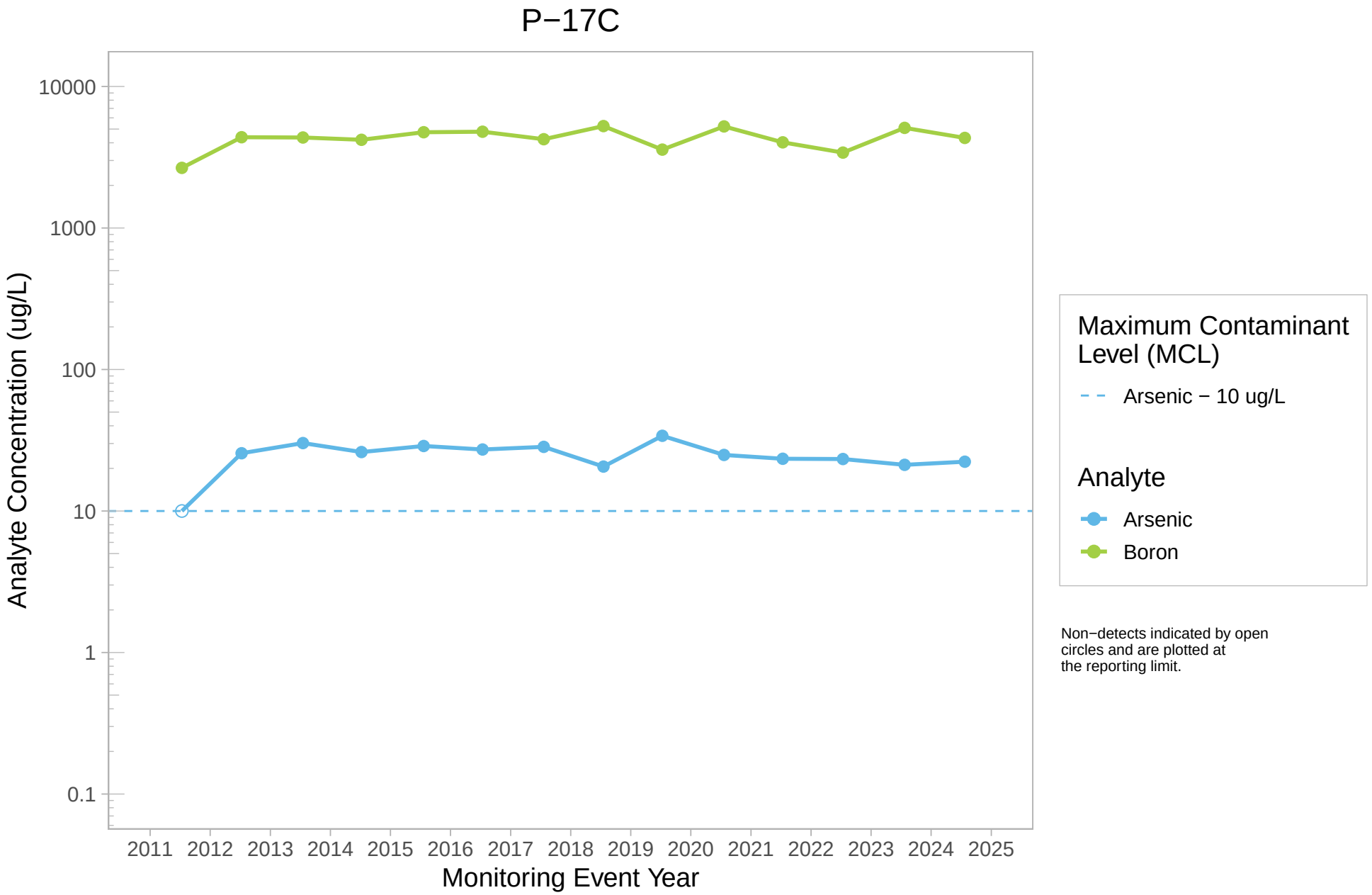
P-340L Leachate Indicator Trends

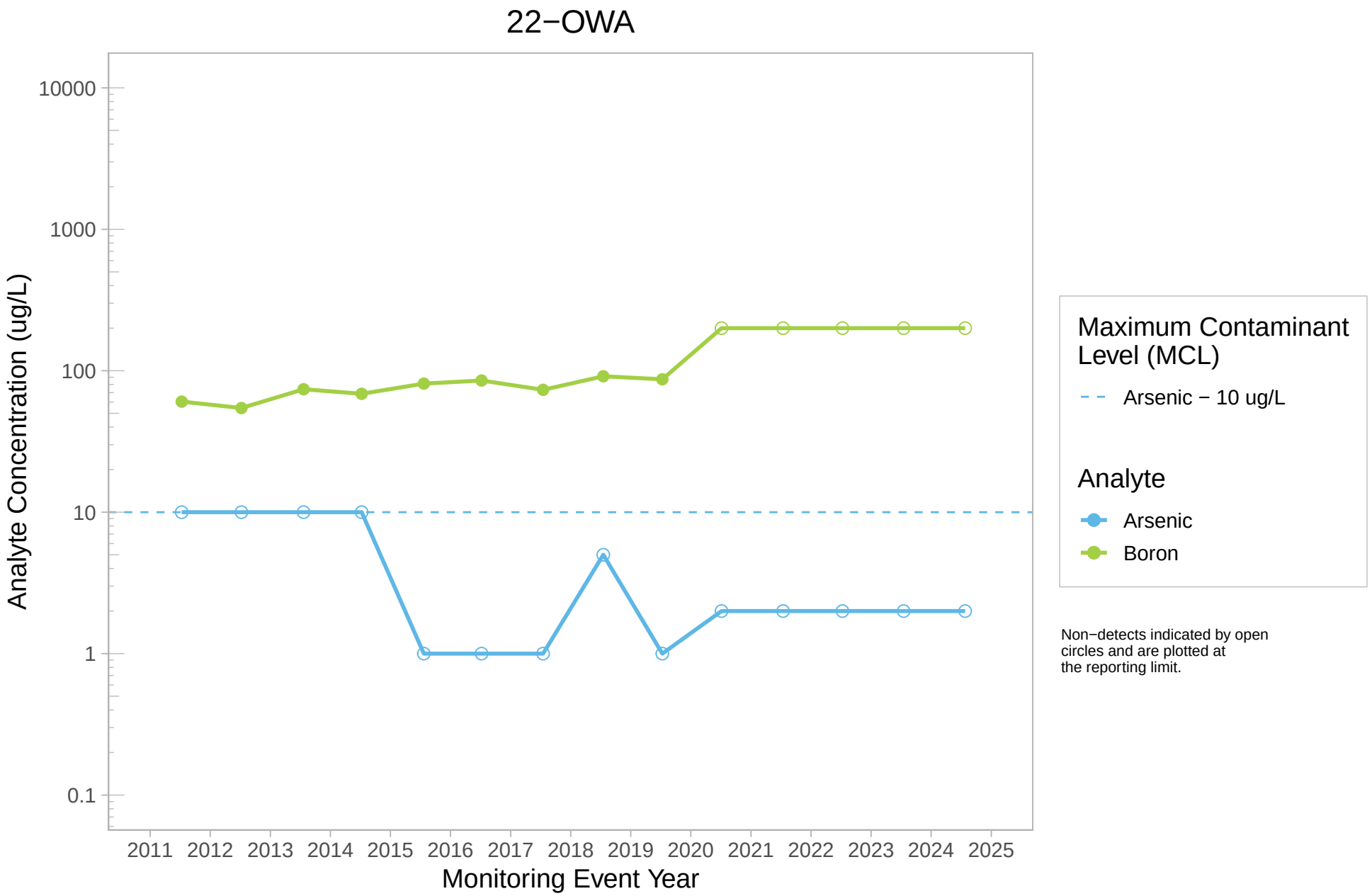


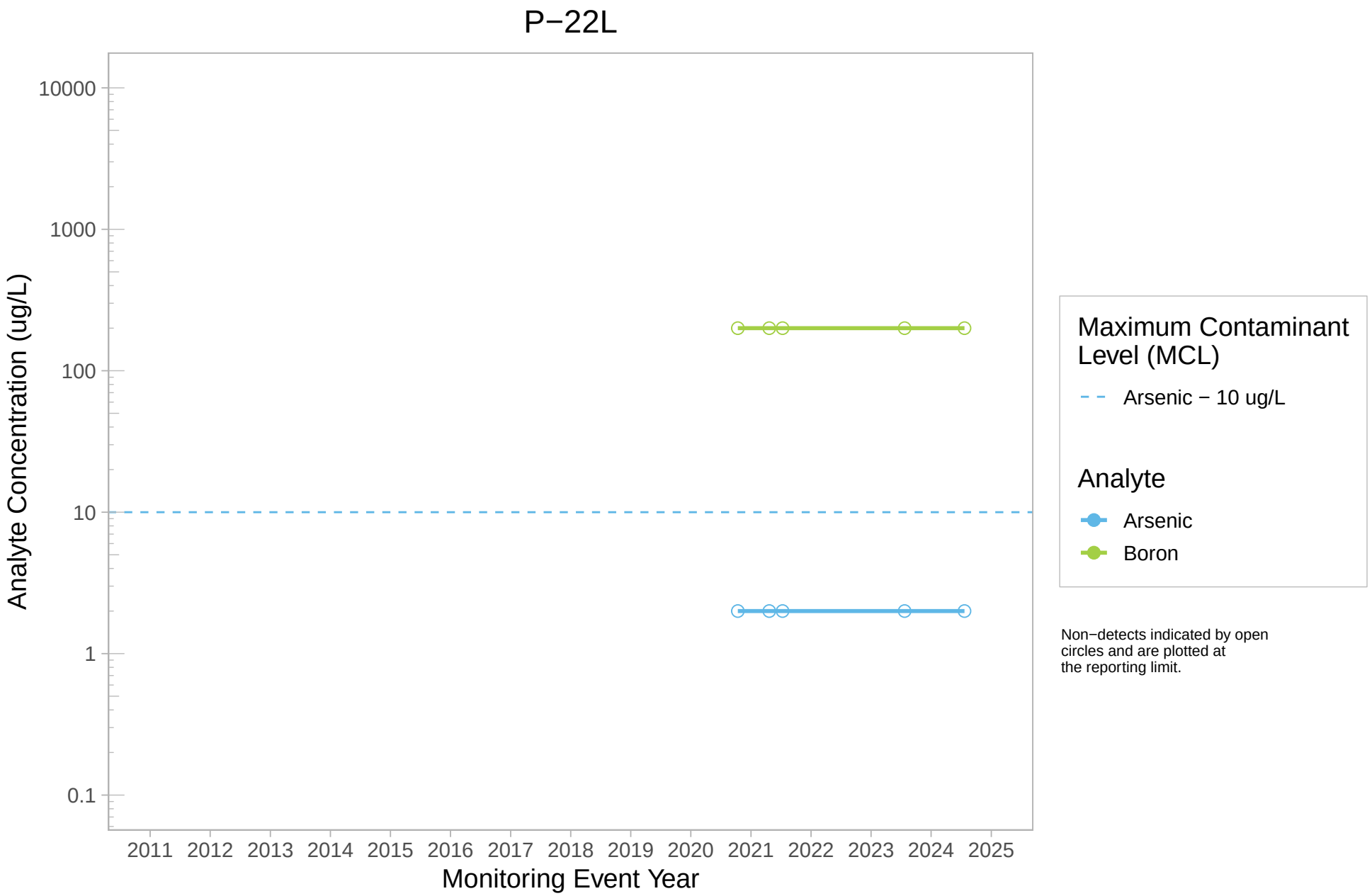
\\barr.com\projects\Mpls\23 MN\71\23711002 EMS Administration Elk River Landfill\2024\WorkFiles\MPCA GW Reports\Annual\Appendix C - LITs\2024_Leachate_Indicator_Plots.xlsx

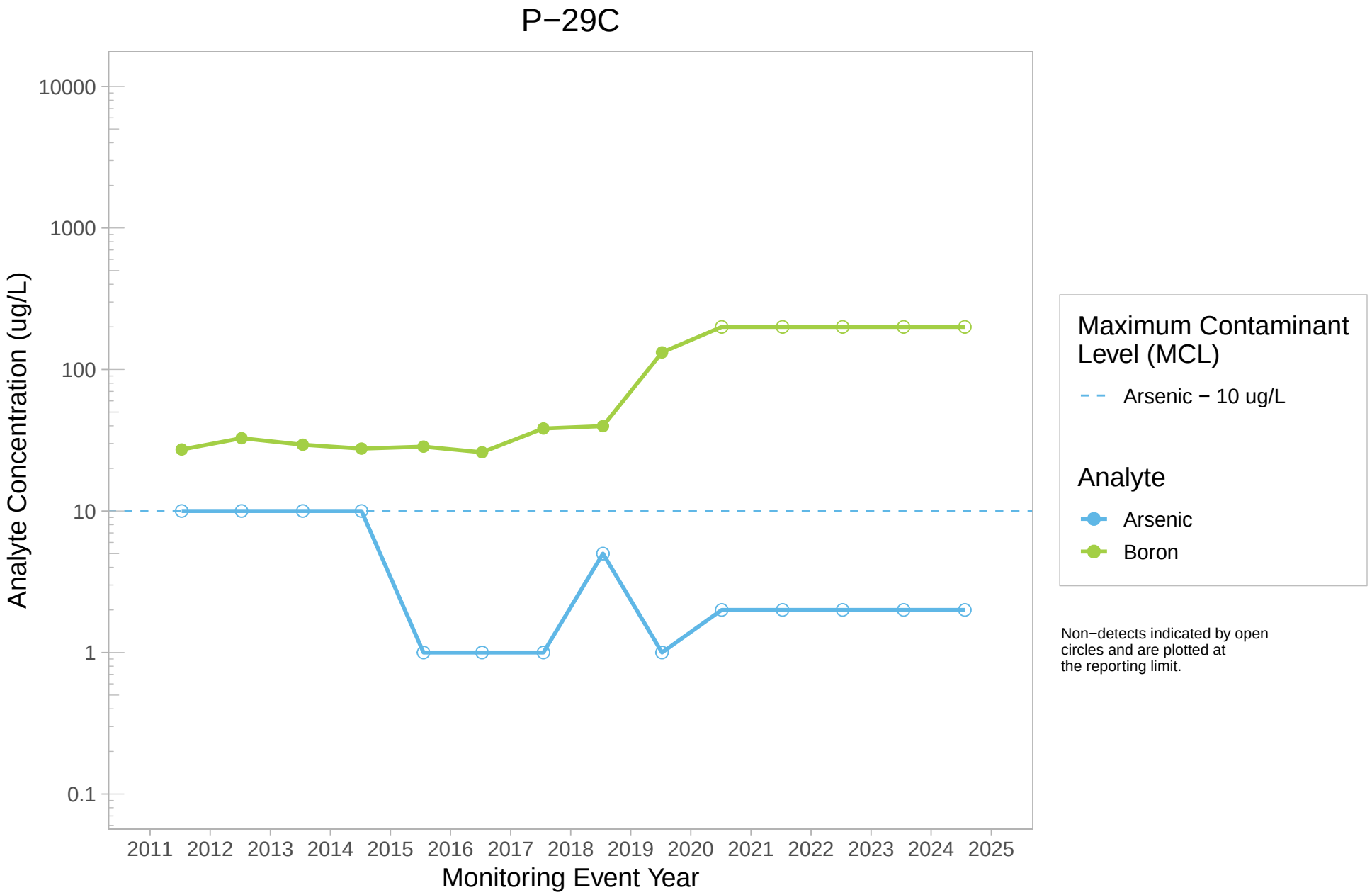
Appendix D

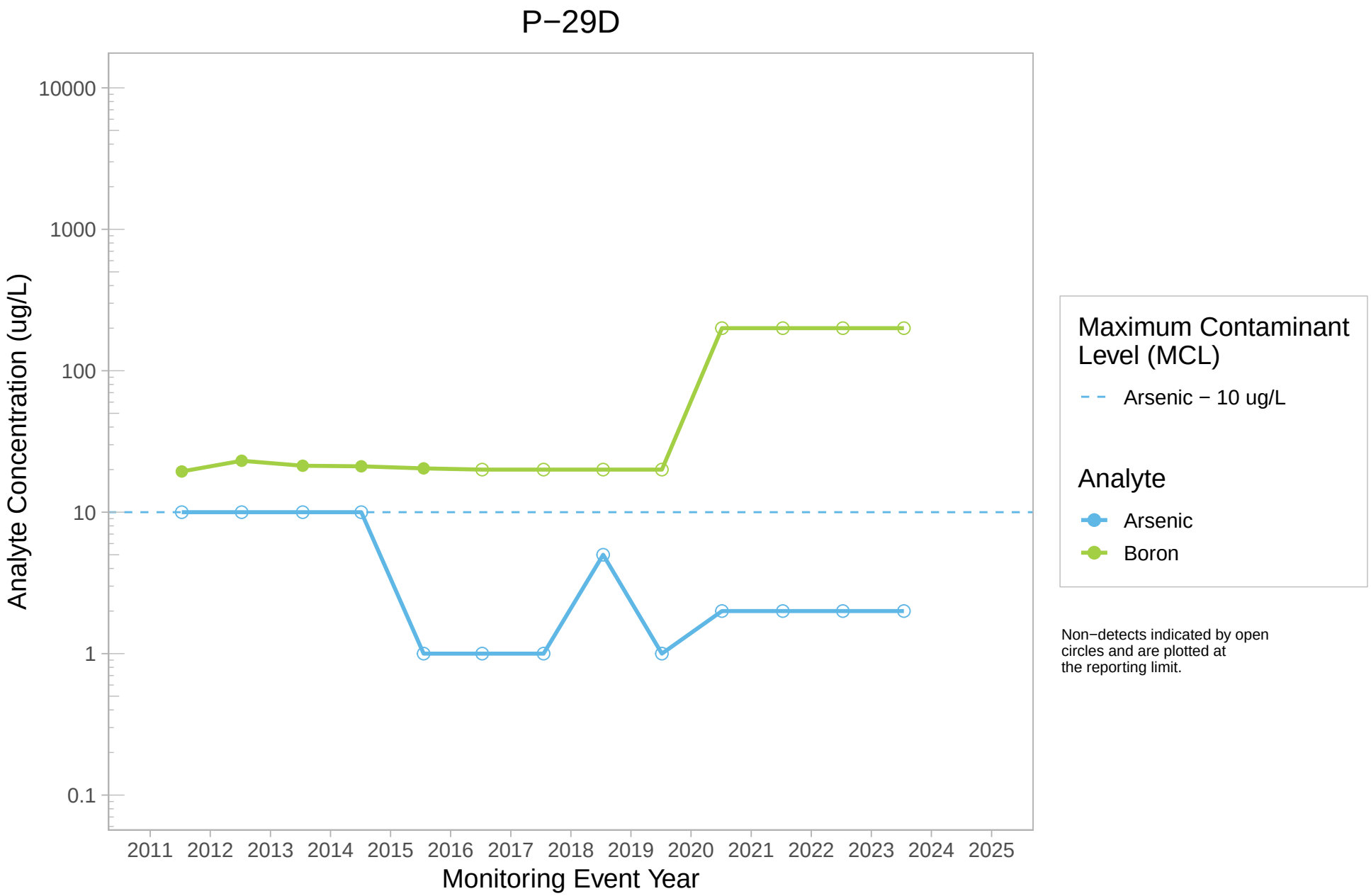
Parameter Concentration Trends

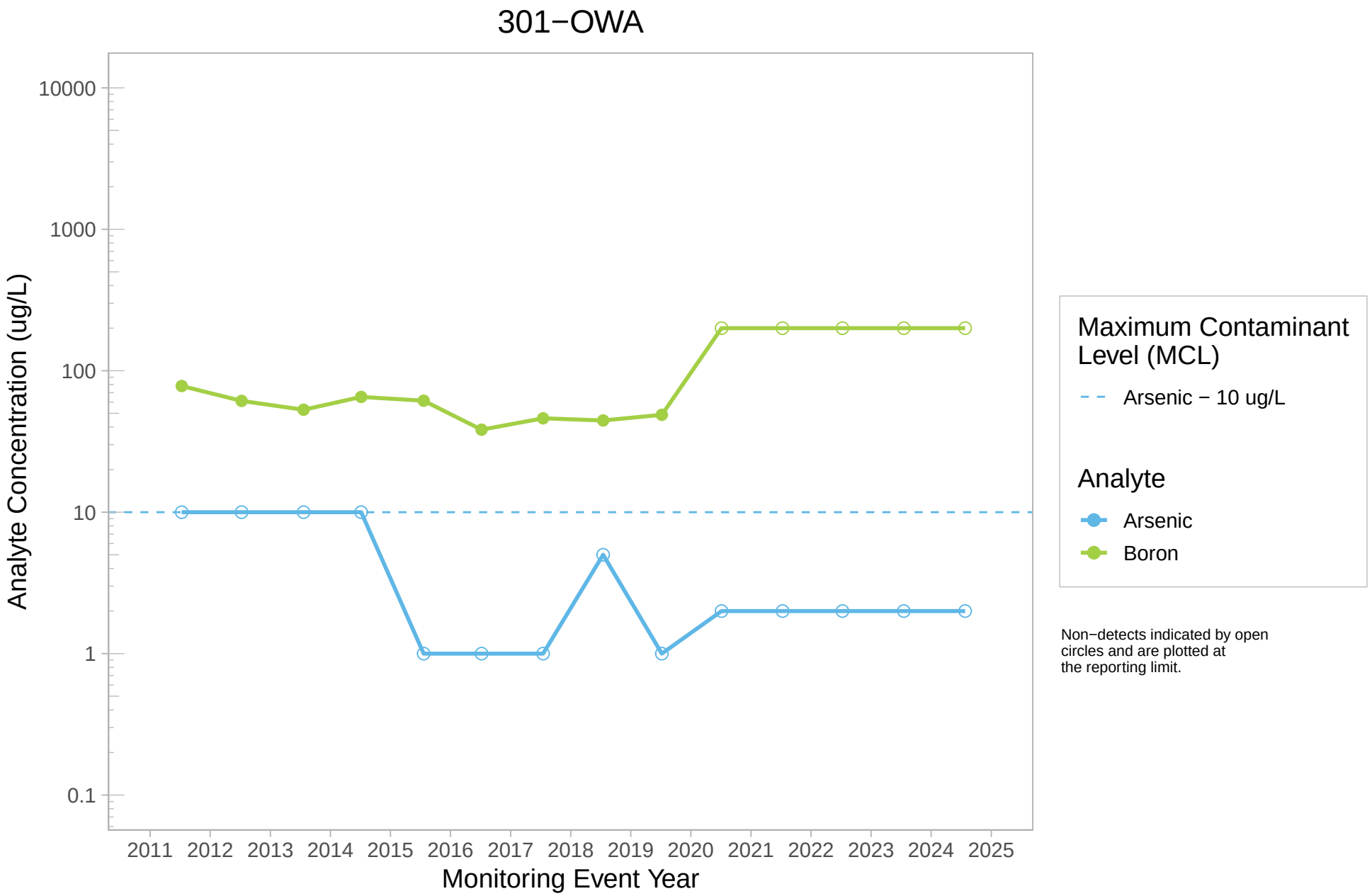

P−17C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

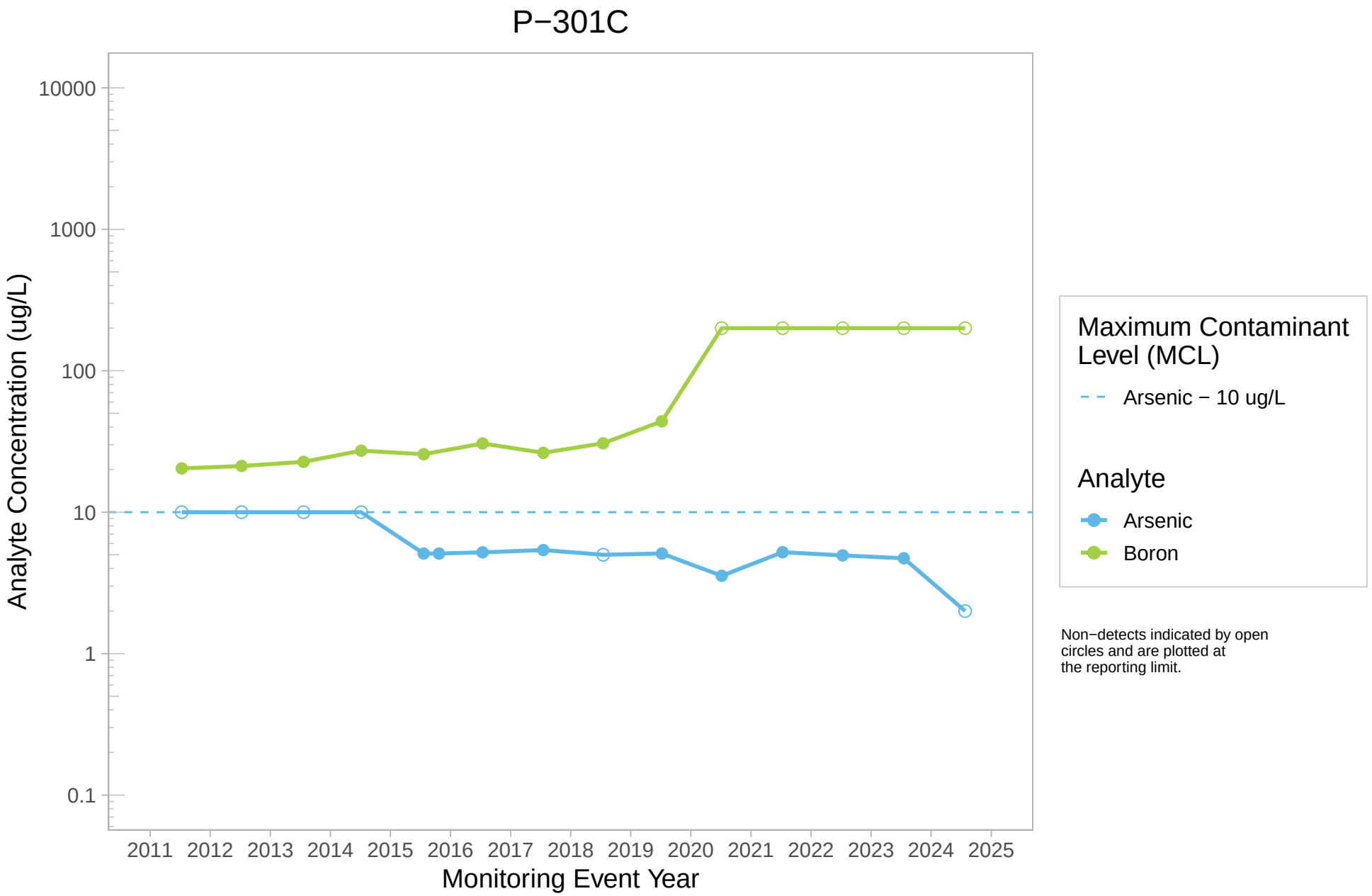

22−OWA
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

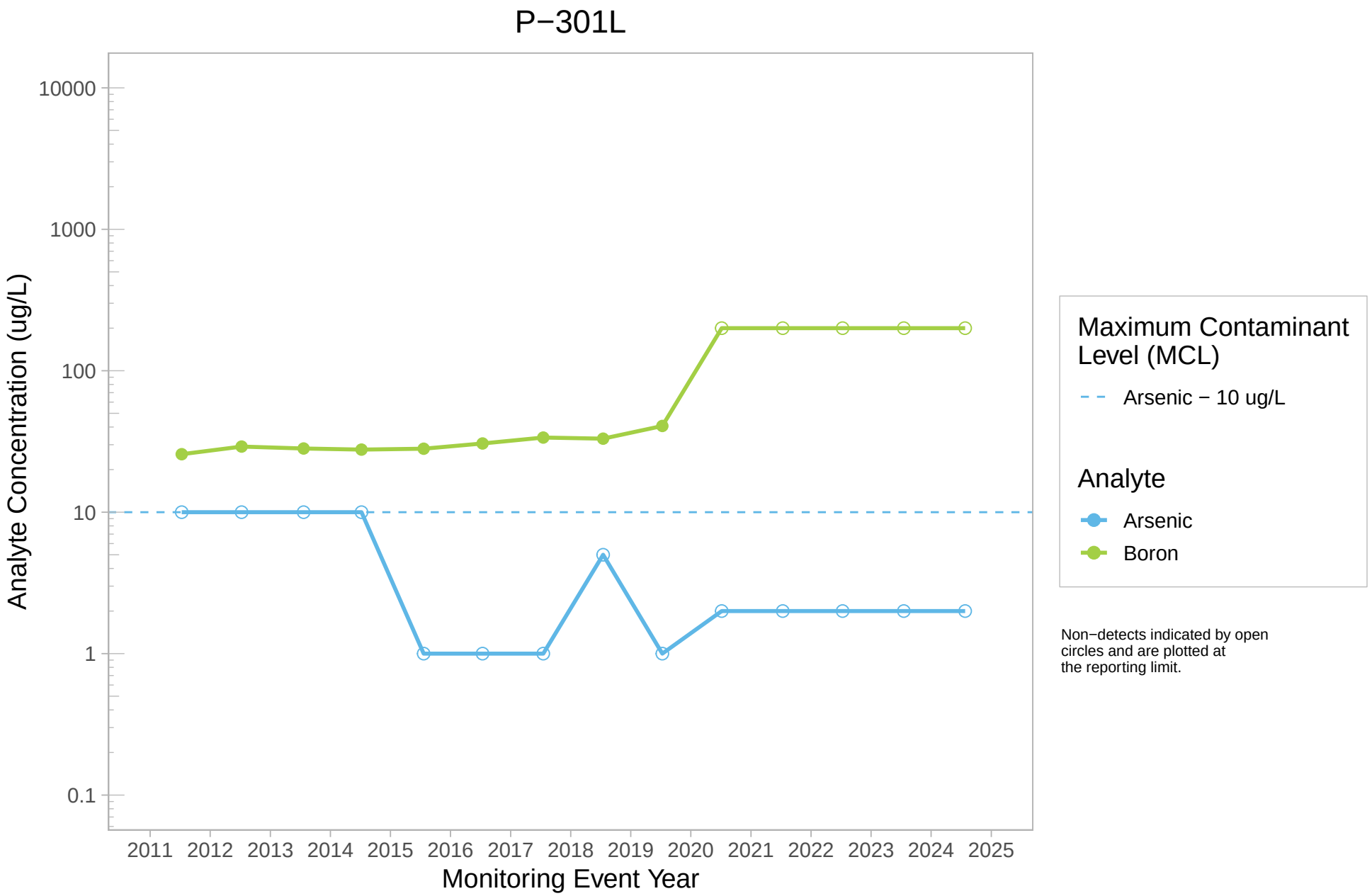

P−22L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

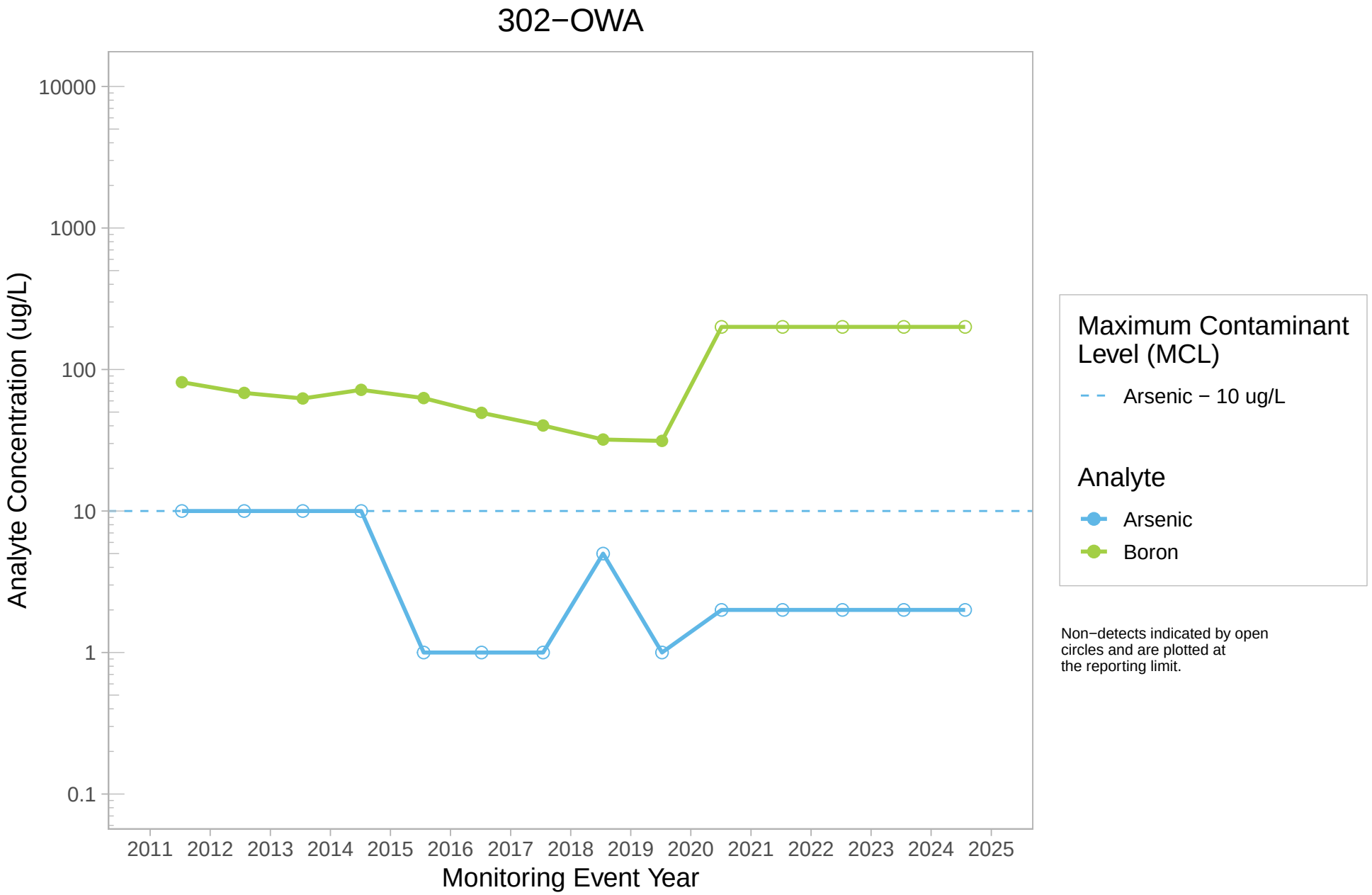

P−29C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

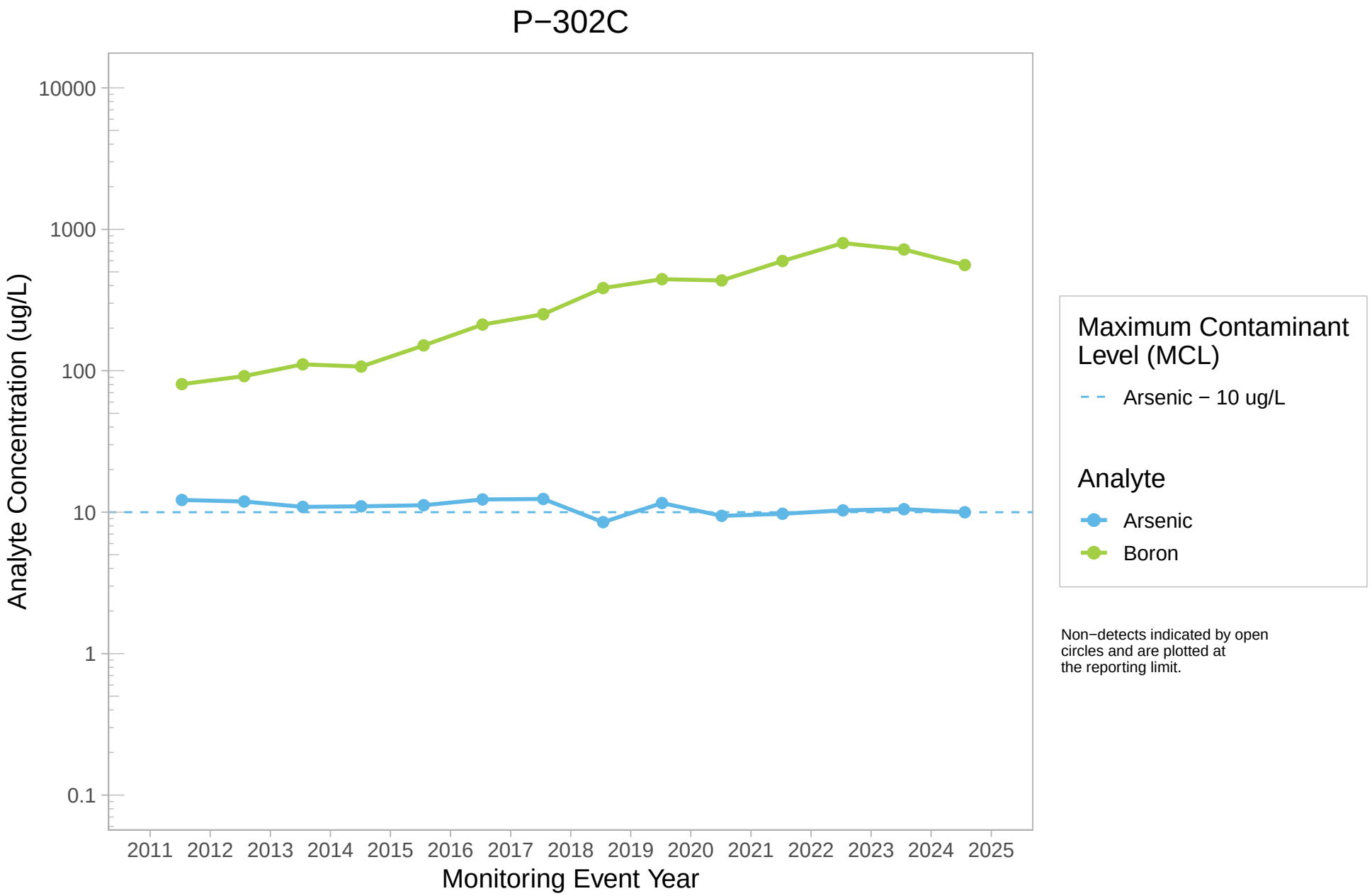

P−29D
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

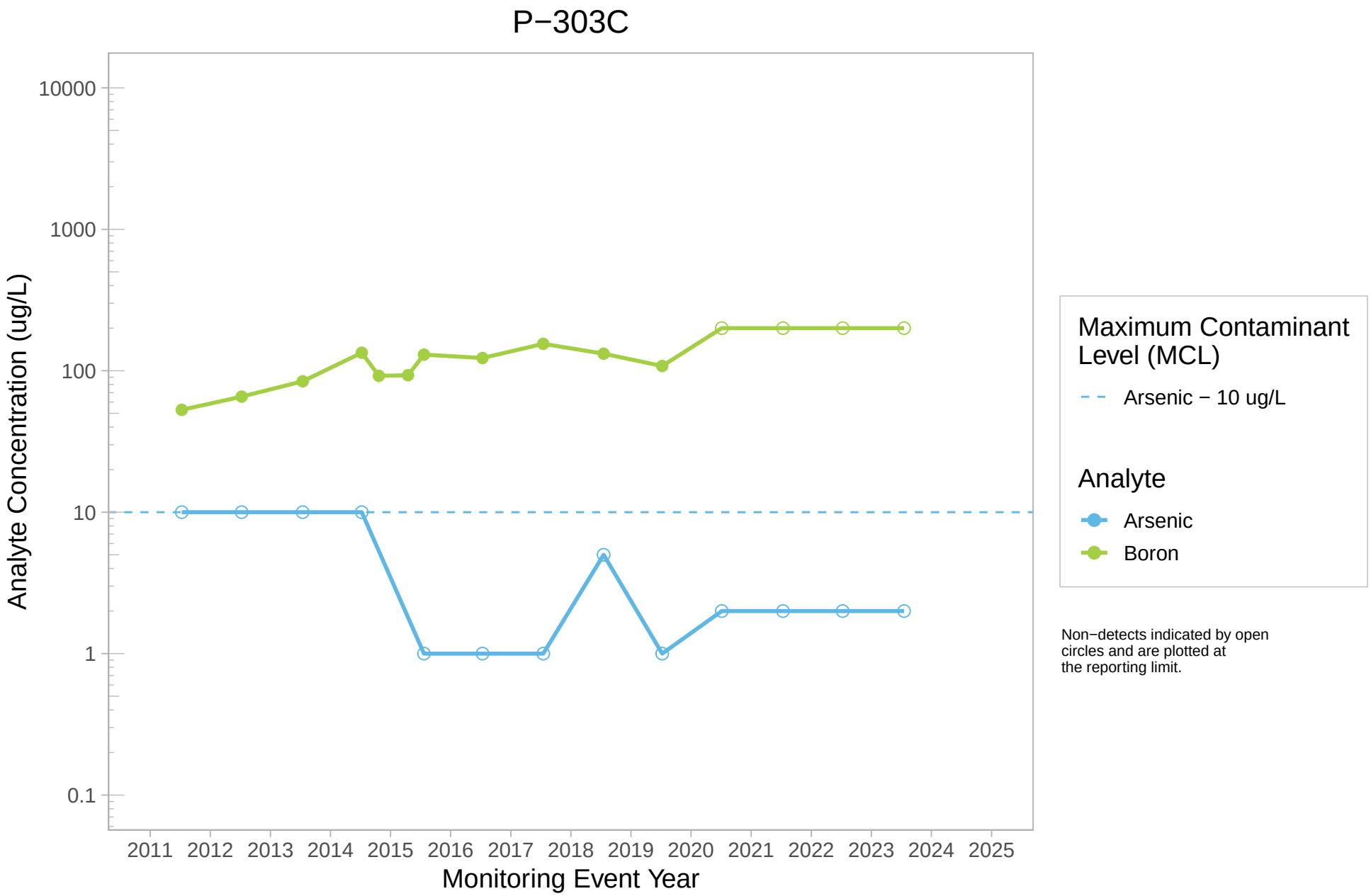

301−OWA
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

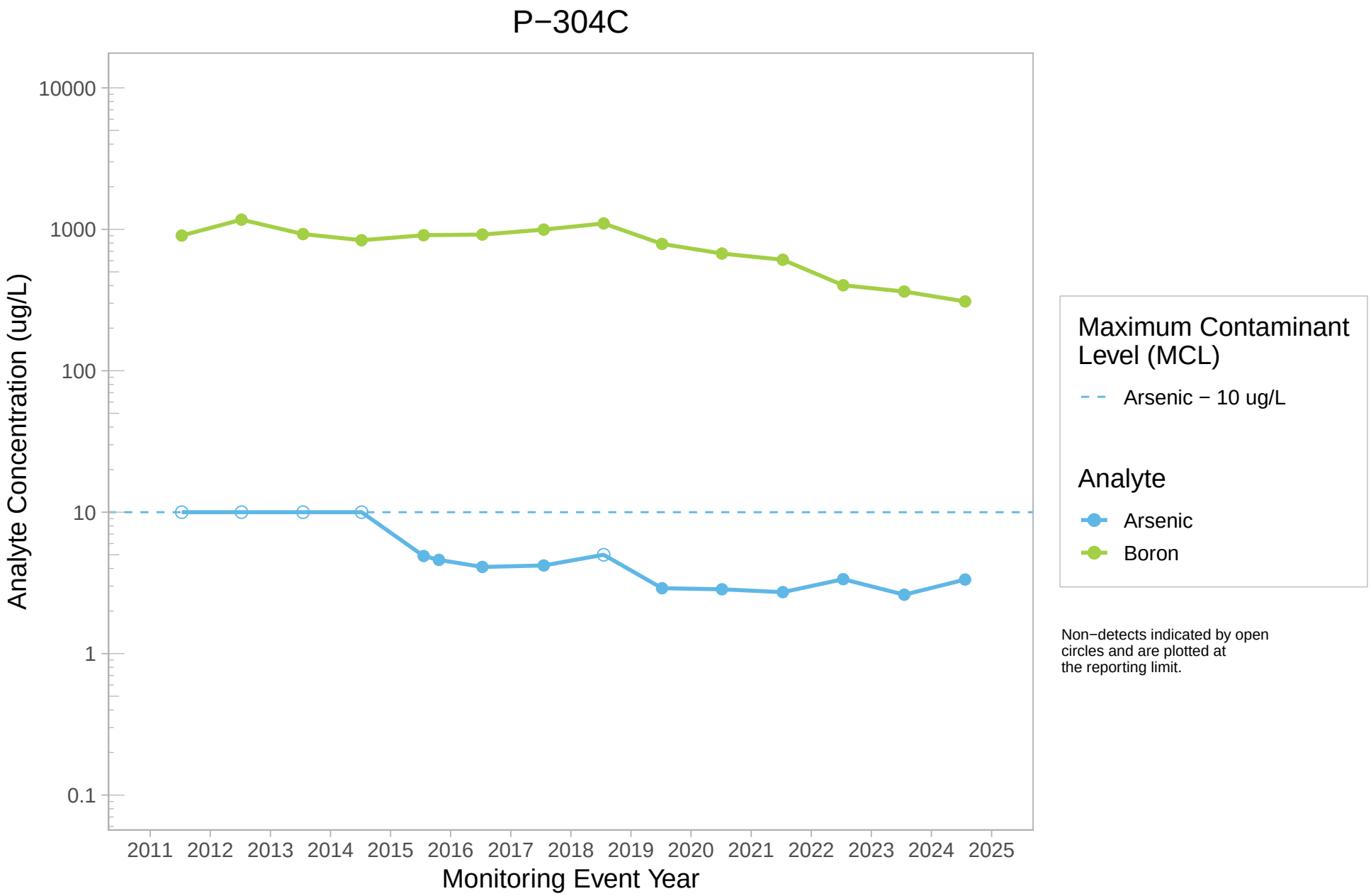

P−301C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

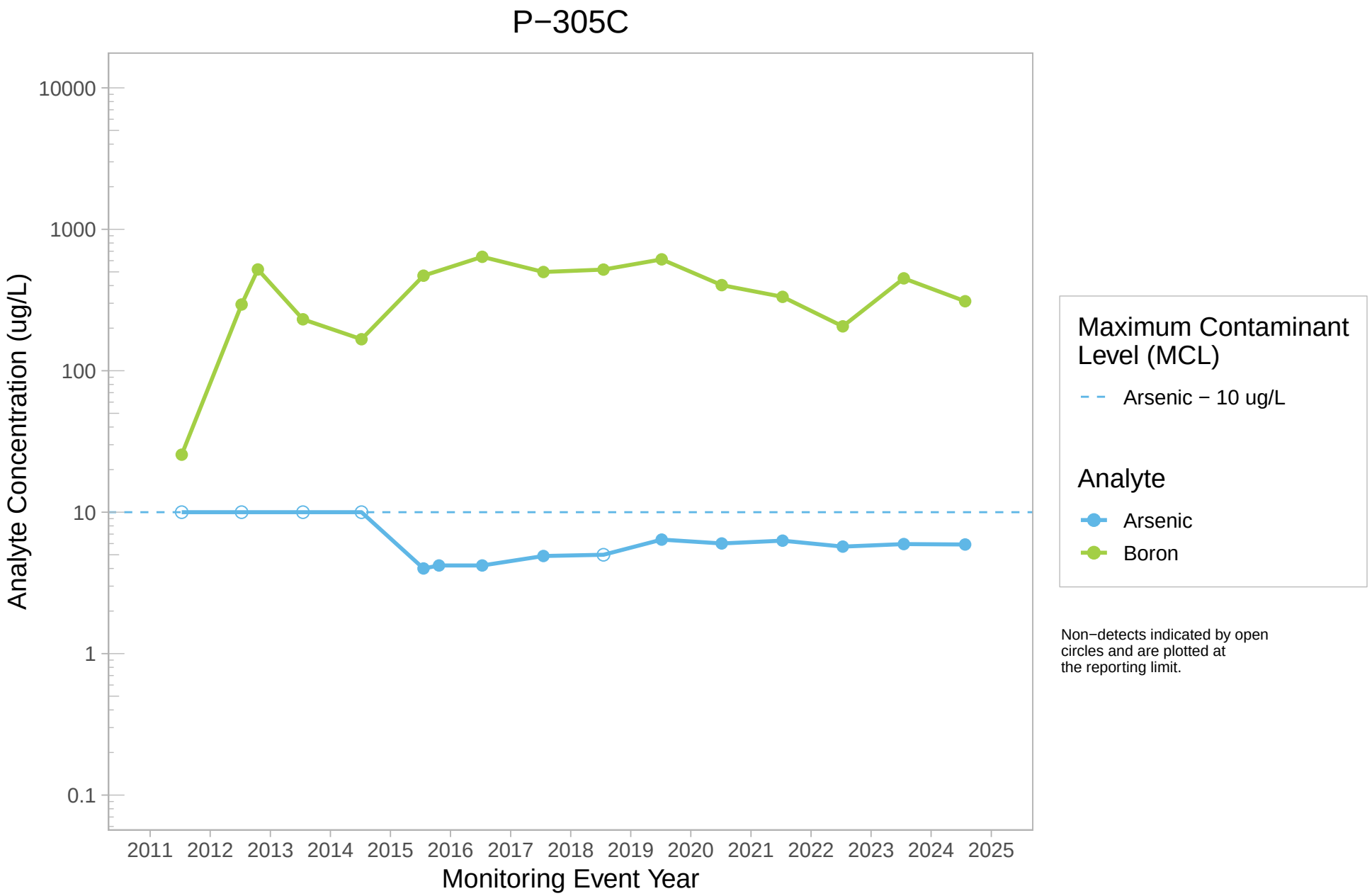

P−301L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

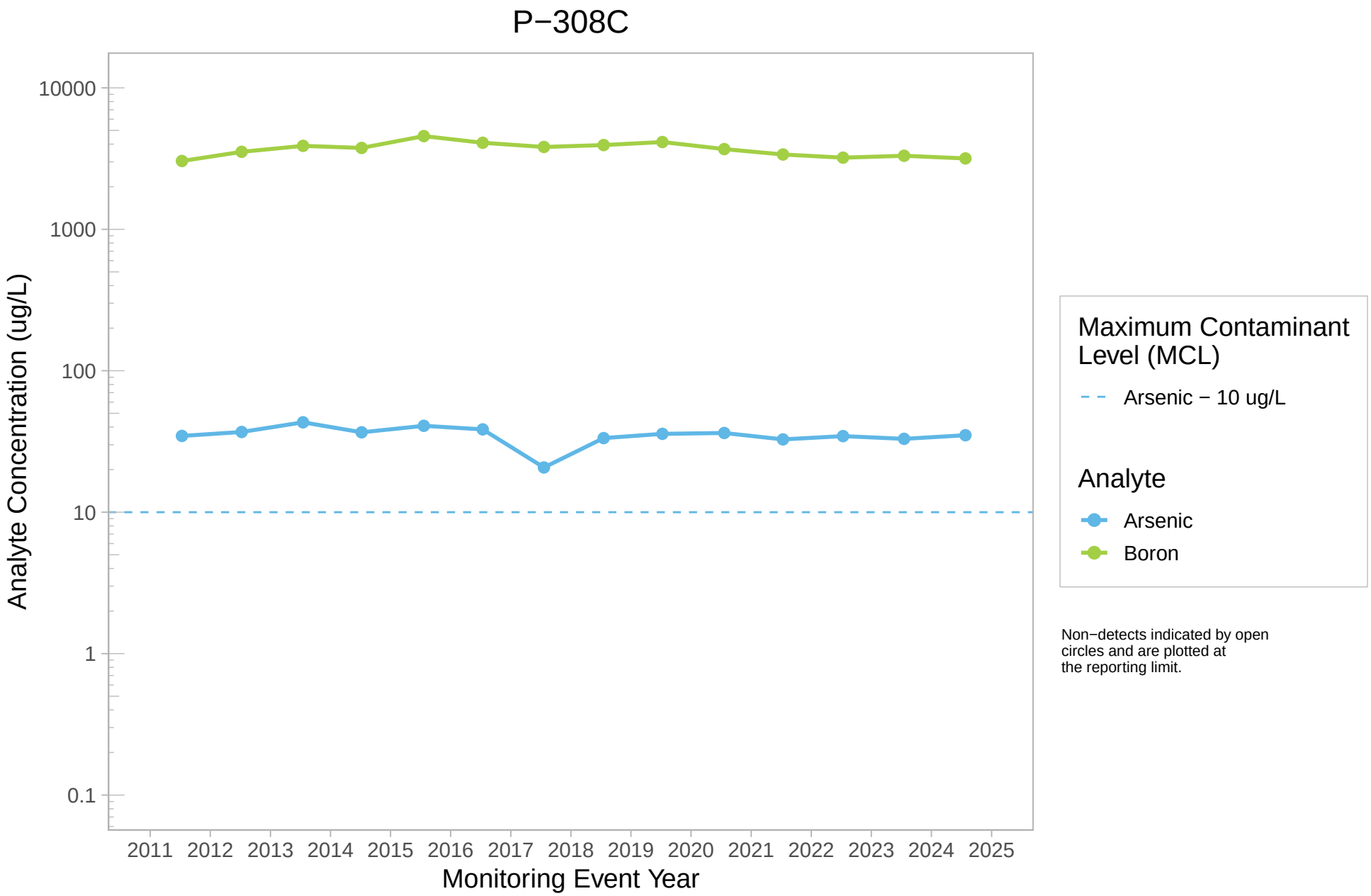

302−OWA
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

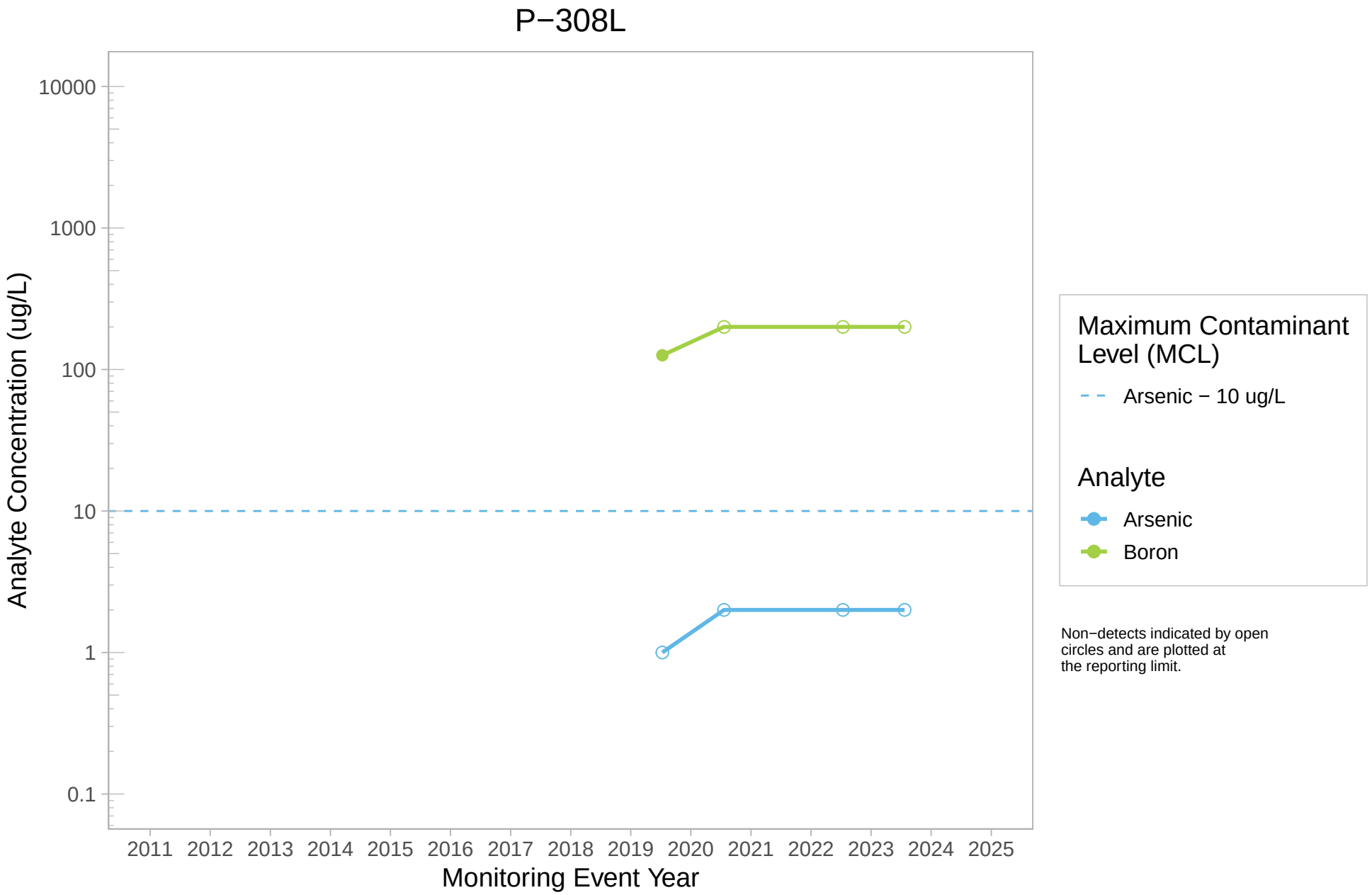

P−302C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

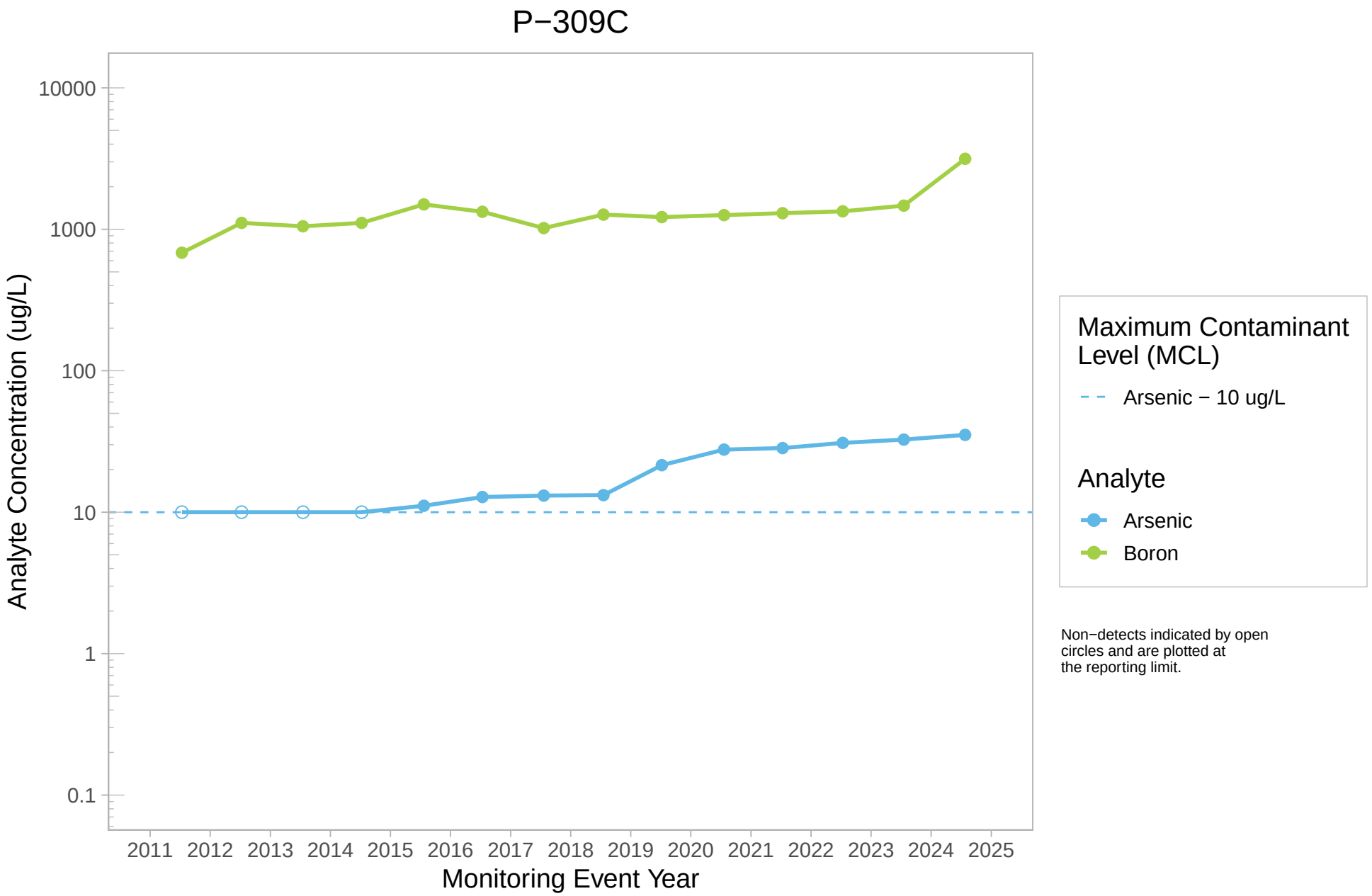

P−303C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

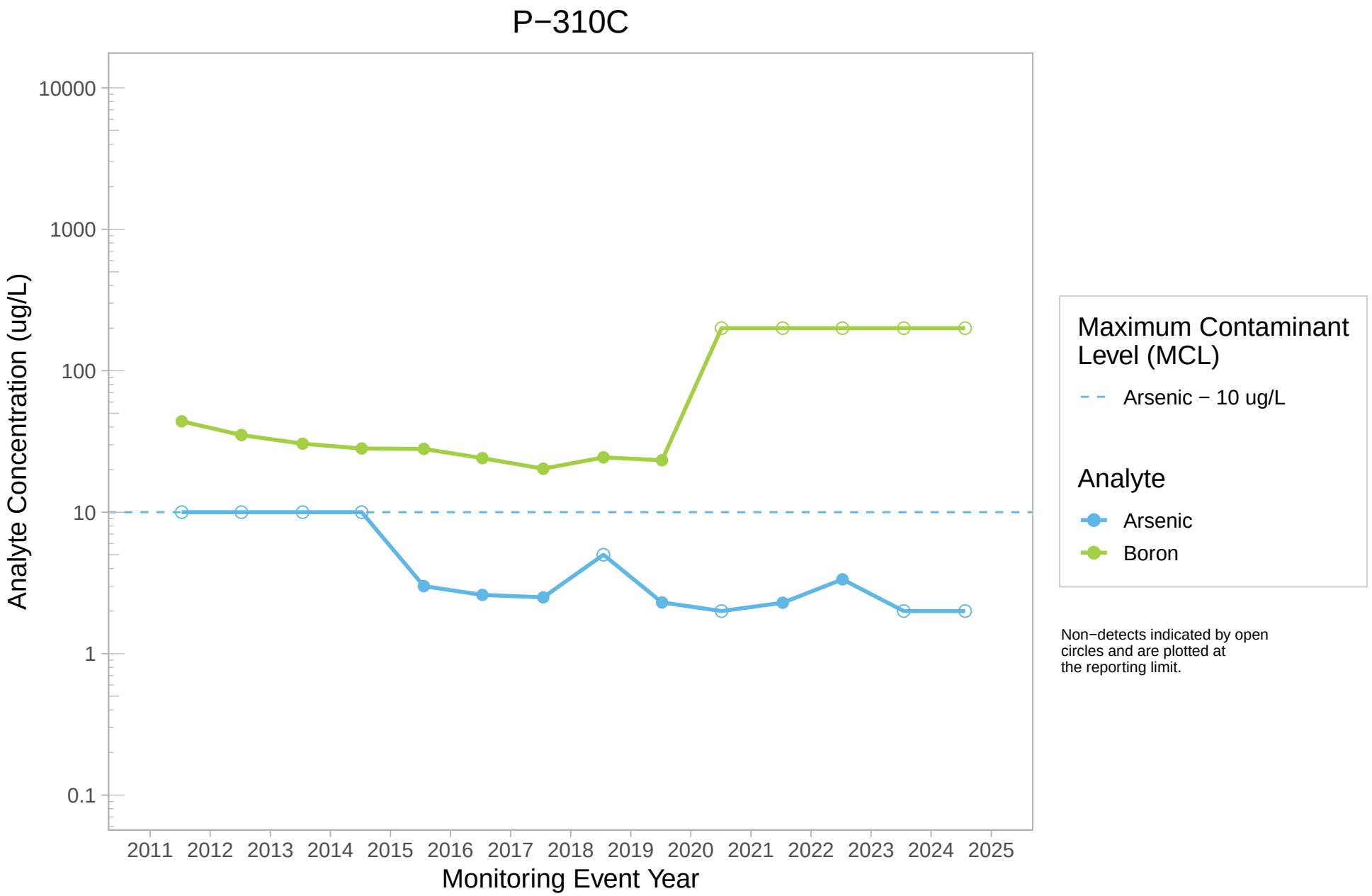

P−304C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

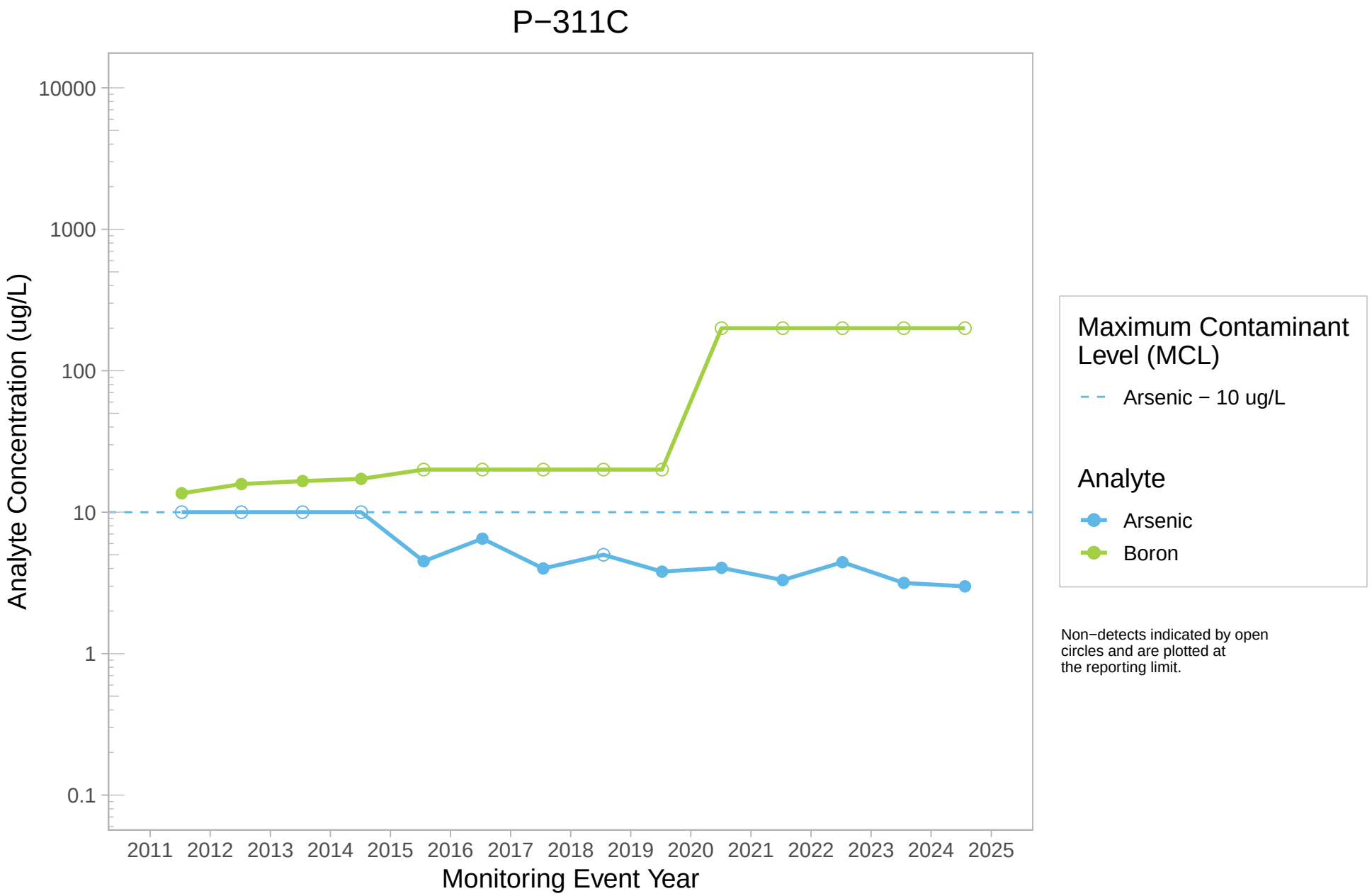

P−305C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.


P−308C
10000
1000
100
10
1
0.1
Analyte Concentration (ug/L)
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

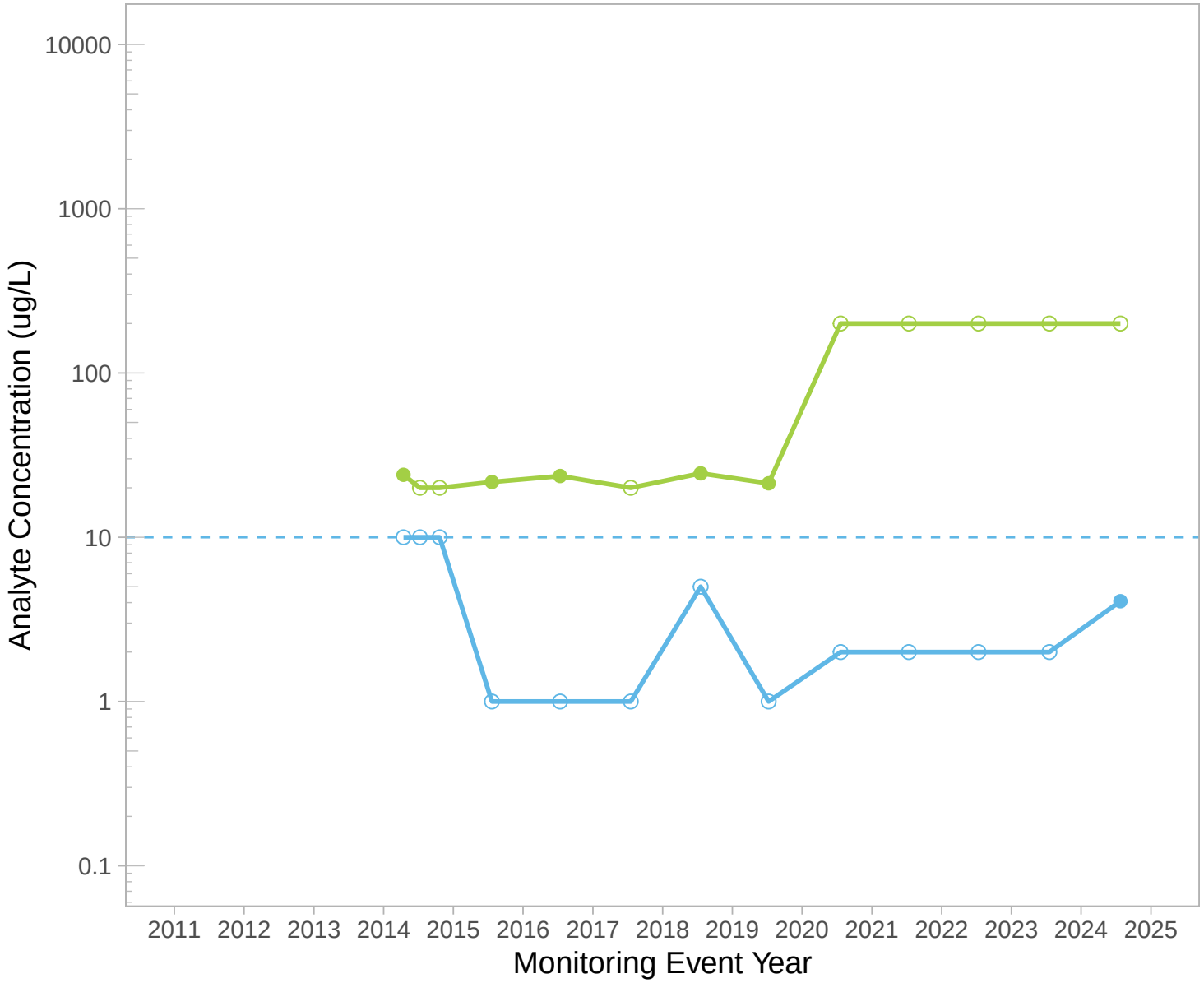

P−308L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.


P−309C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.


P−310C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.


P−311C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

P−311L



Maximum Contaminant Level (MCL)

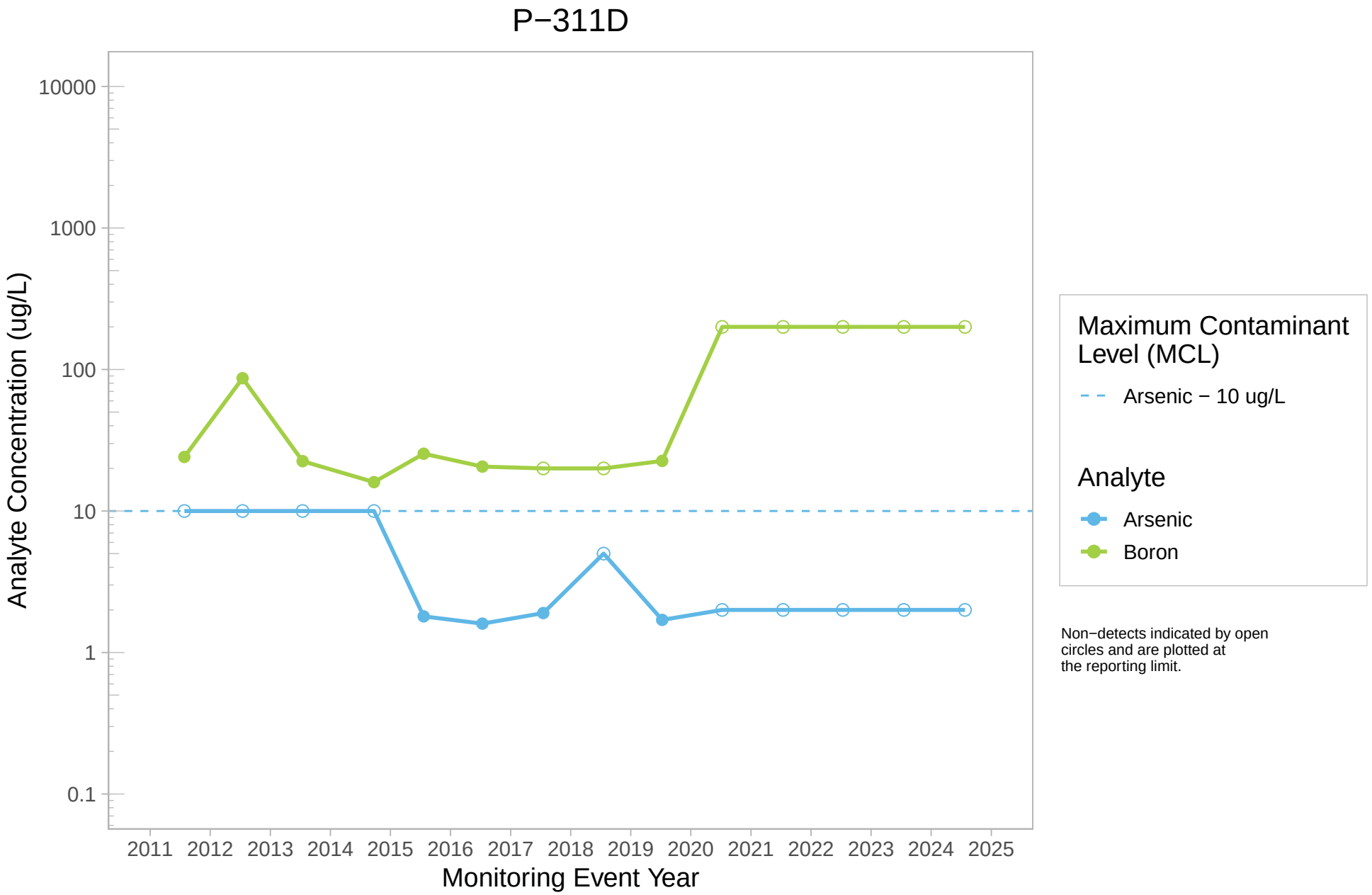
Arsenic − 10 ug/L

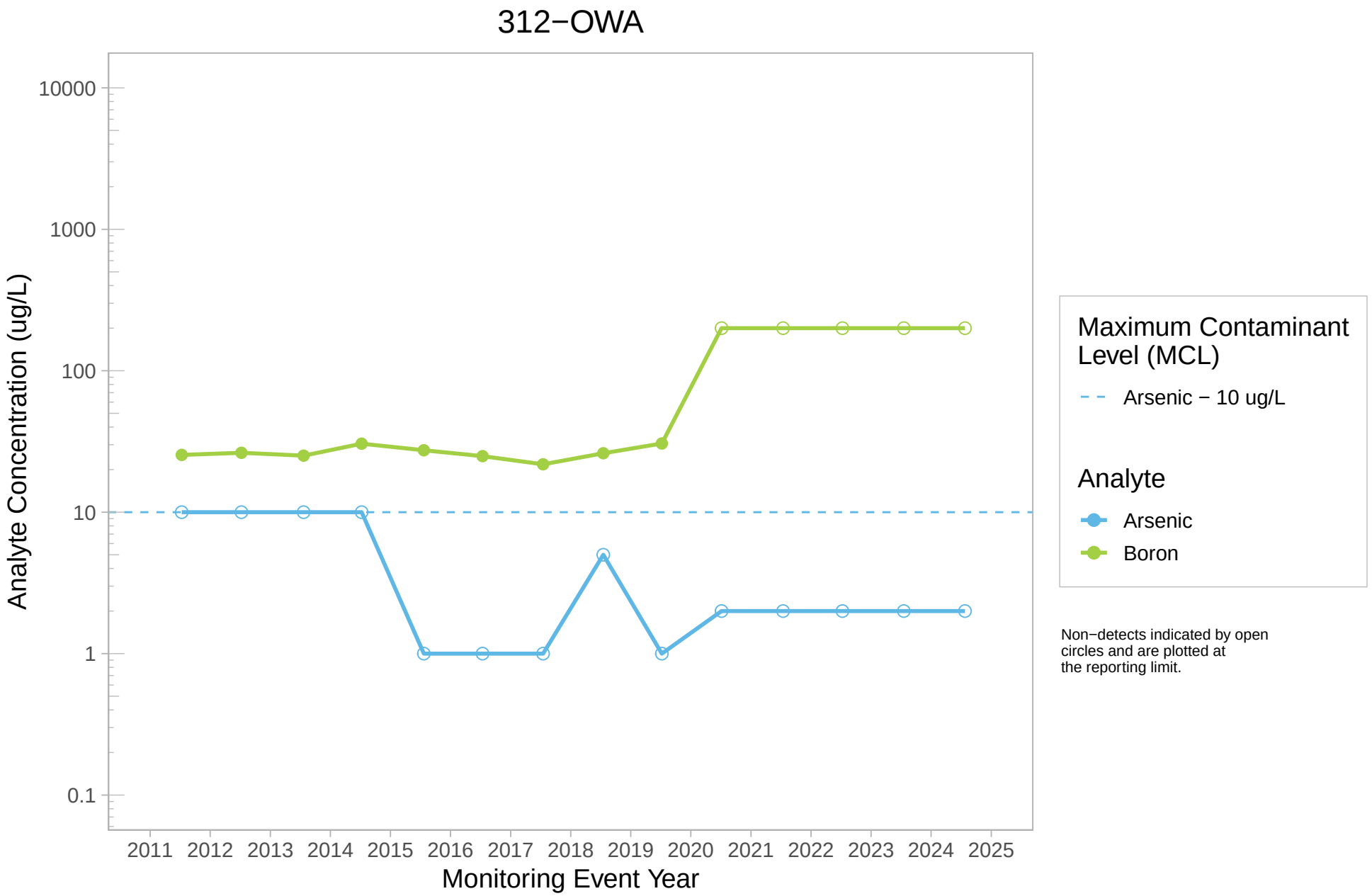
Analyte

Arsenic

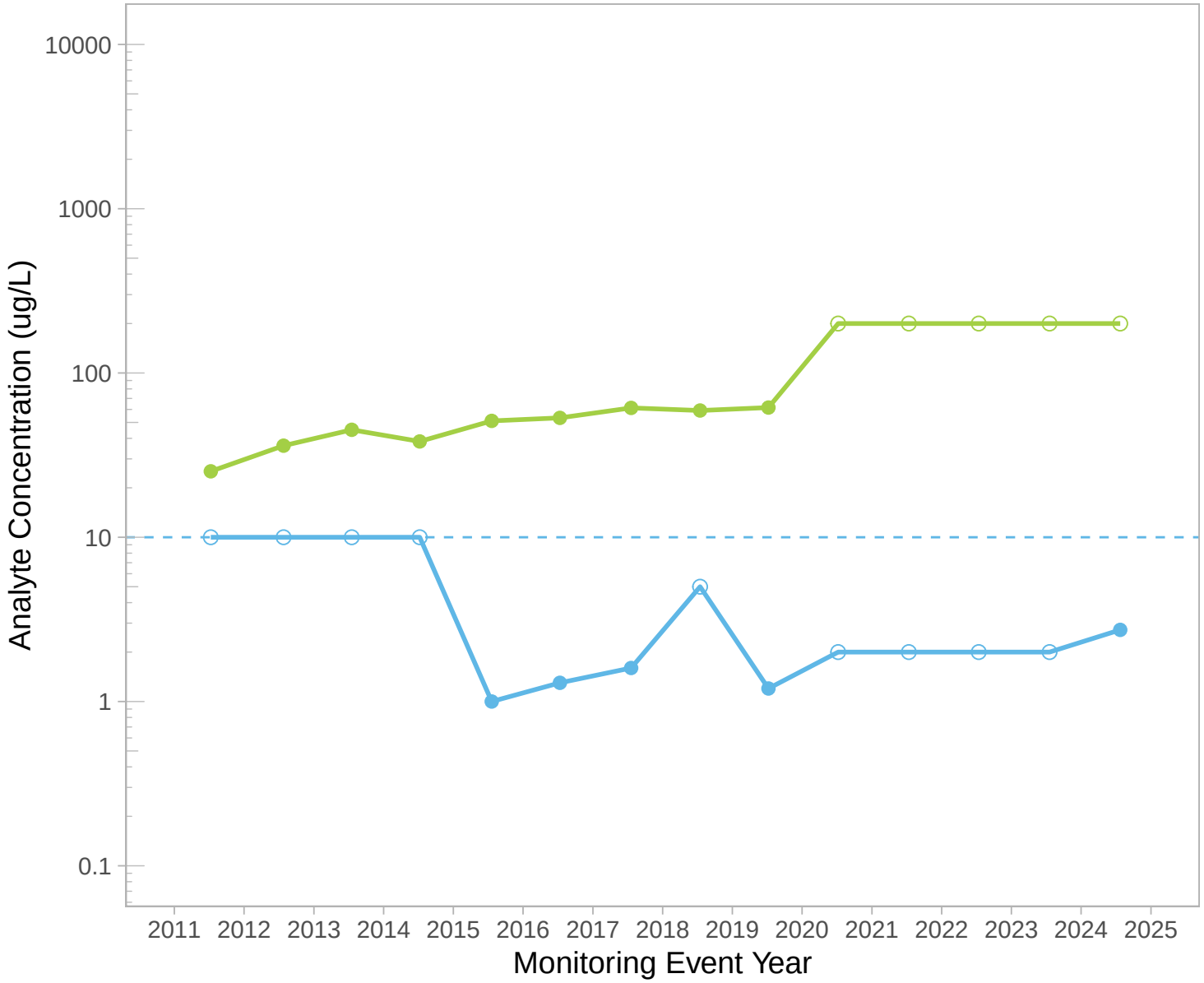
Boron

Non−detects indicated by open circles and are plotted at the reporting limit.


P−311D
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.


312−OWA
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

P−313C



Maximum Contaminant Level (MCL)

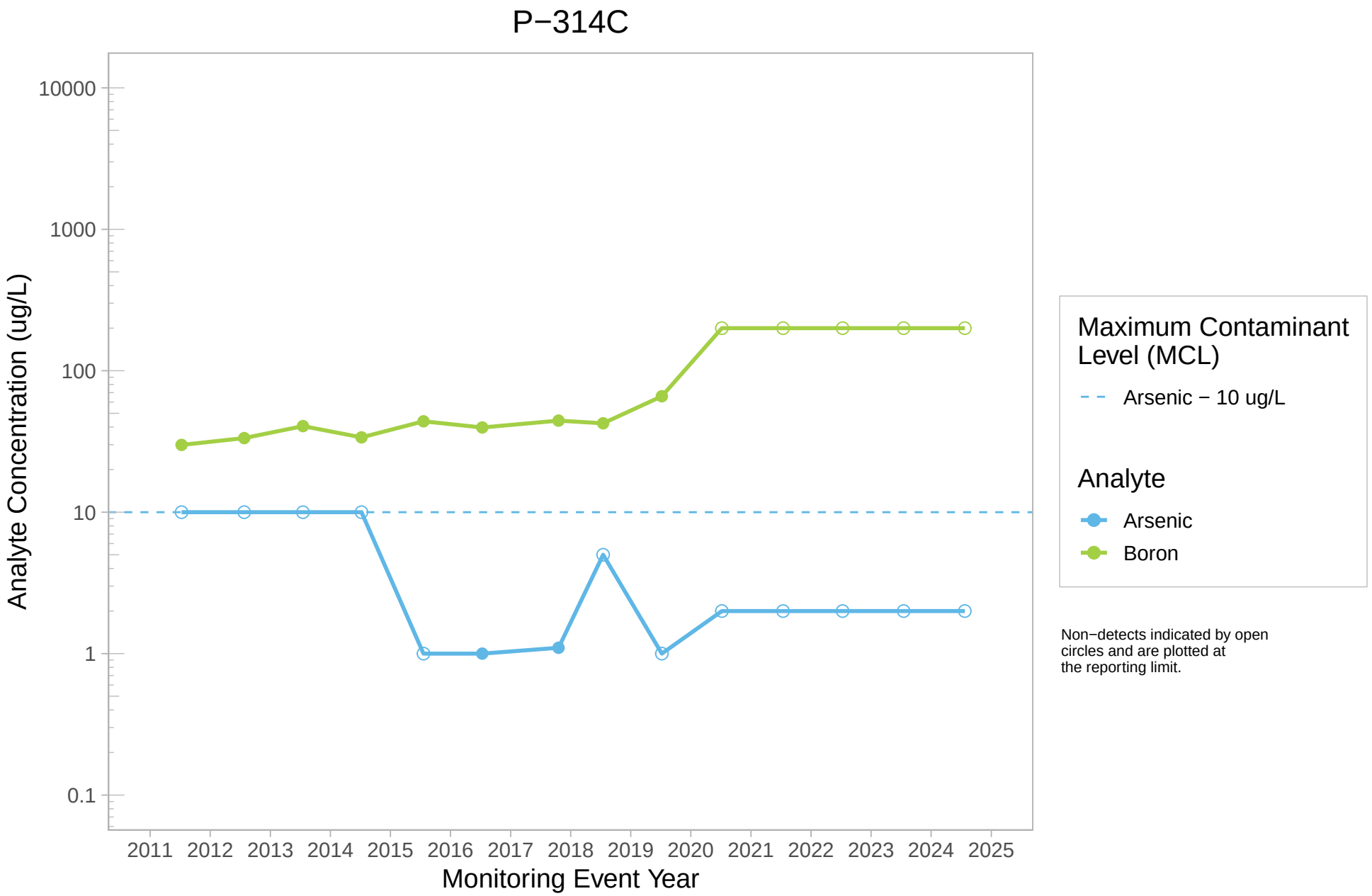
Arsenic − 10 ug/L

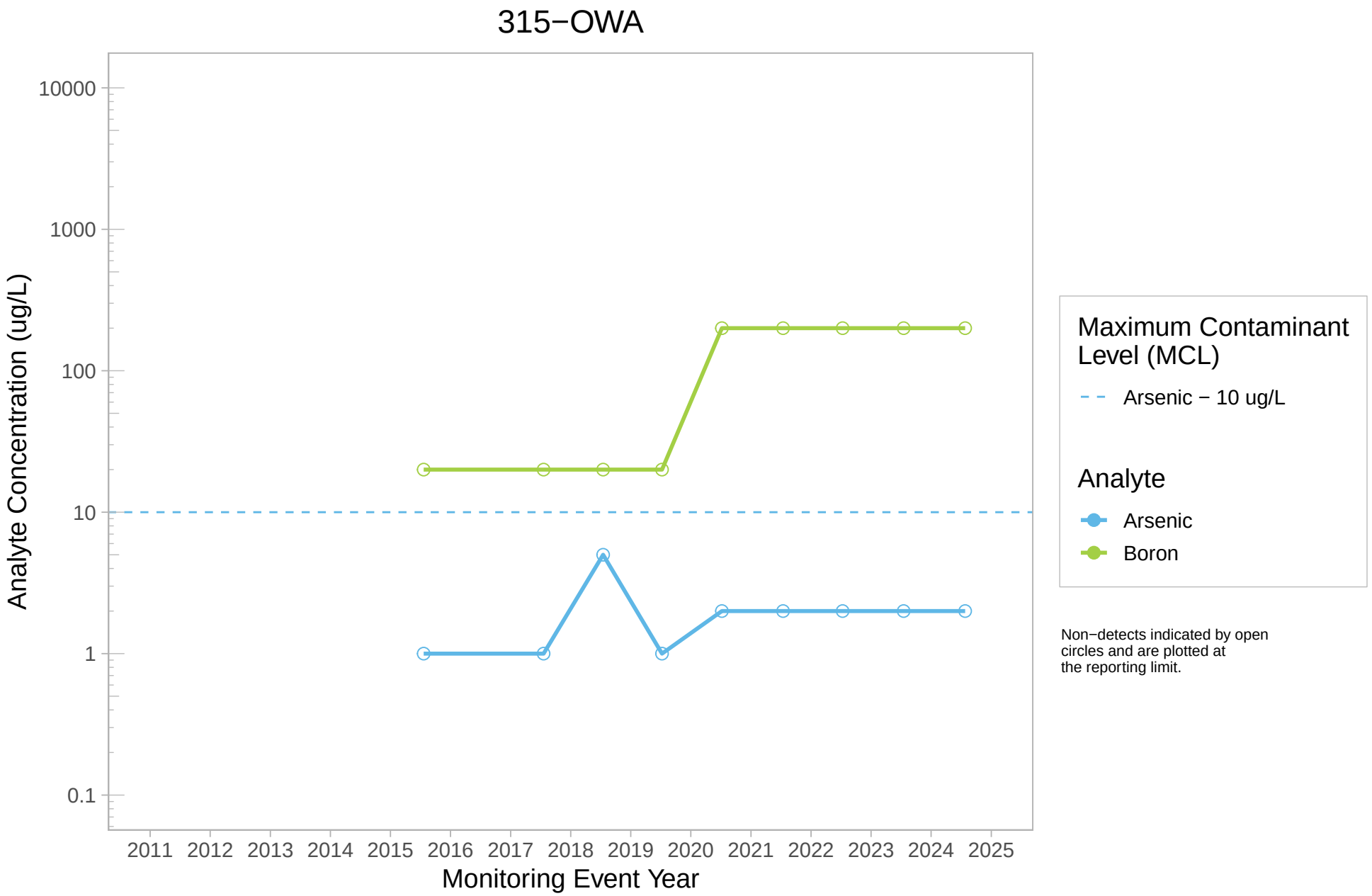
Analyte

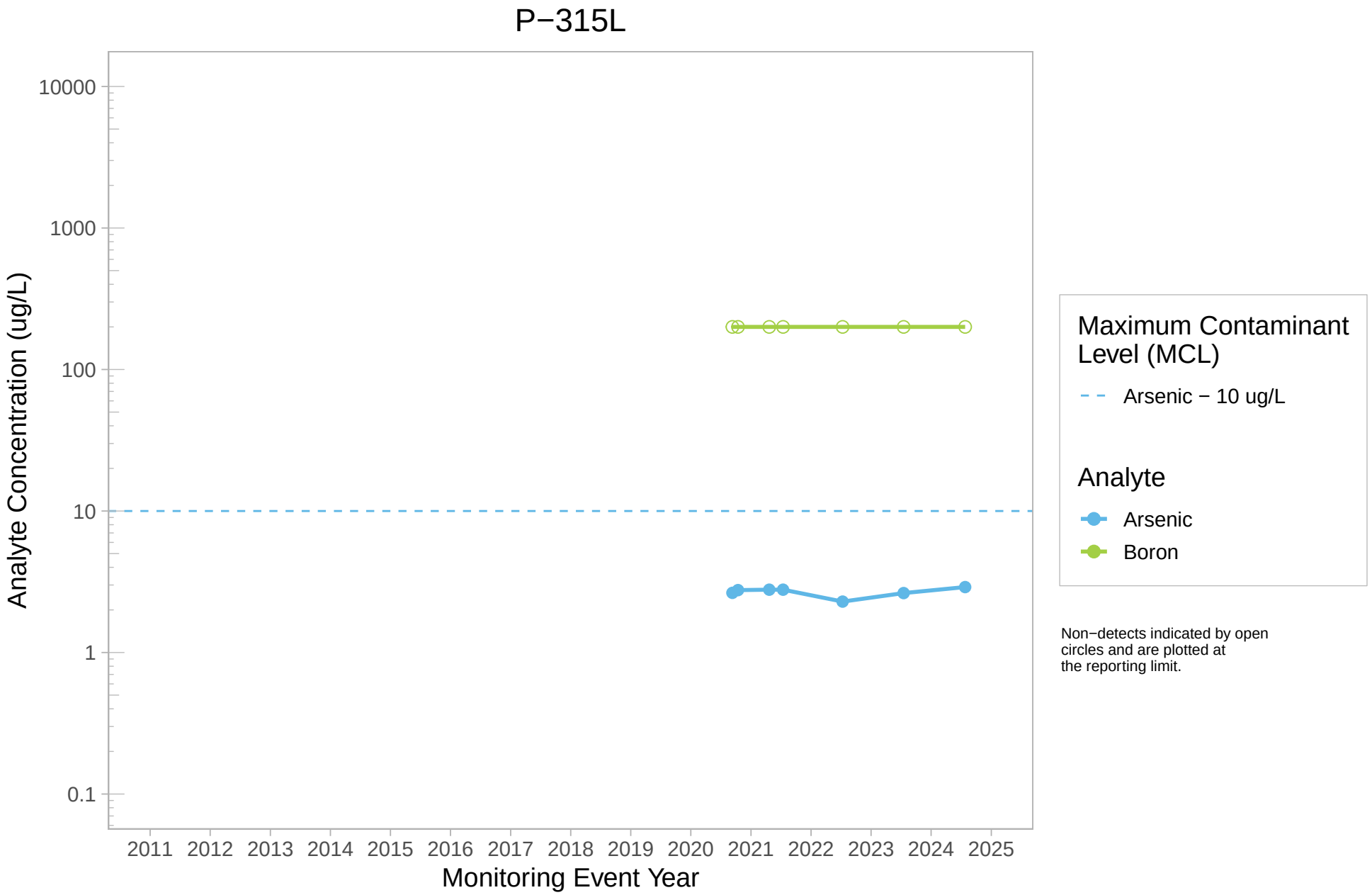
Arsenic

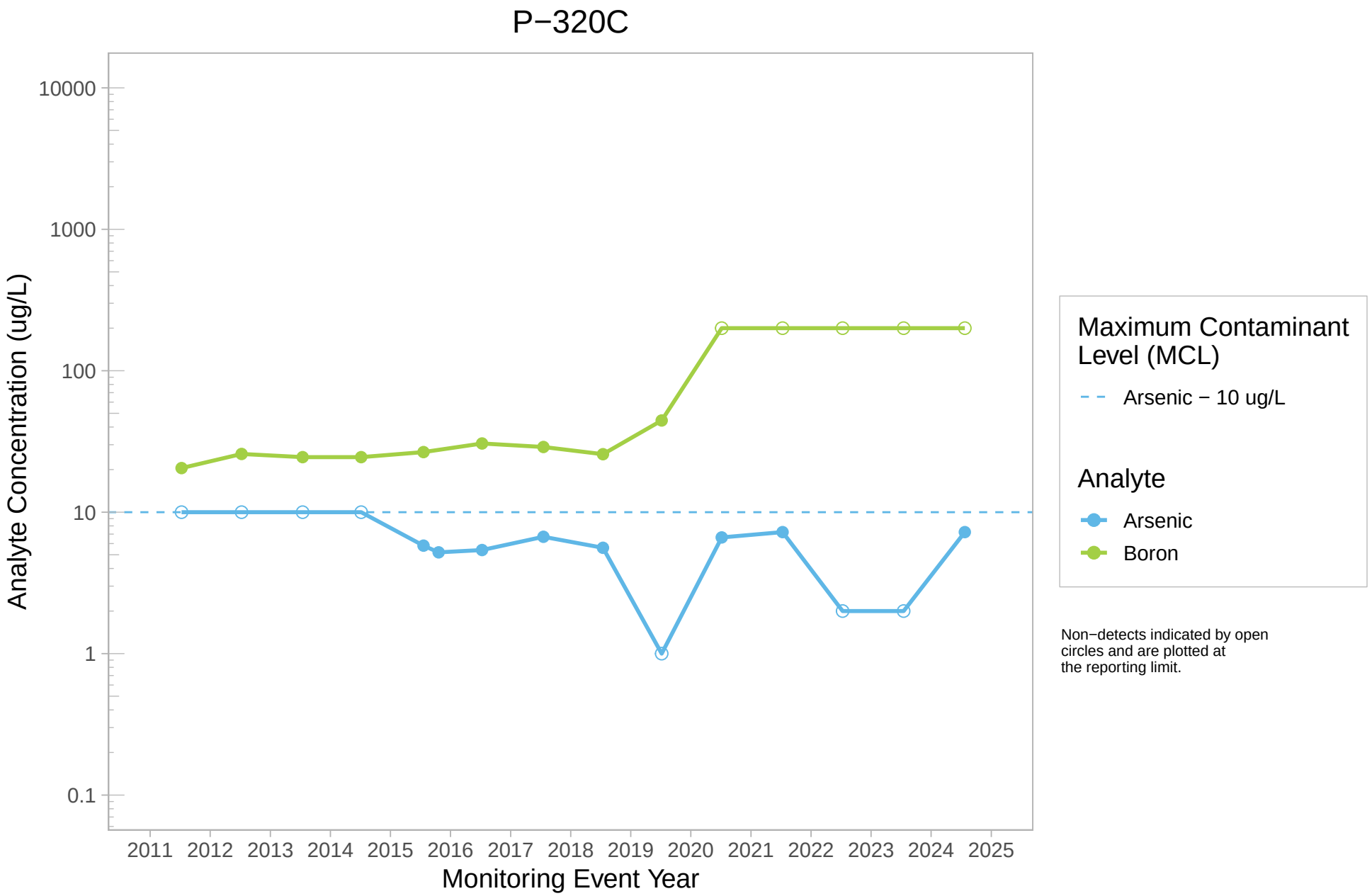
Boron

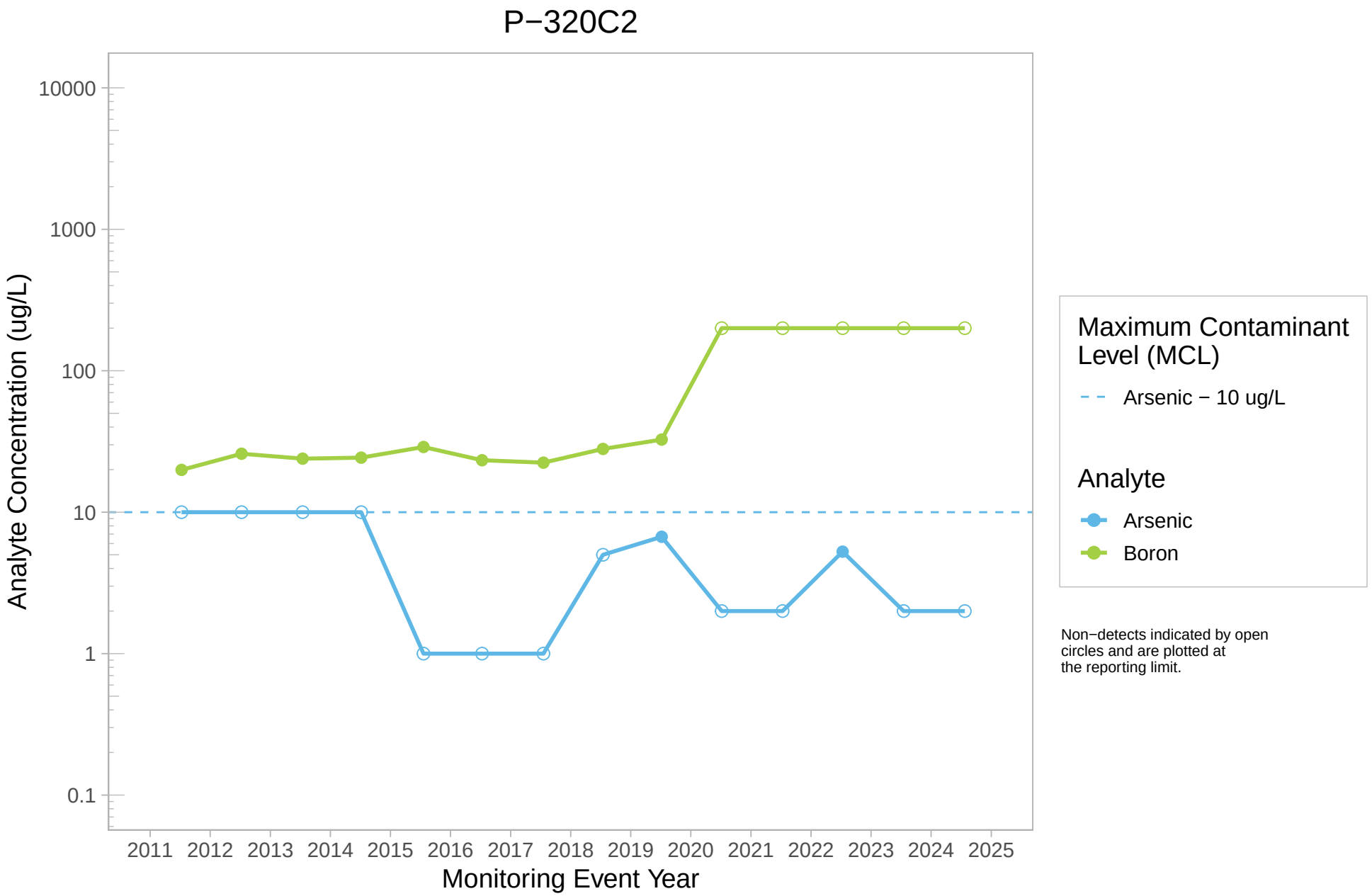
Non−detects indicated by open circles and are plotted at the reporting limit.

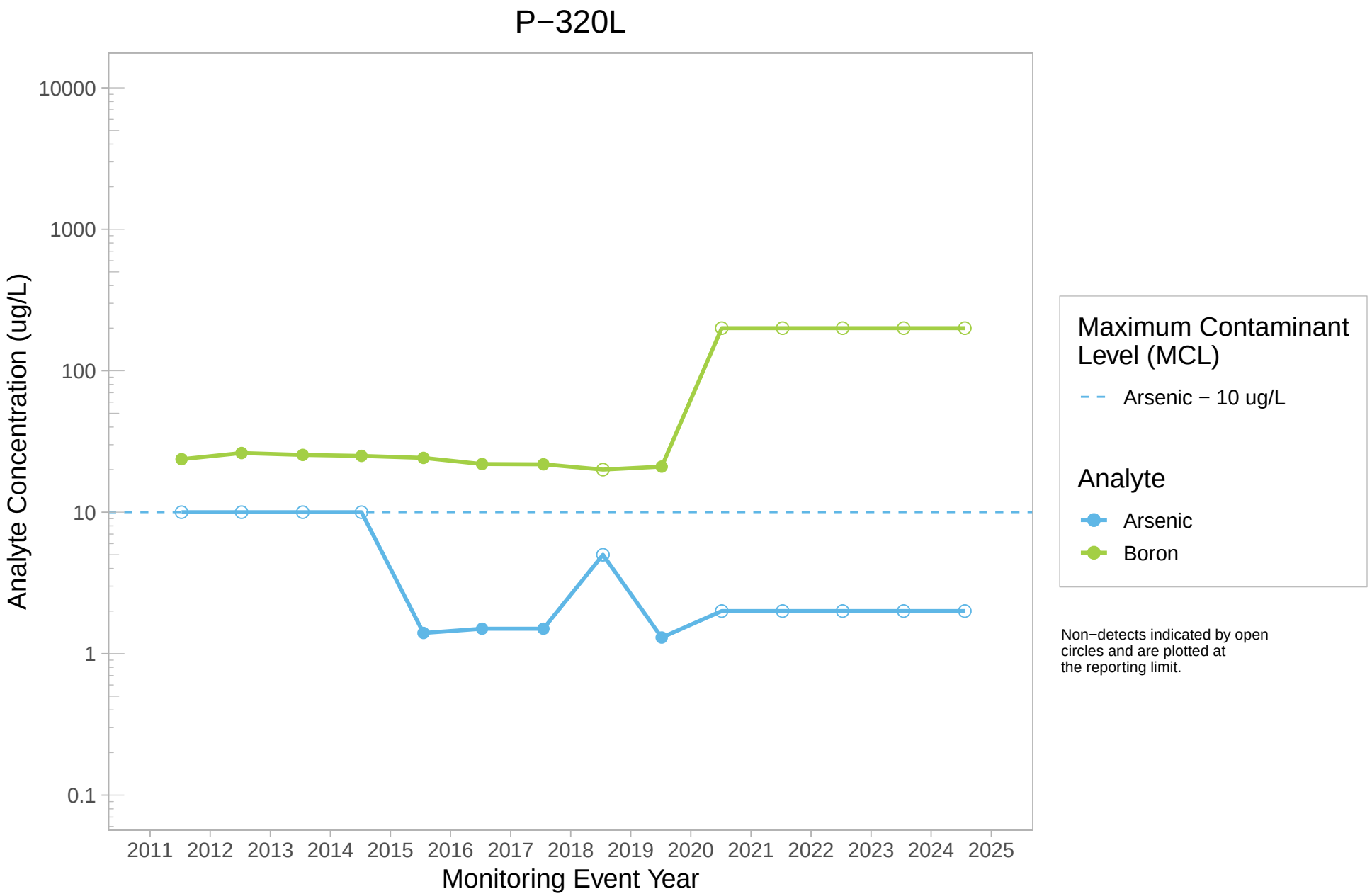

P−314C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

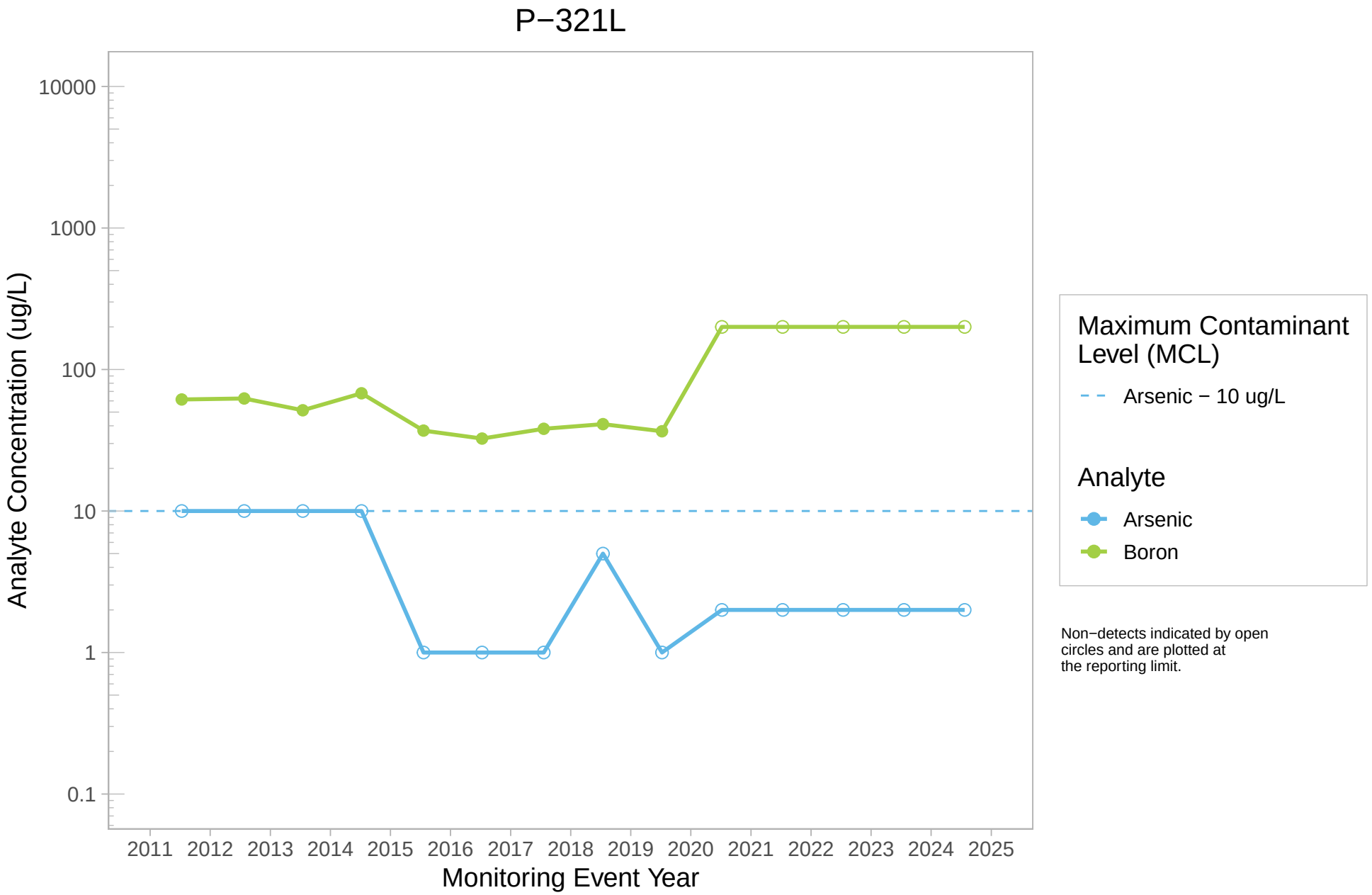

315−OWA
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

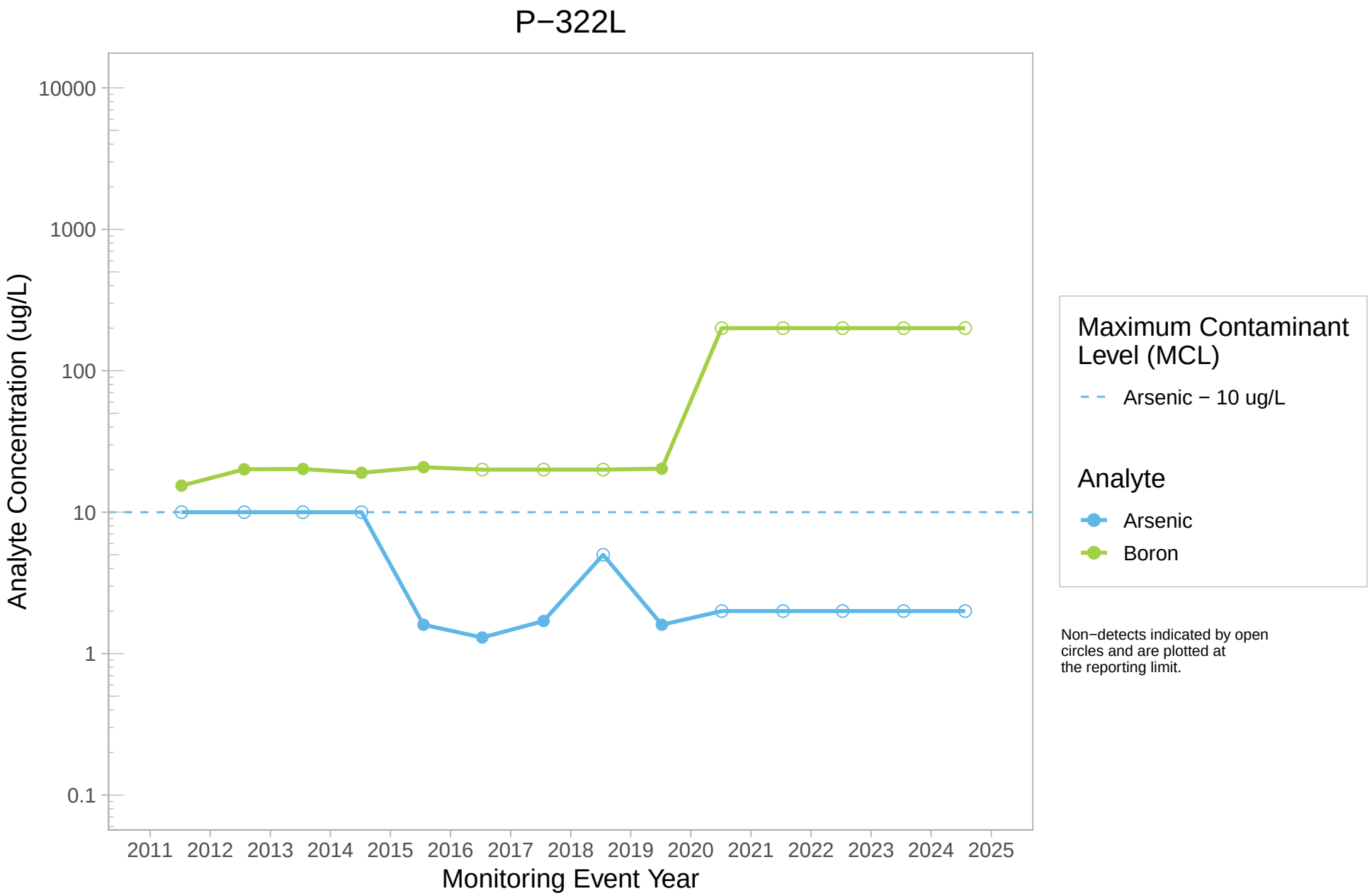

P−315L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

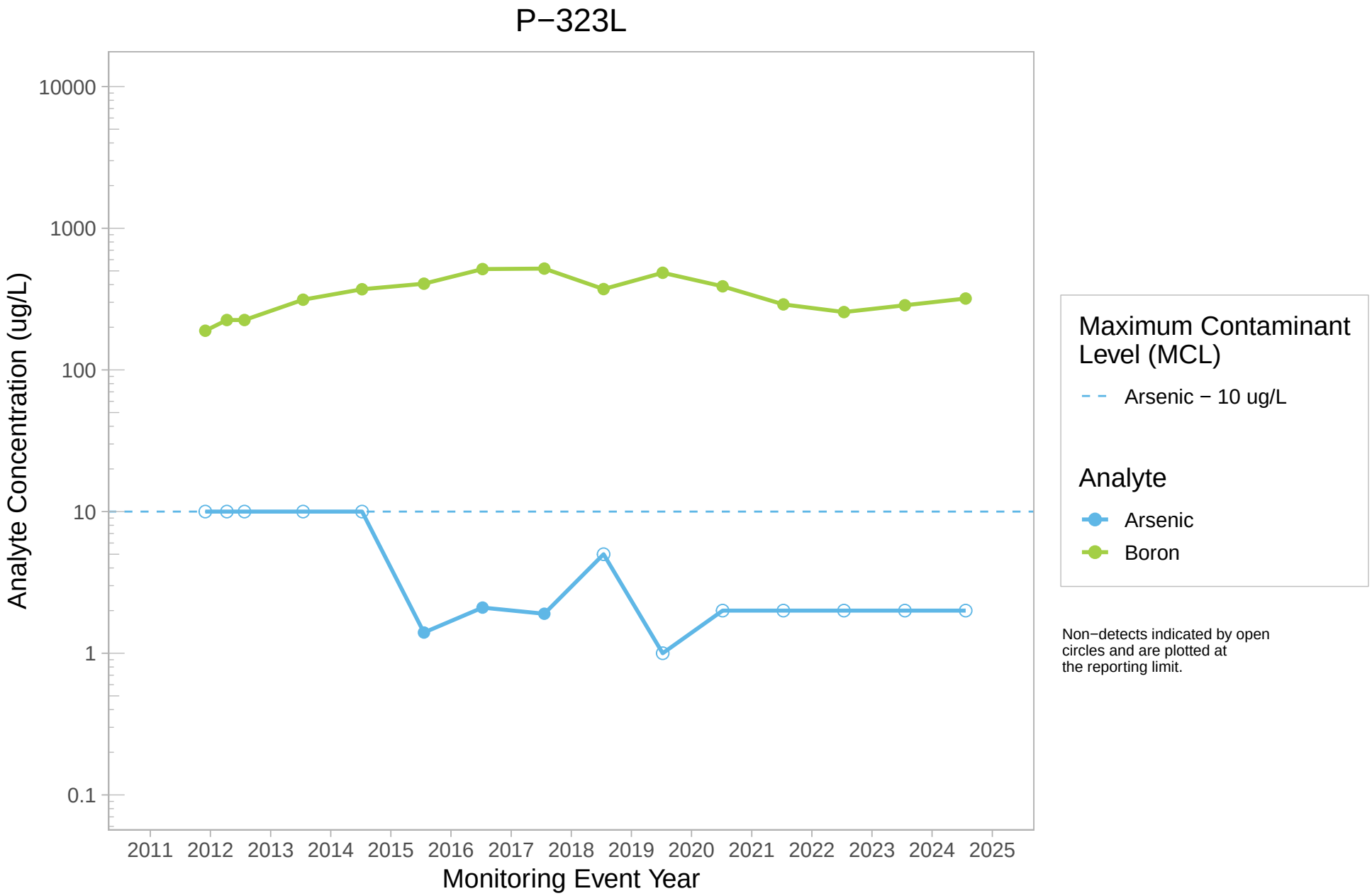

P−320C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

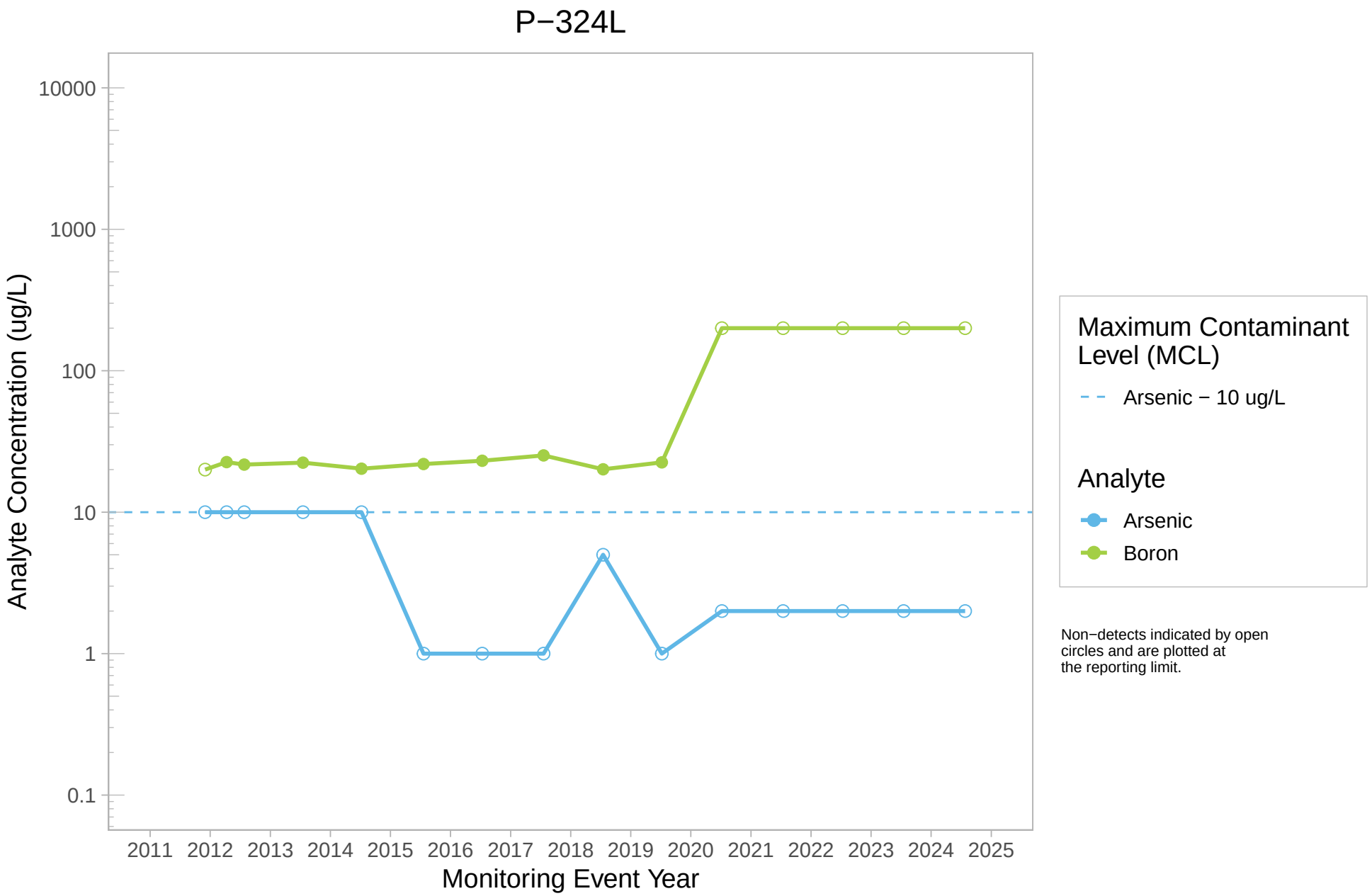

P−320C2
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

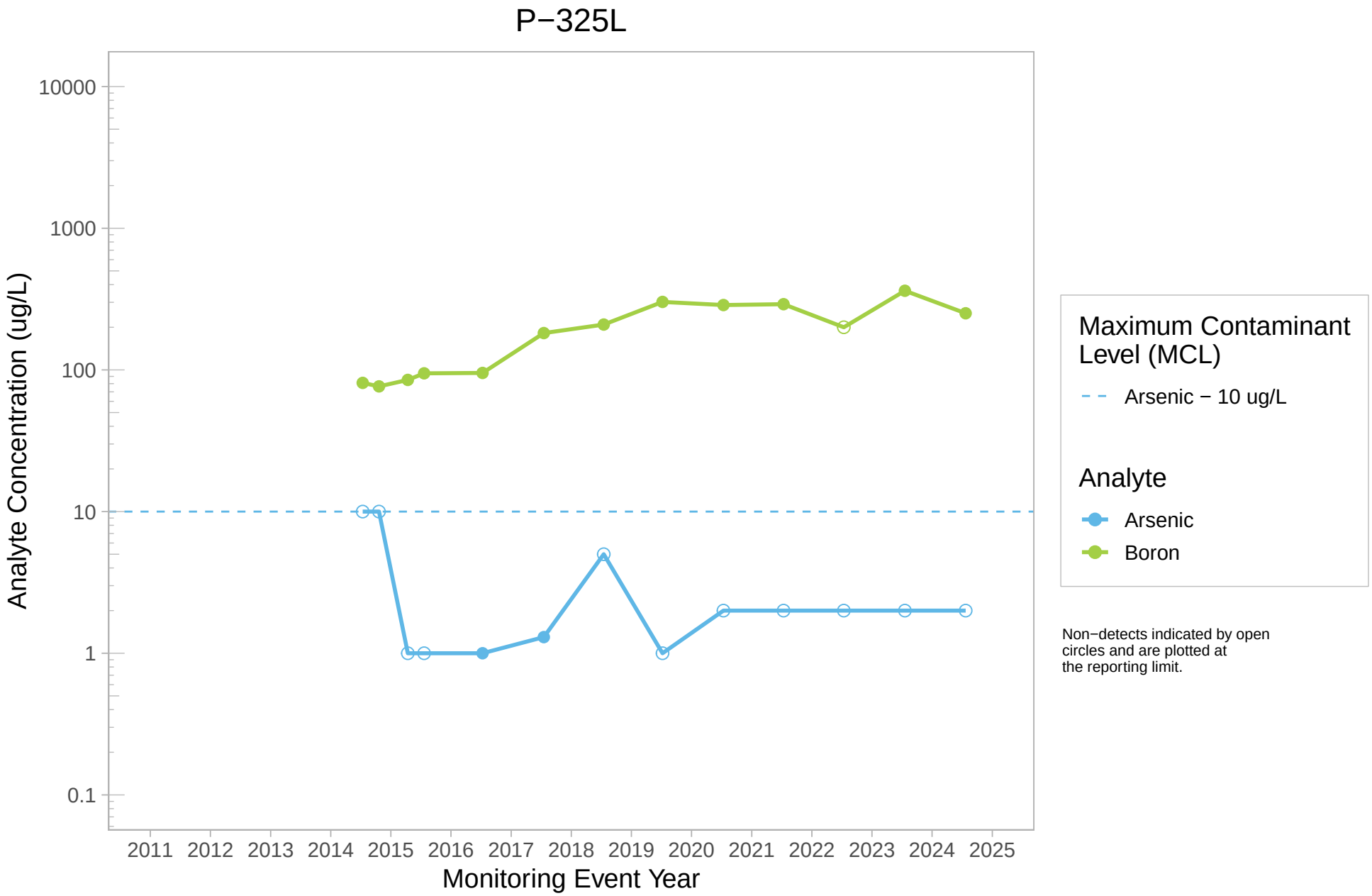

P−320L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

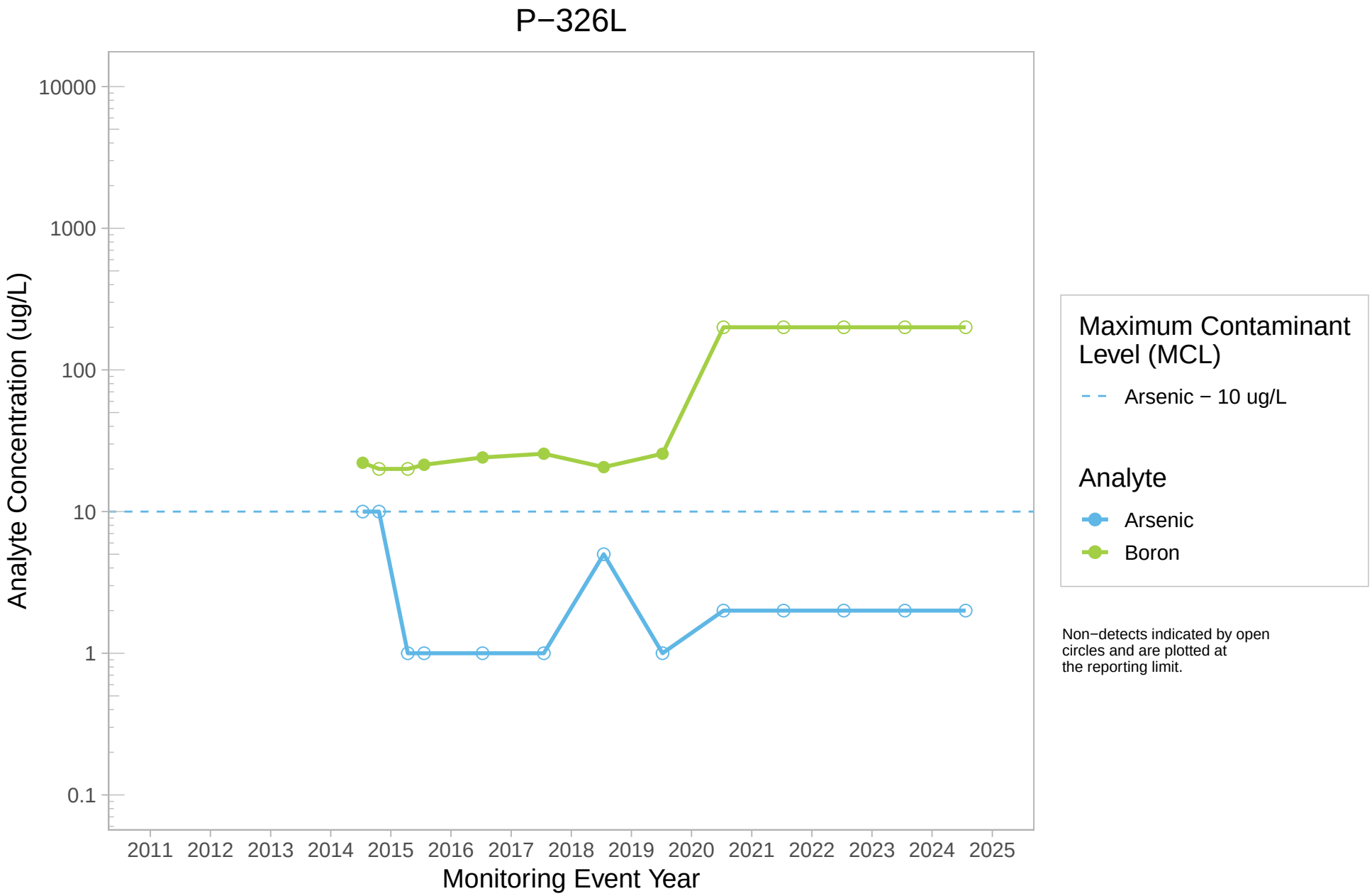

P−321L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

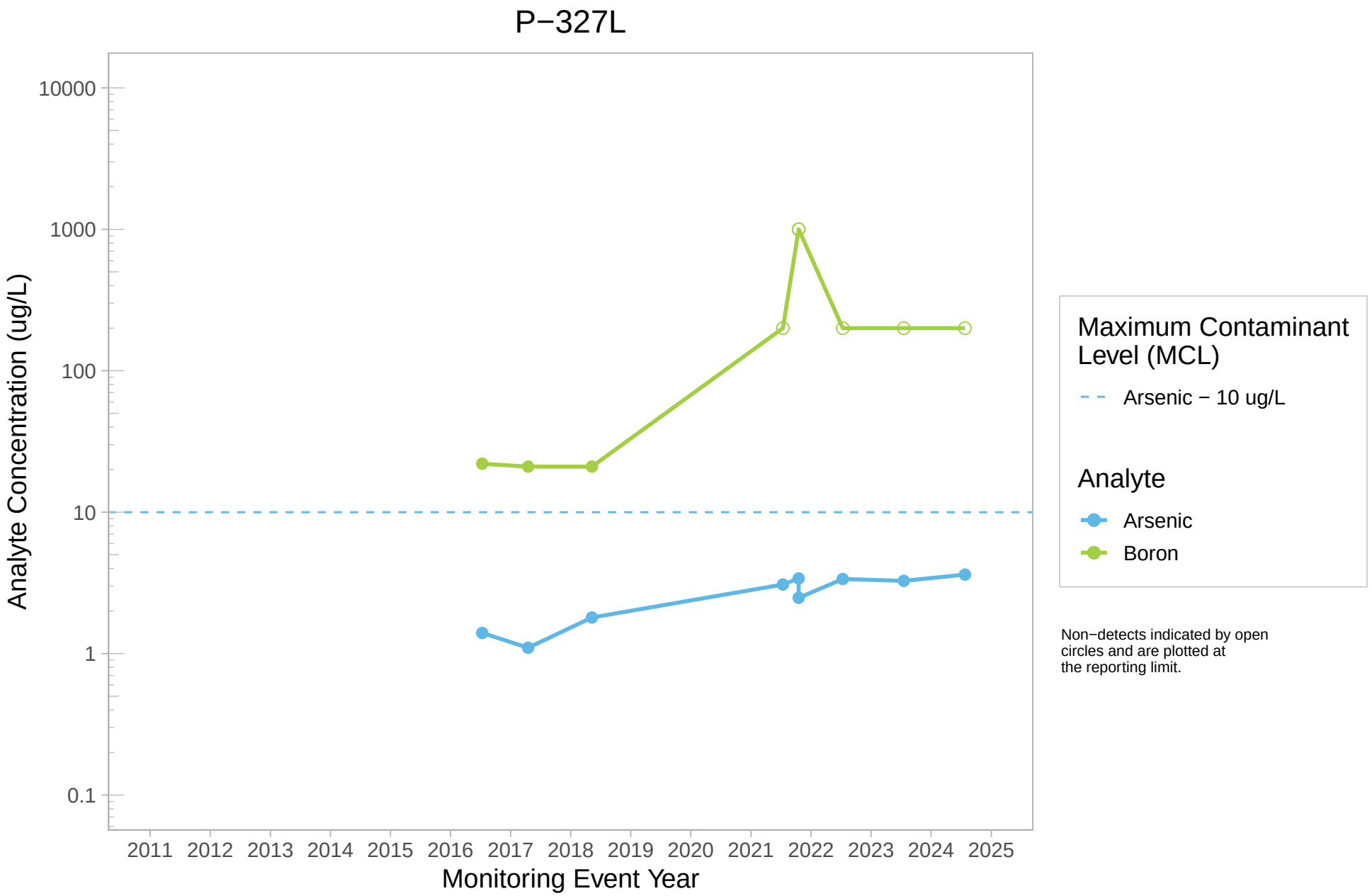

P−322L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

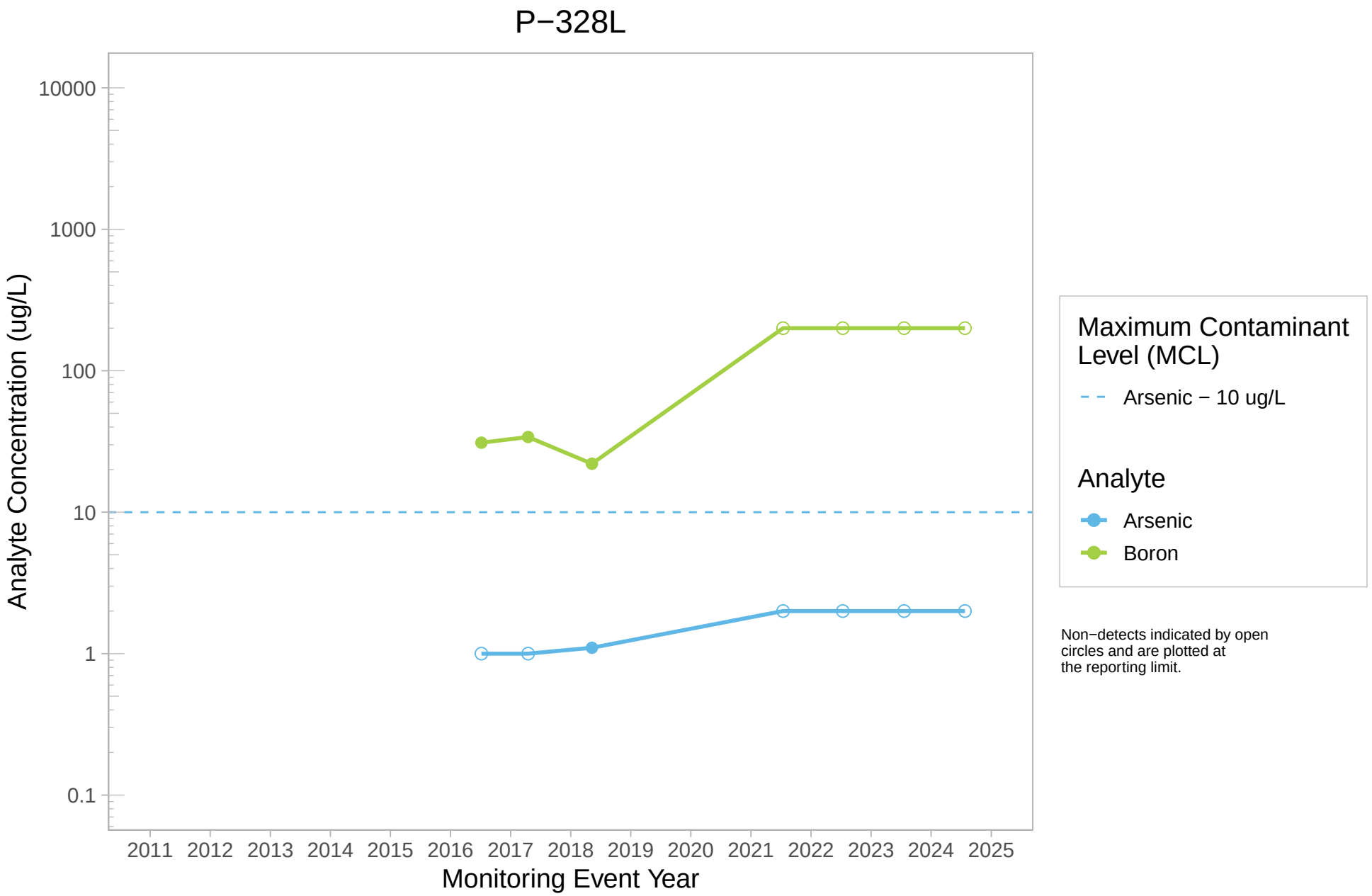

P−323L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

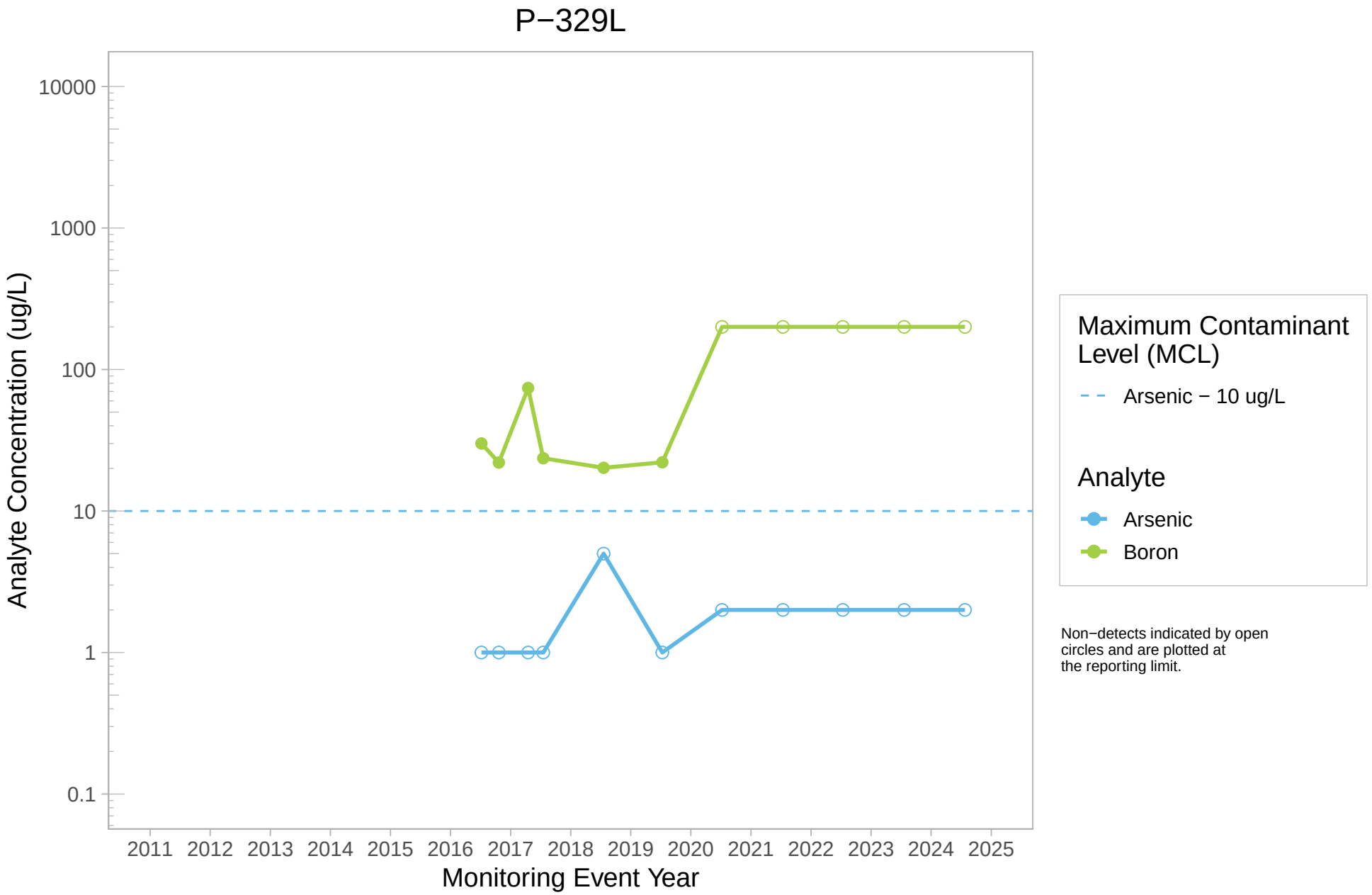

P−324L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

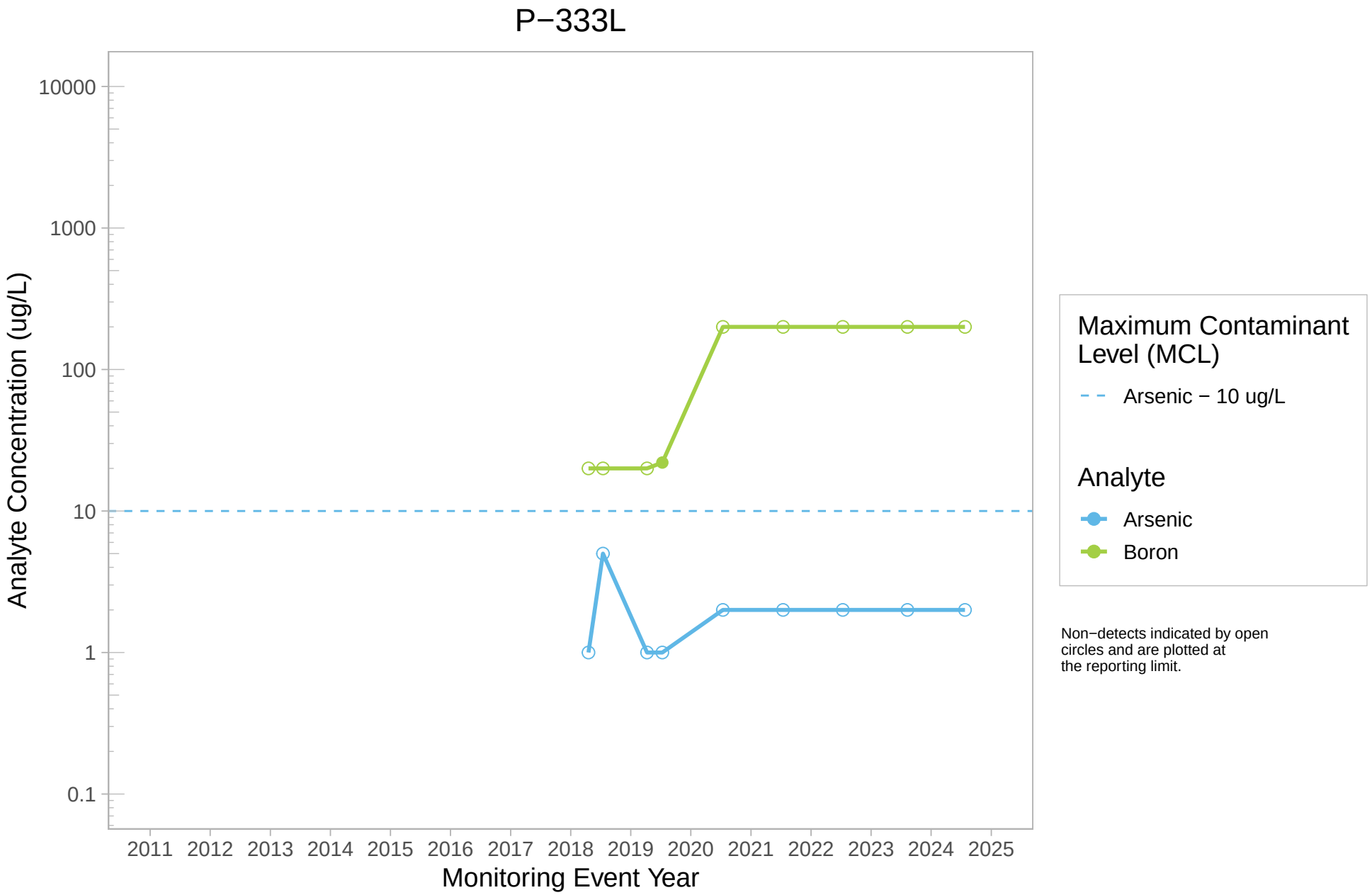

P−325L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

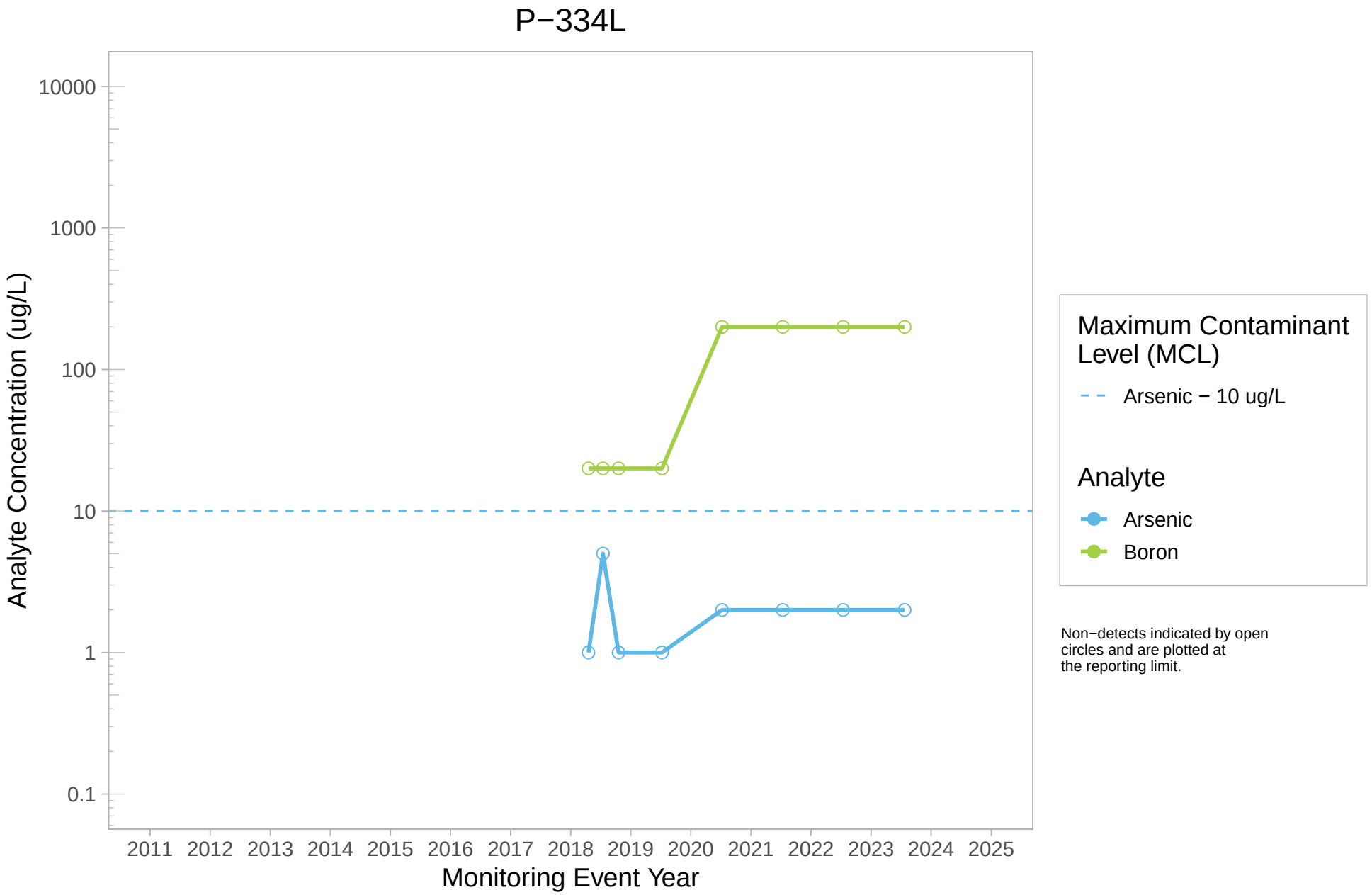

P−326L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
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2015
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2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

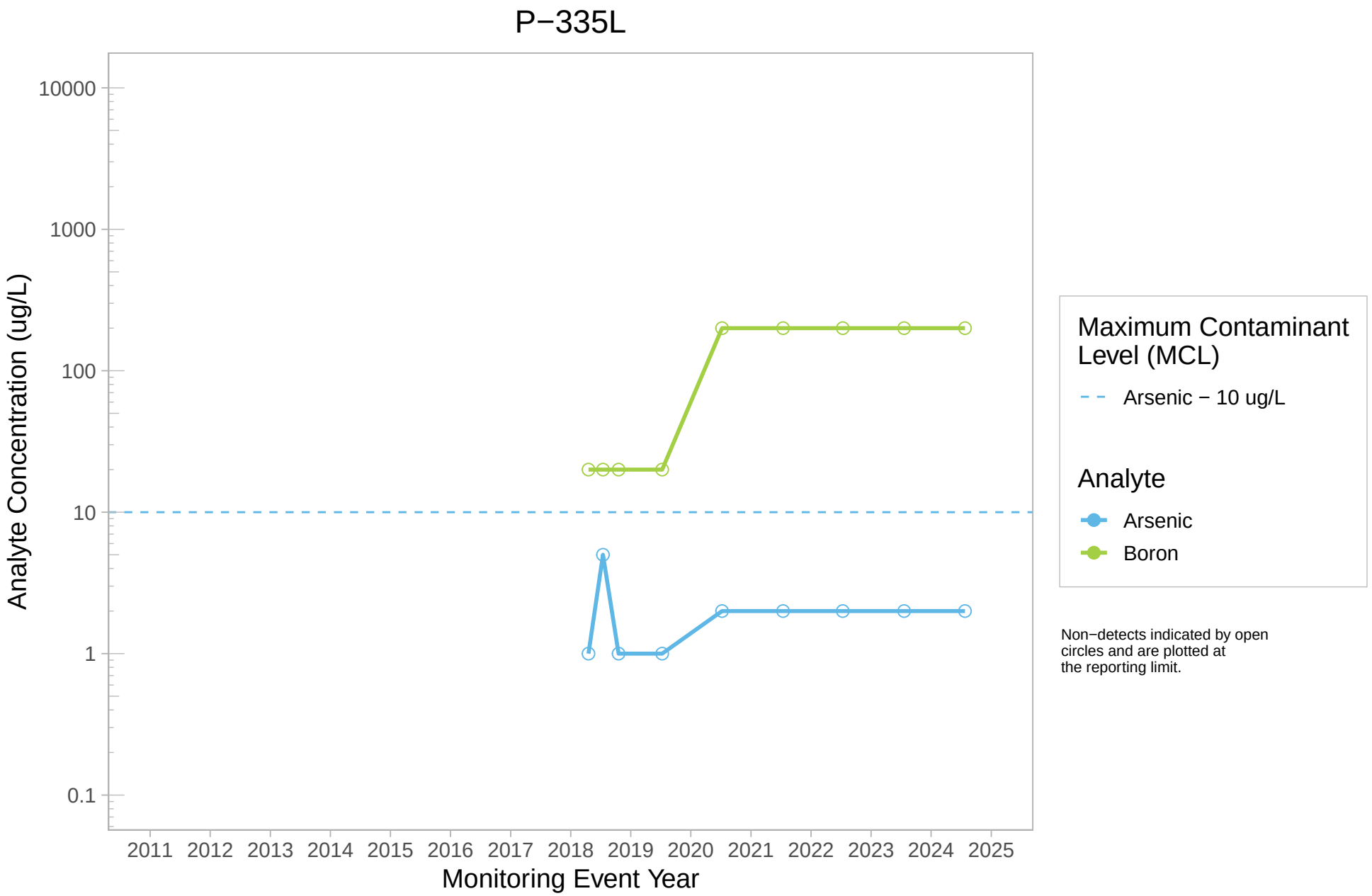

P−327L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

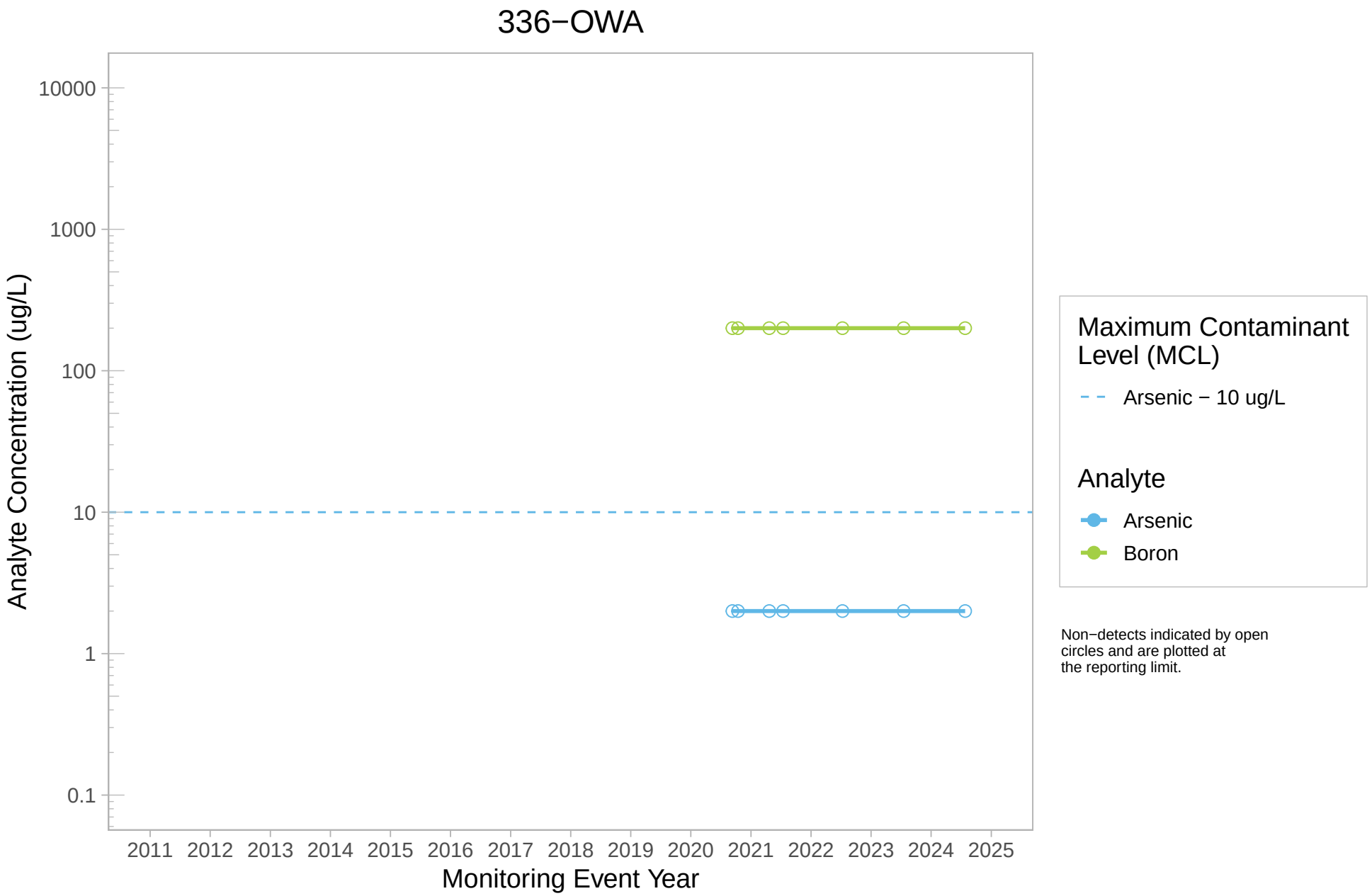

P−328L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

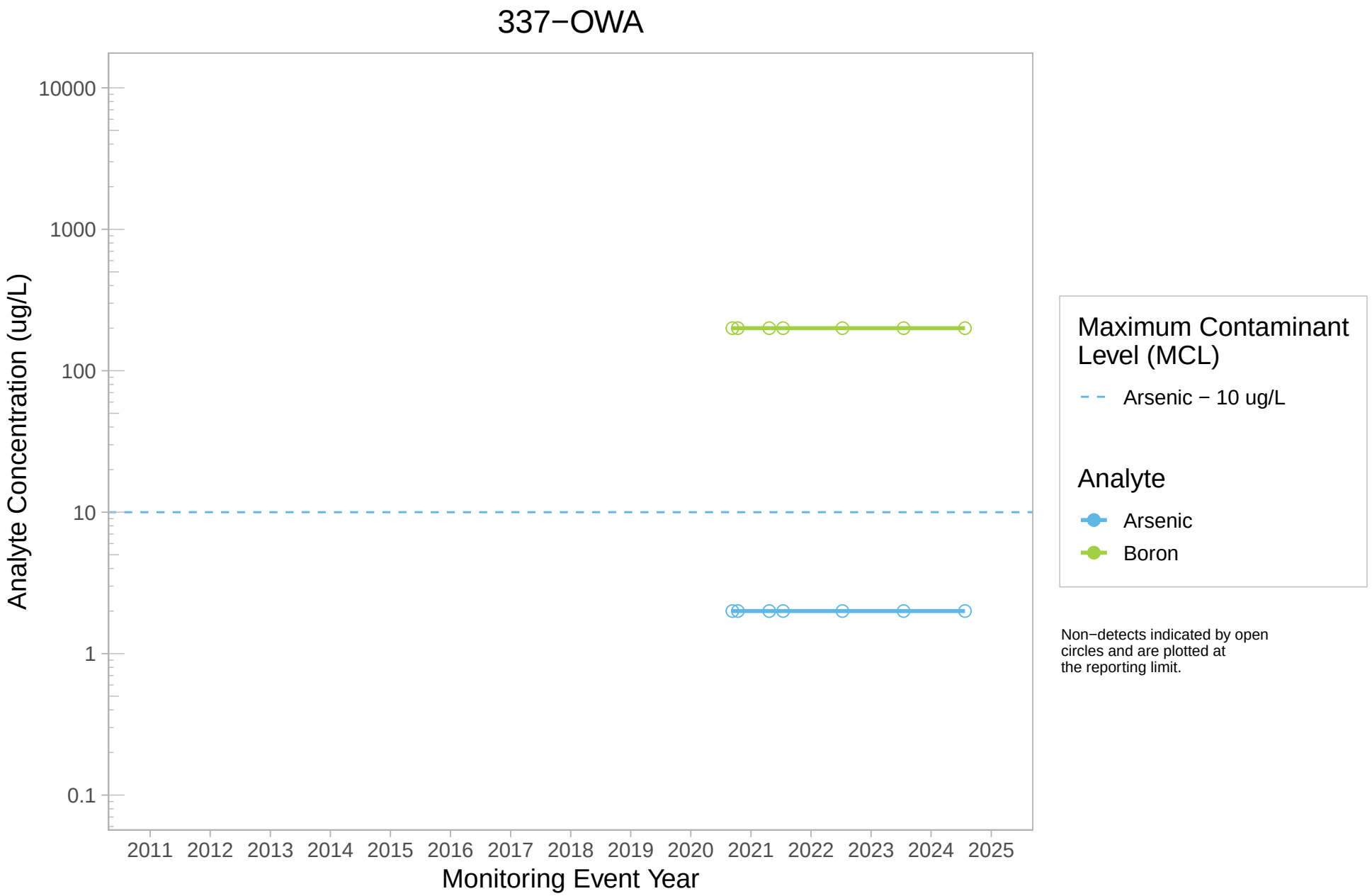

P−329L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

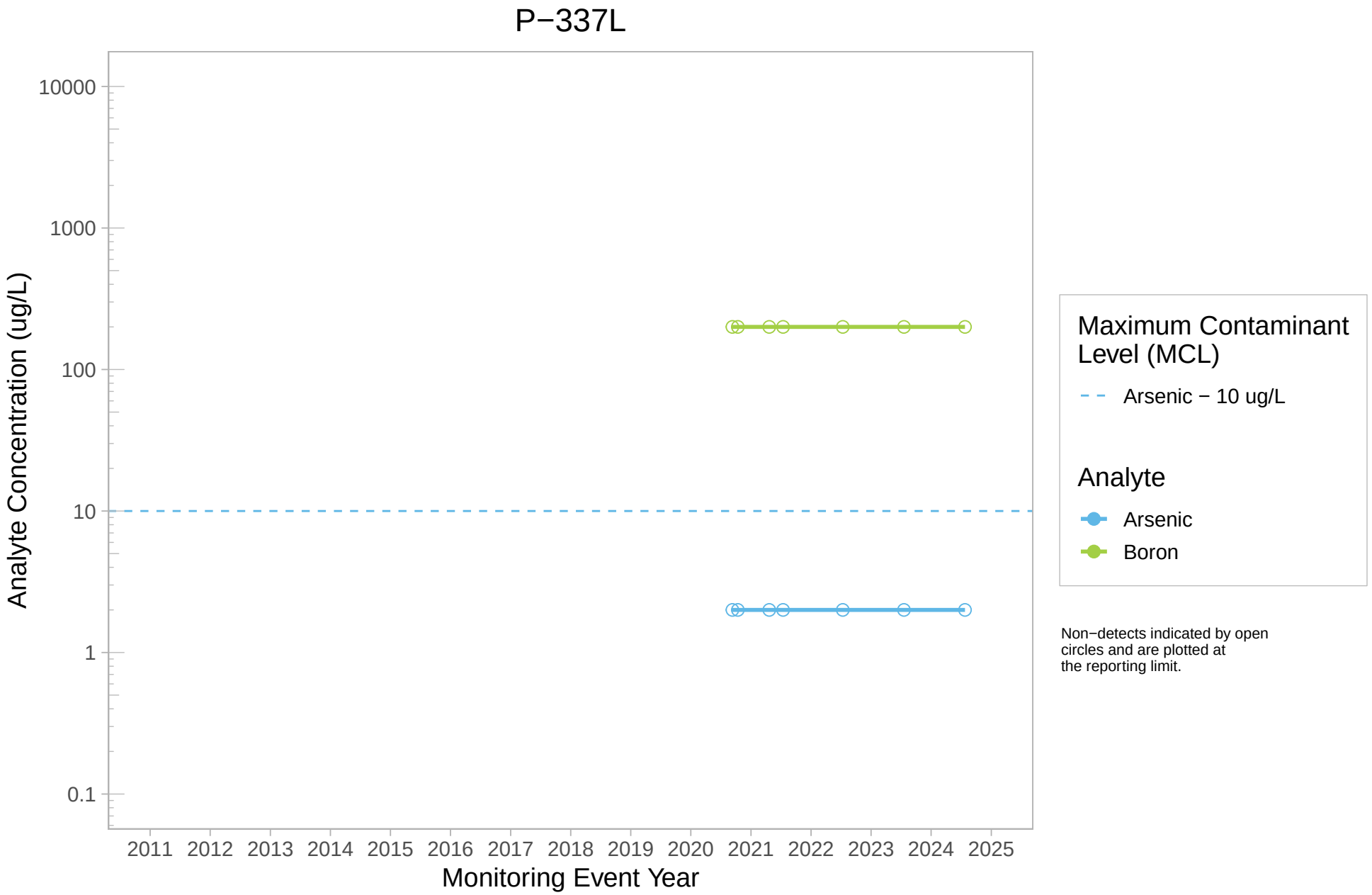

P−333L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

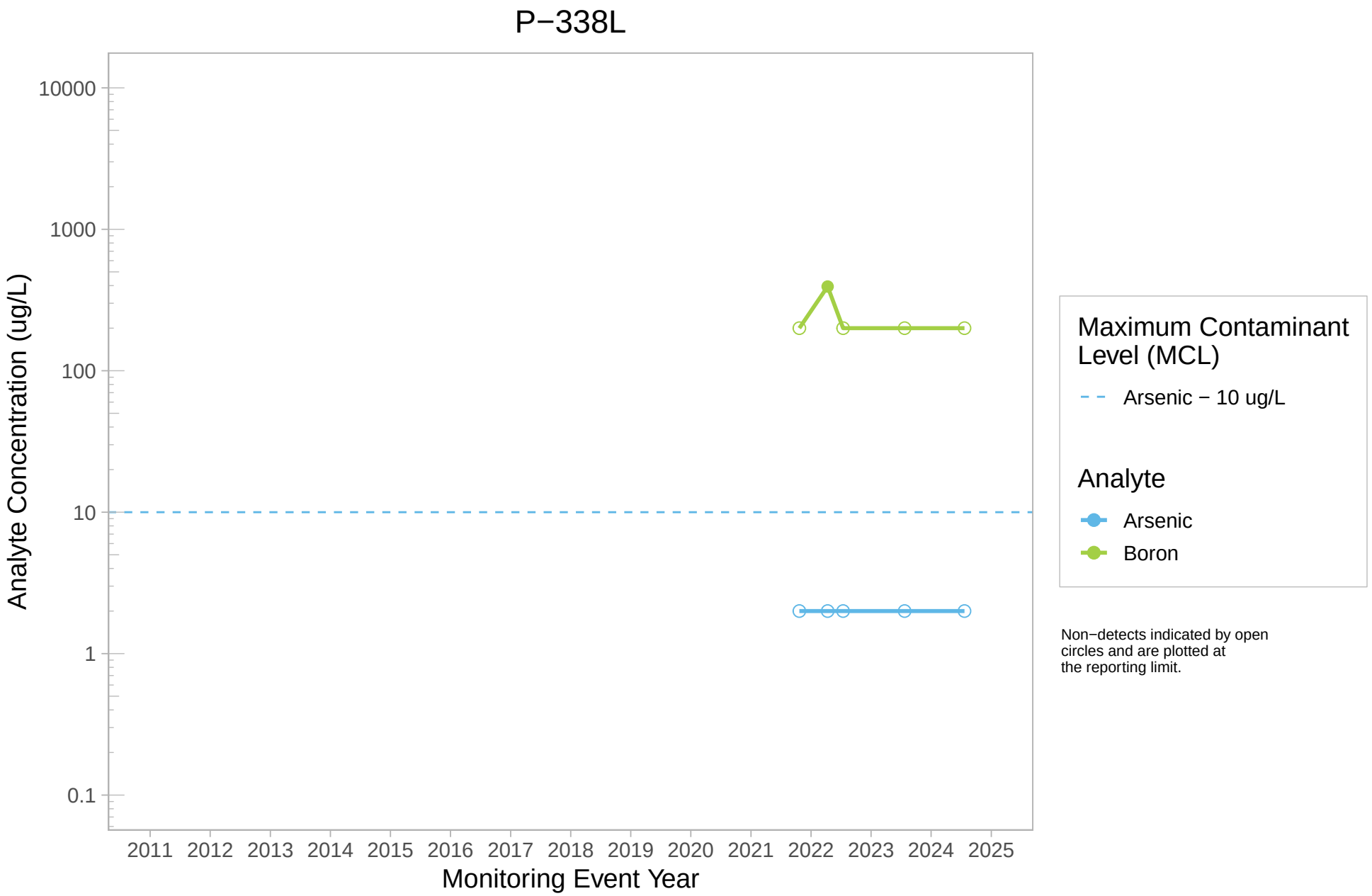

P−334L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

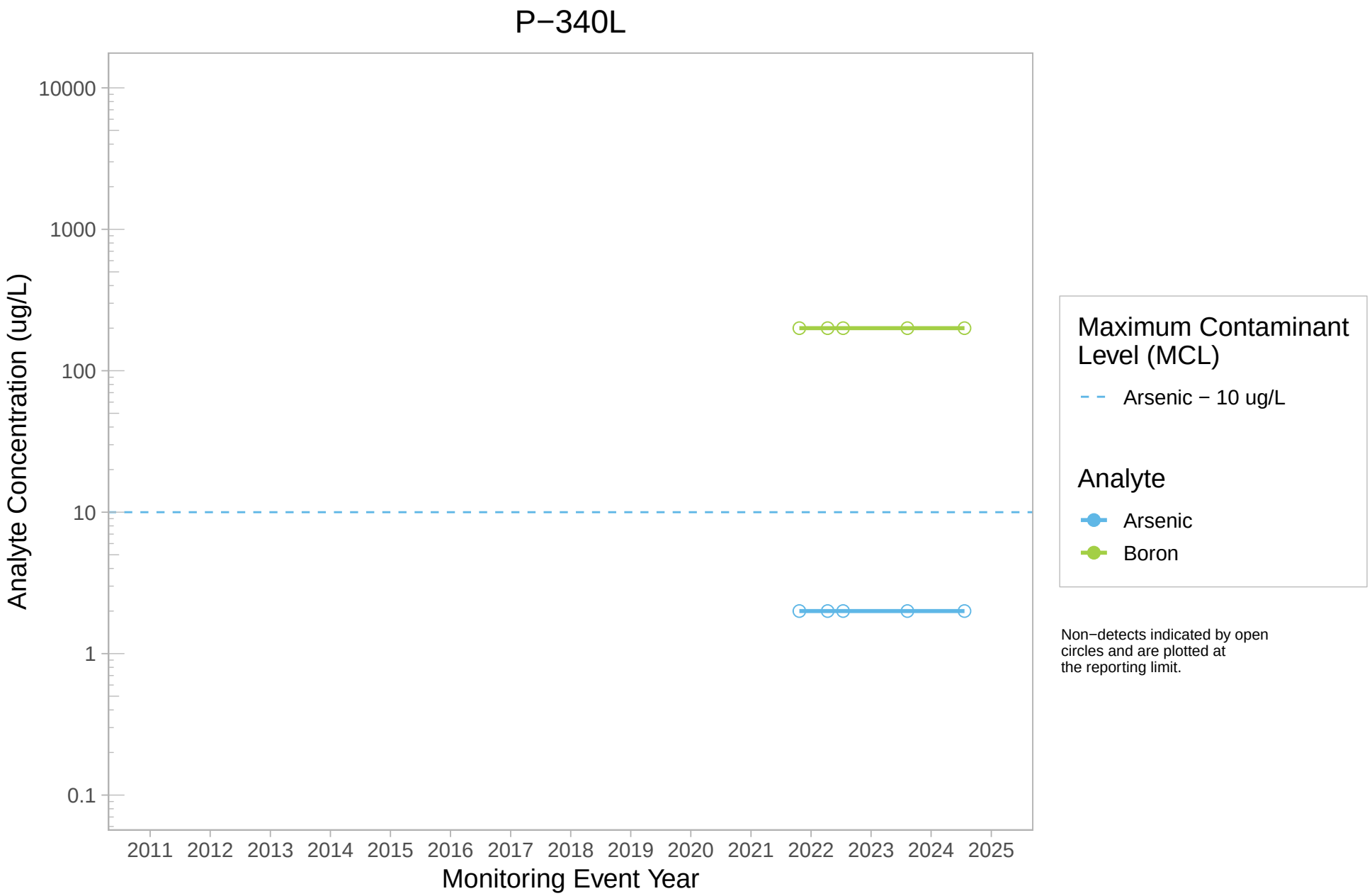

P−335L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

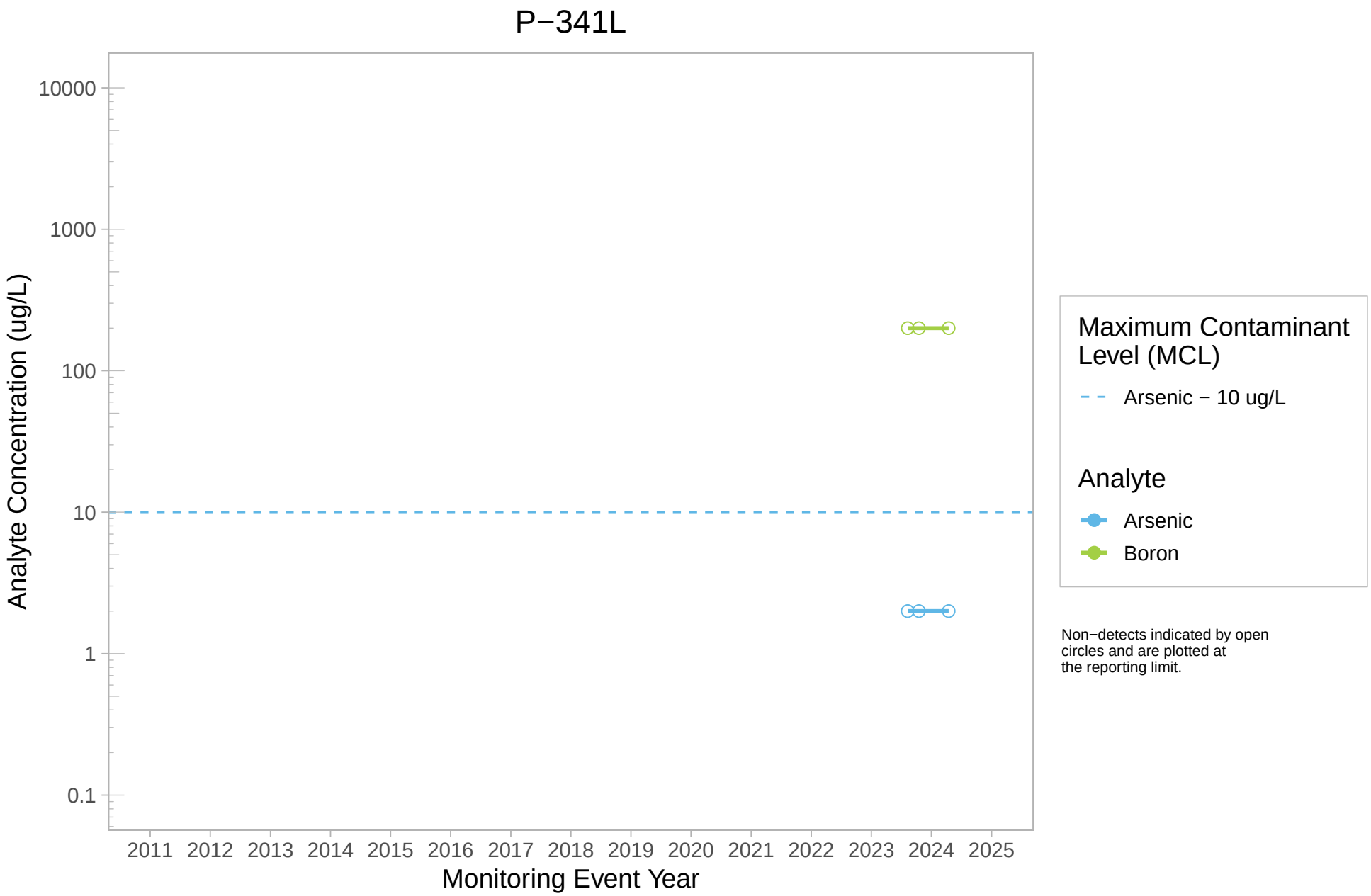

336−OWA
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

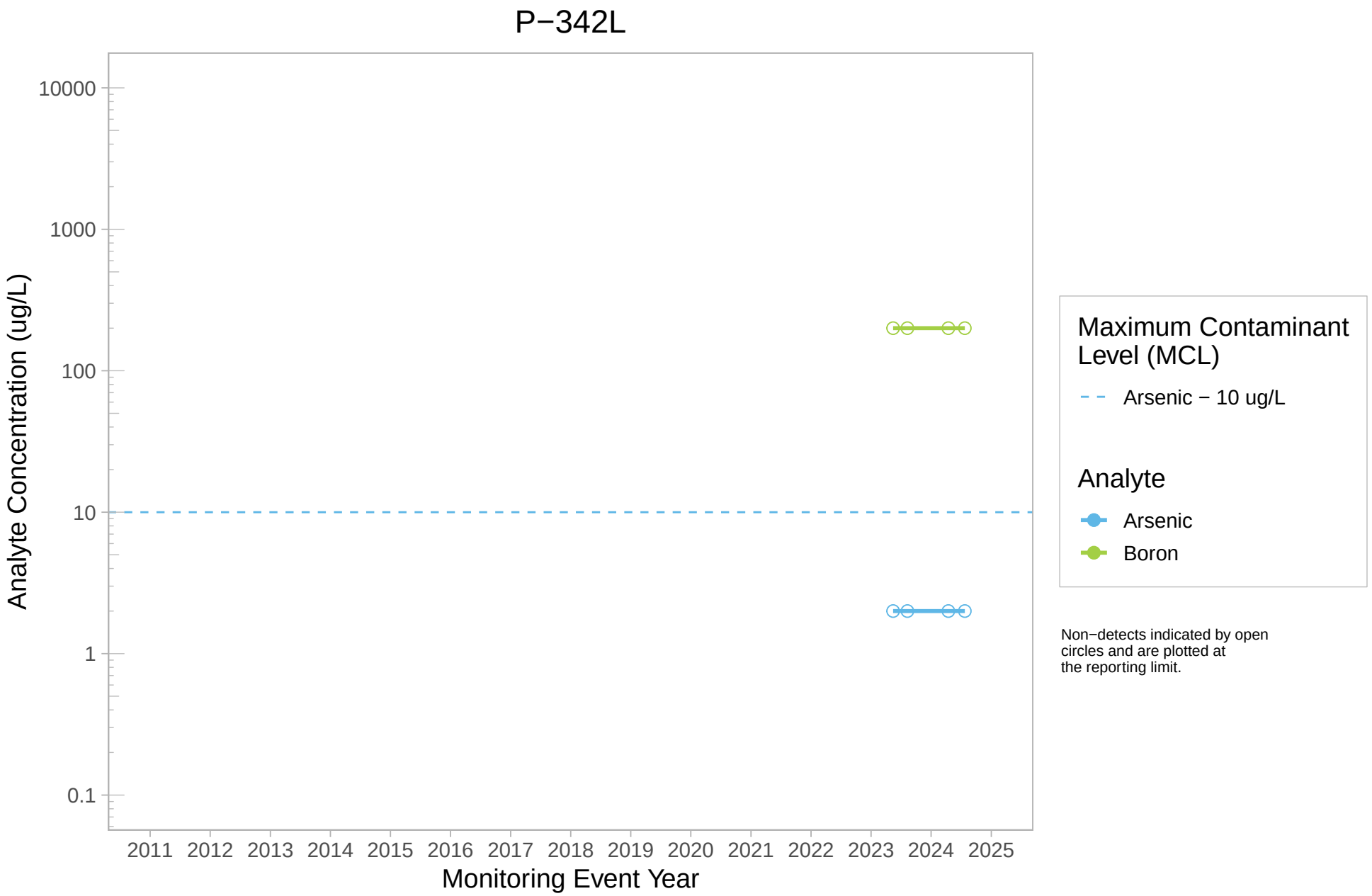

337−OWA
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

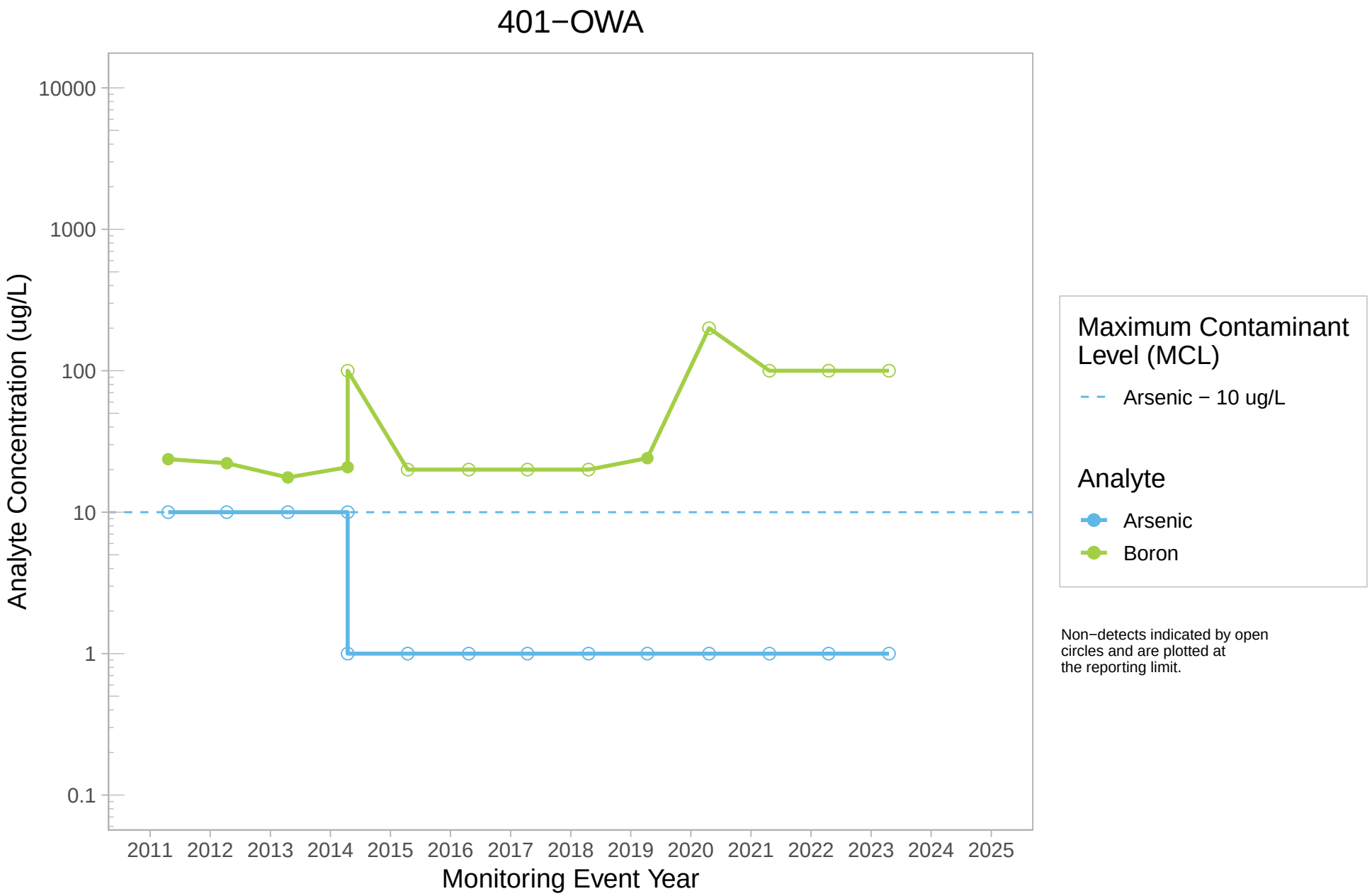

P−337L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

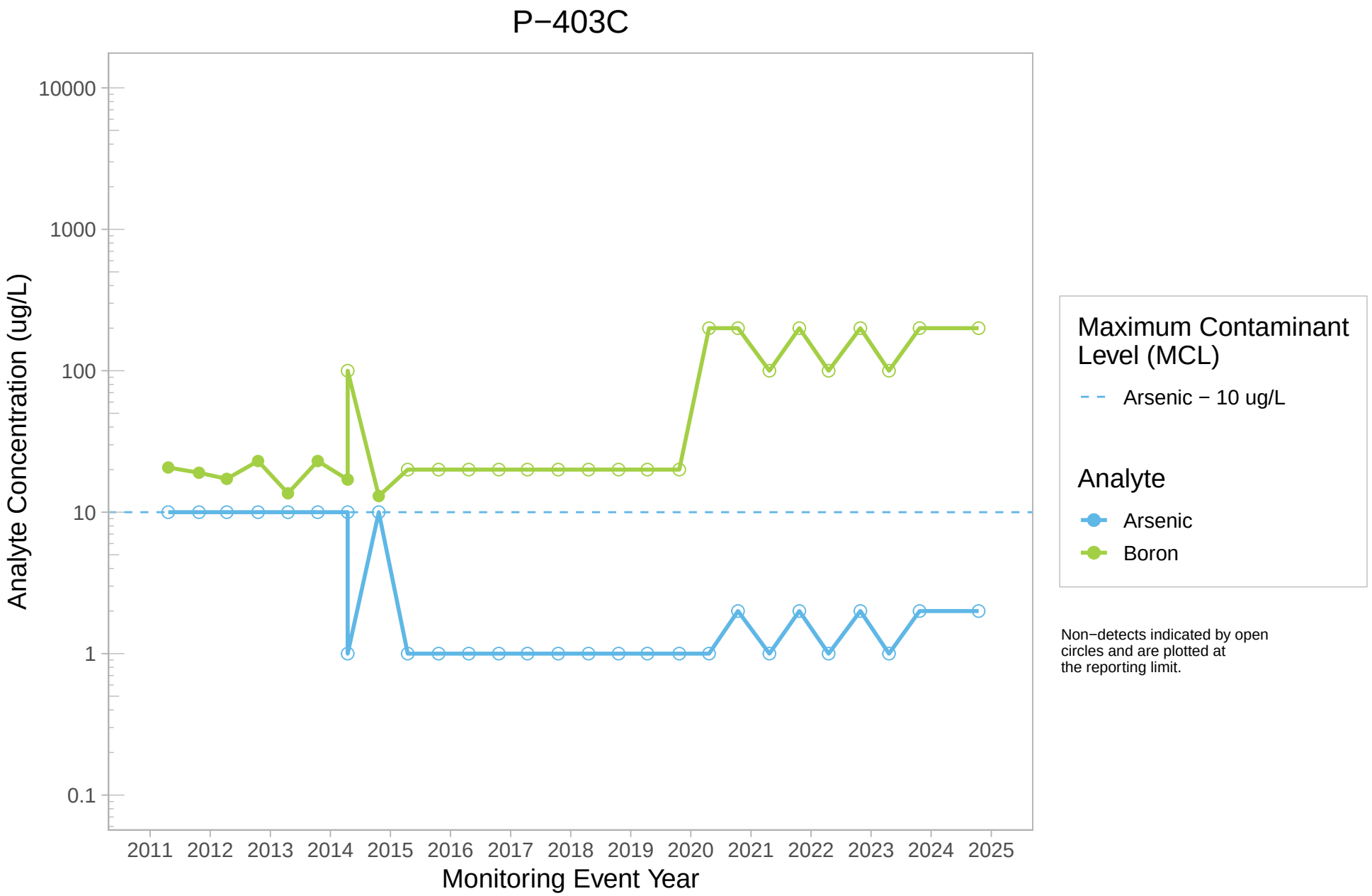

P−338L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

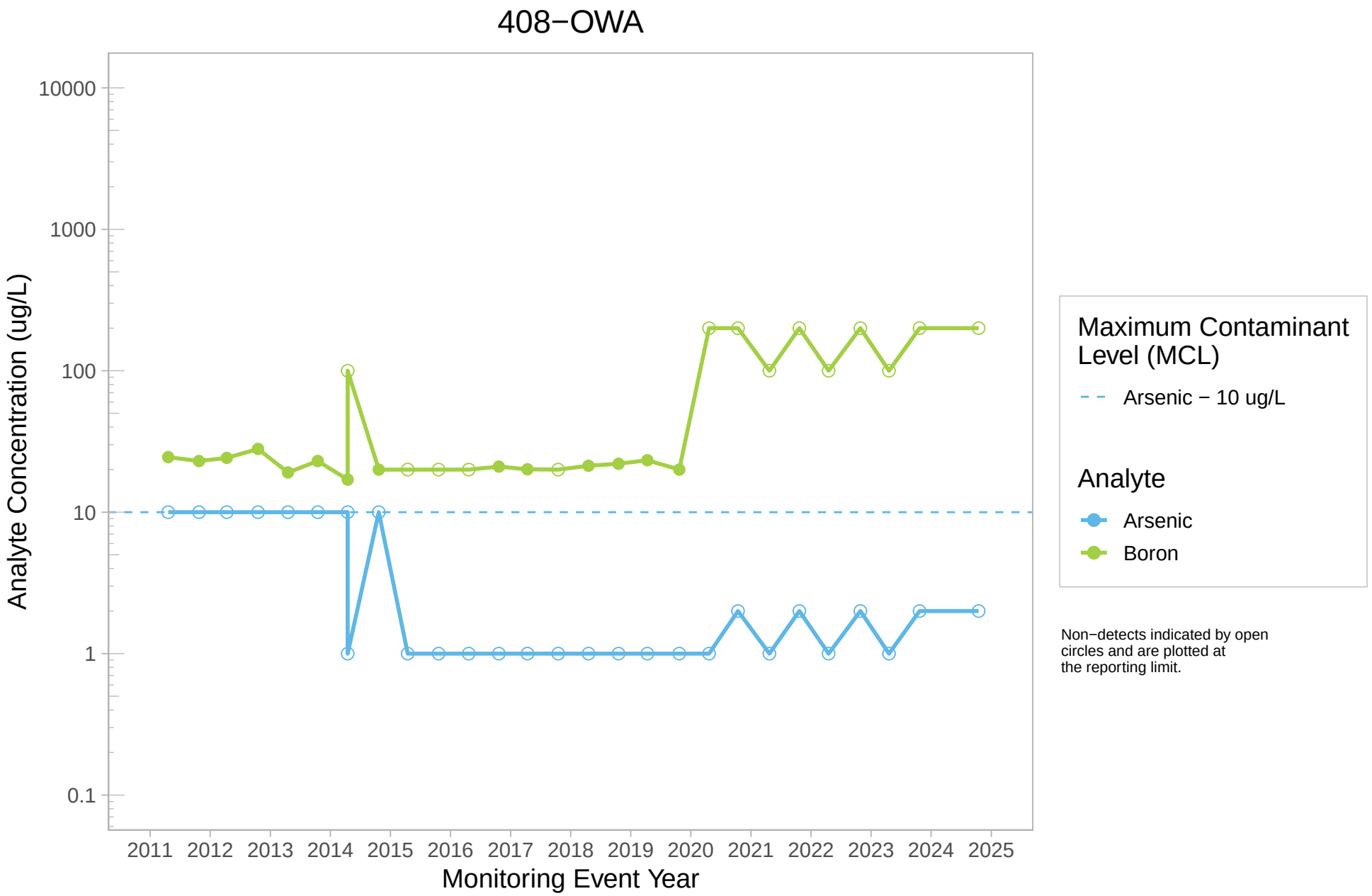

P−340L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

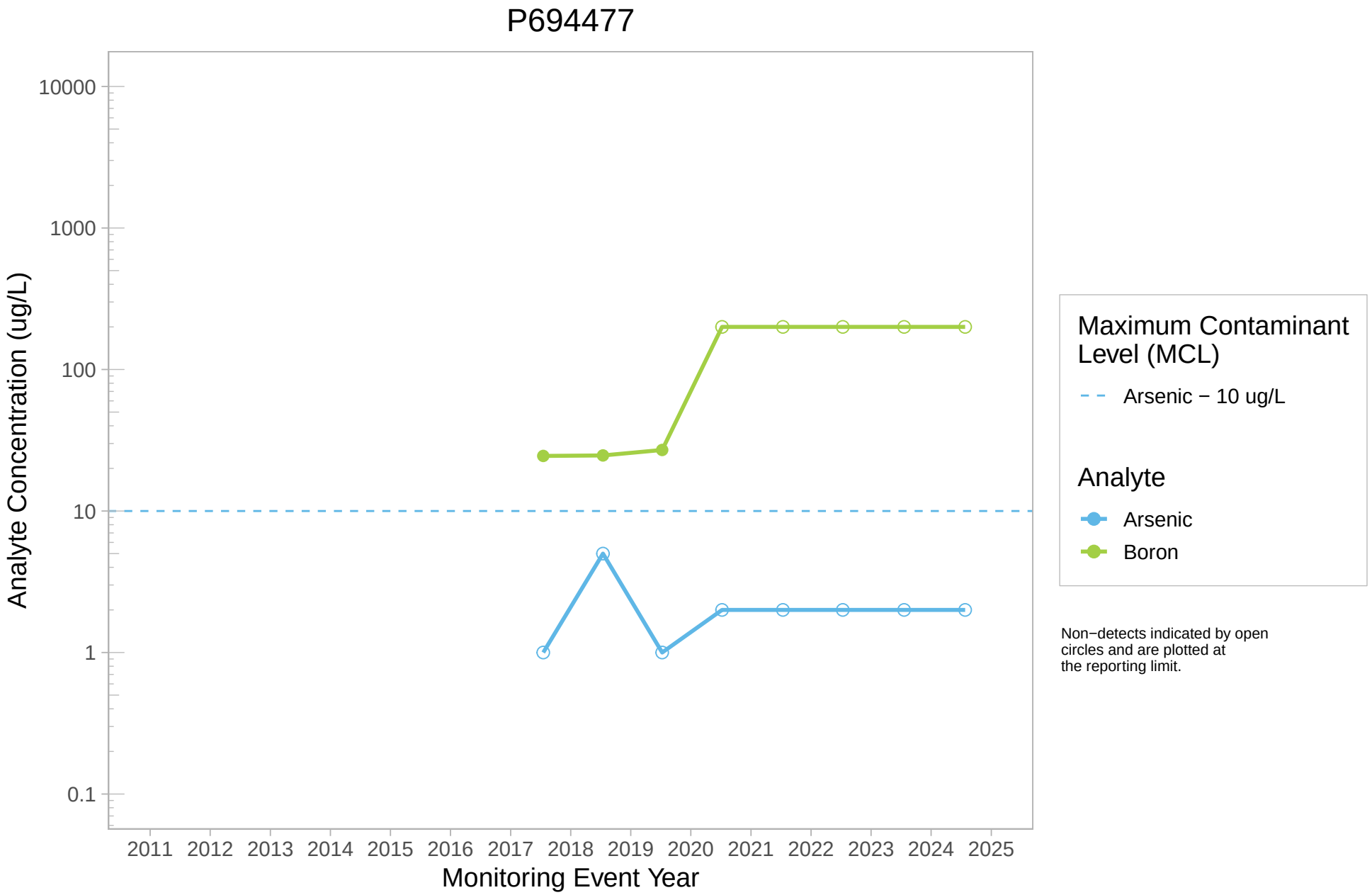

P−341L
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

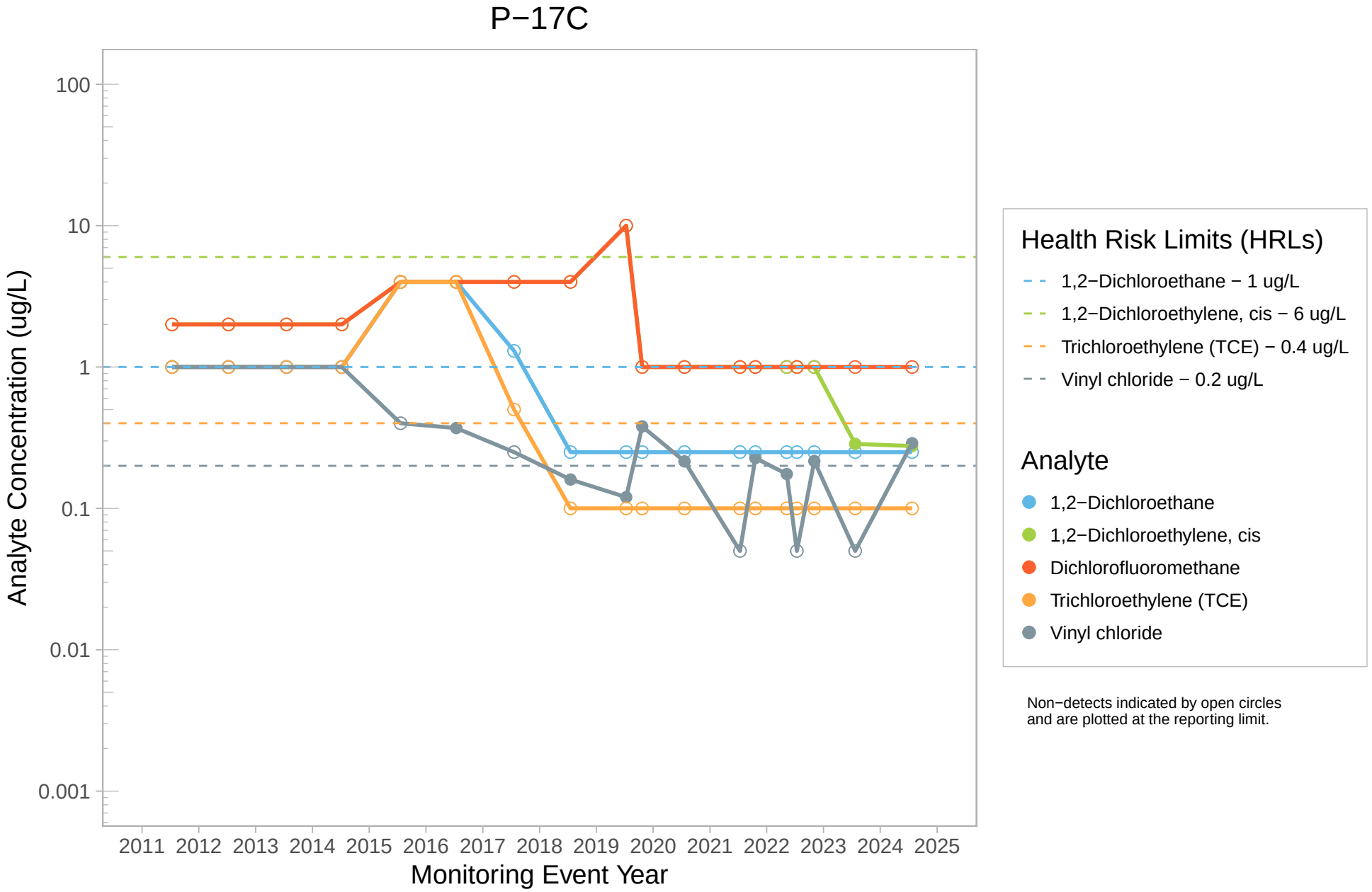

P−342L
10000
1000
100
10
1
0.1
Analyte Concentration (ug/L)
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.


401−OWA
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

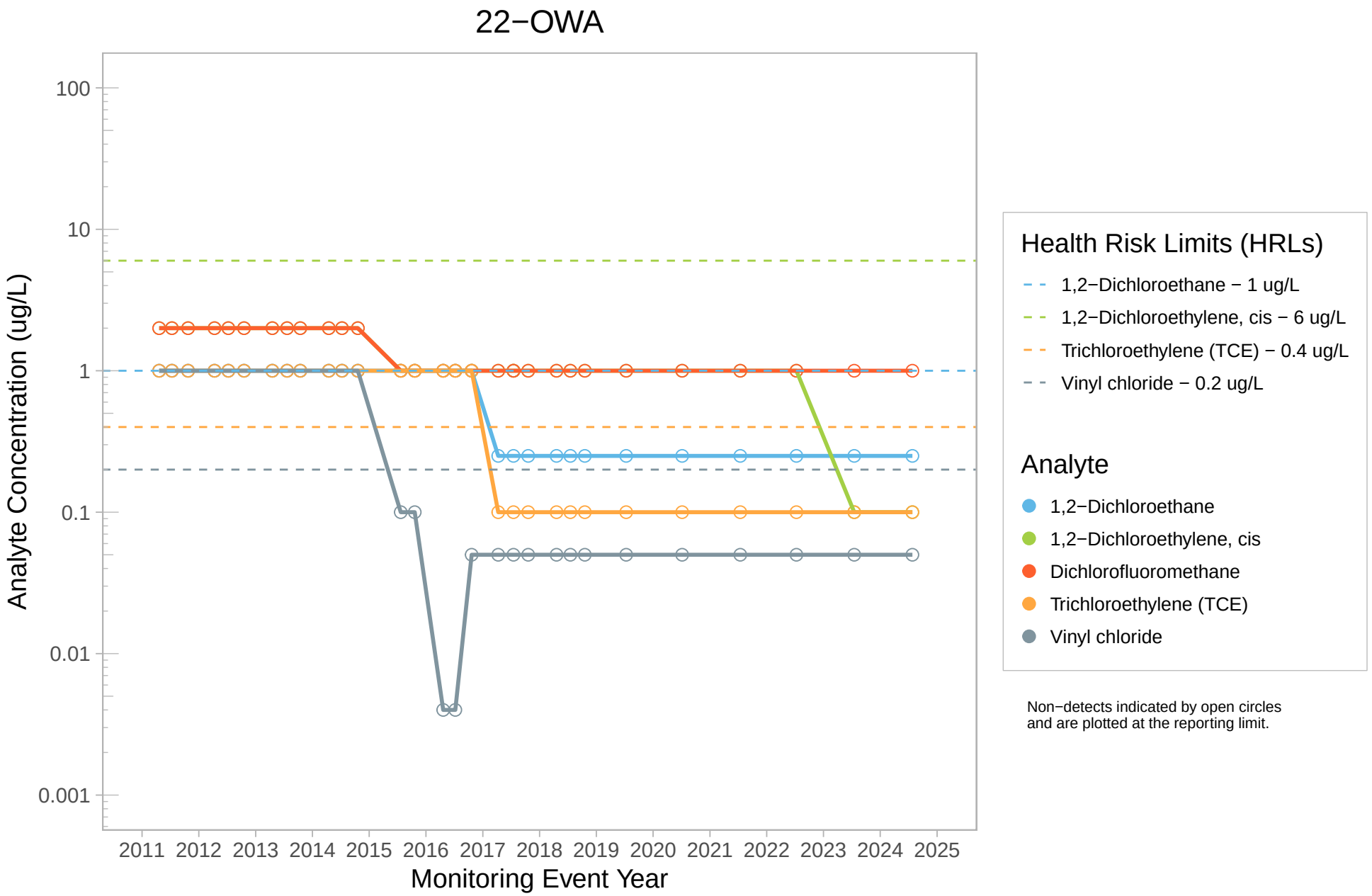

P−403C
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.


408−OWA
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.

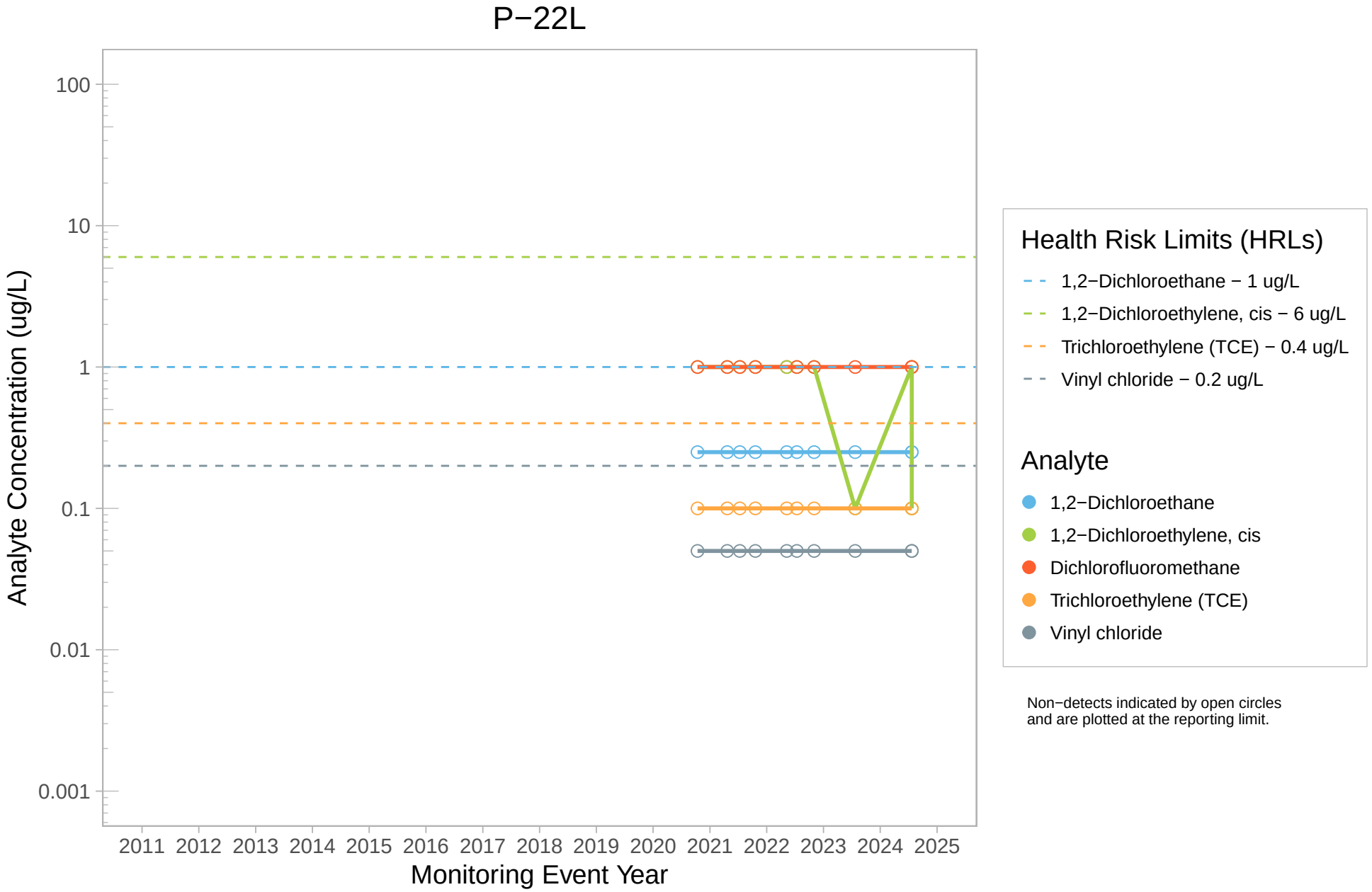

P694477
Analyte Concentration (ug/L)
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Maximum Contaminant Level (MCL)
Arsenic − 10 ug/L
Analyte
Arsenic
Boron
Non−detects indicated by open circles and are plotted at the reporting limit.



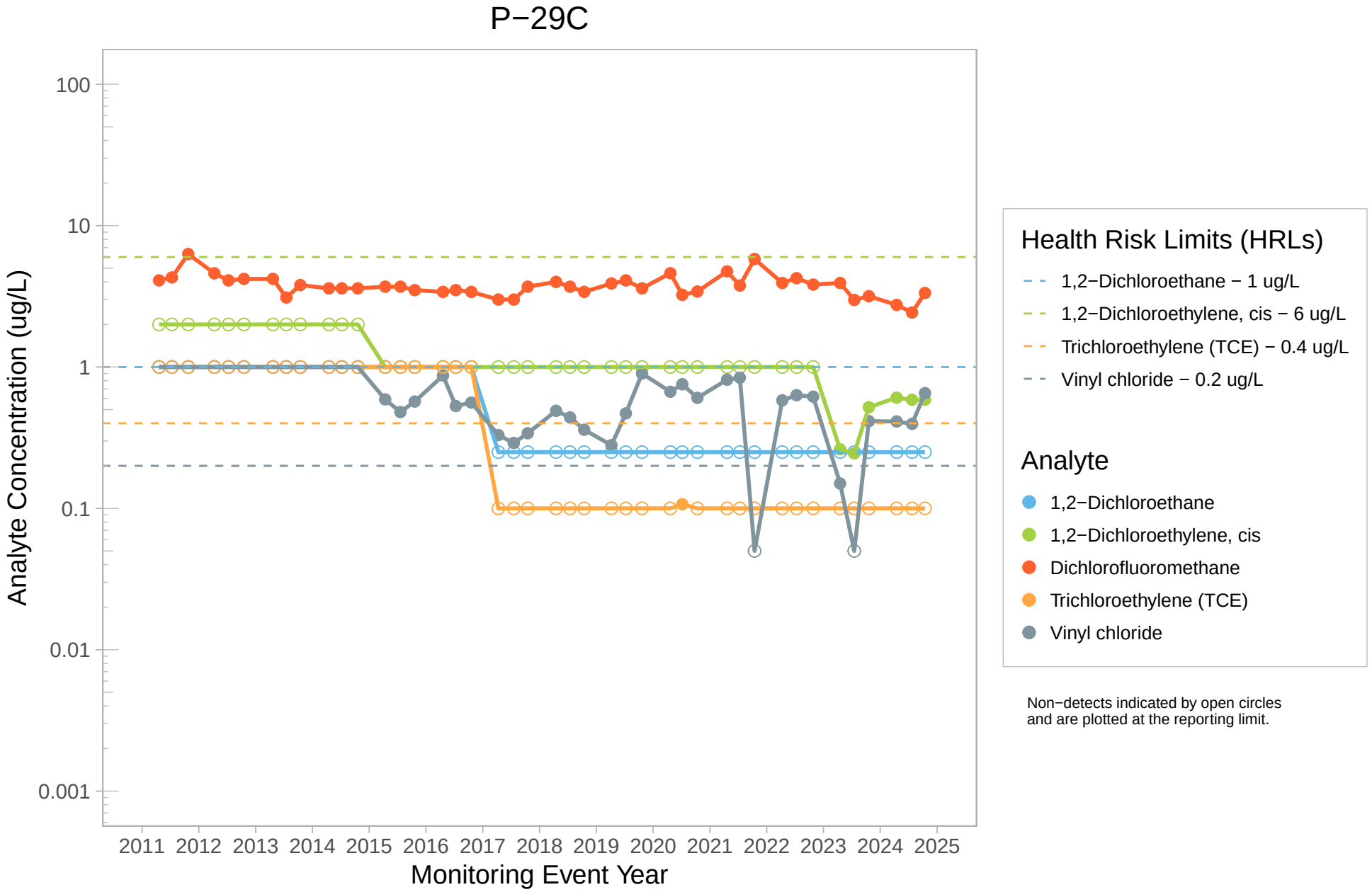
Non−detects indicated by open circles and are plotted at the reporting limit.



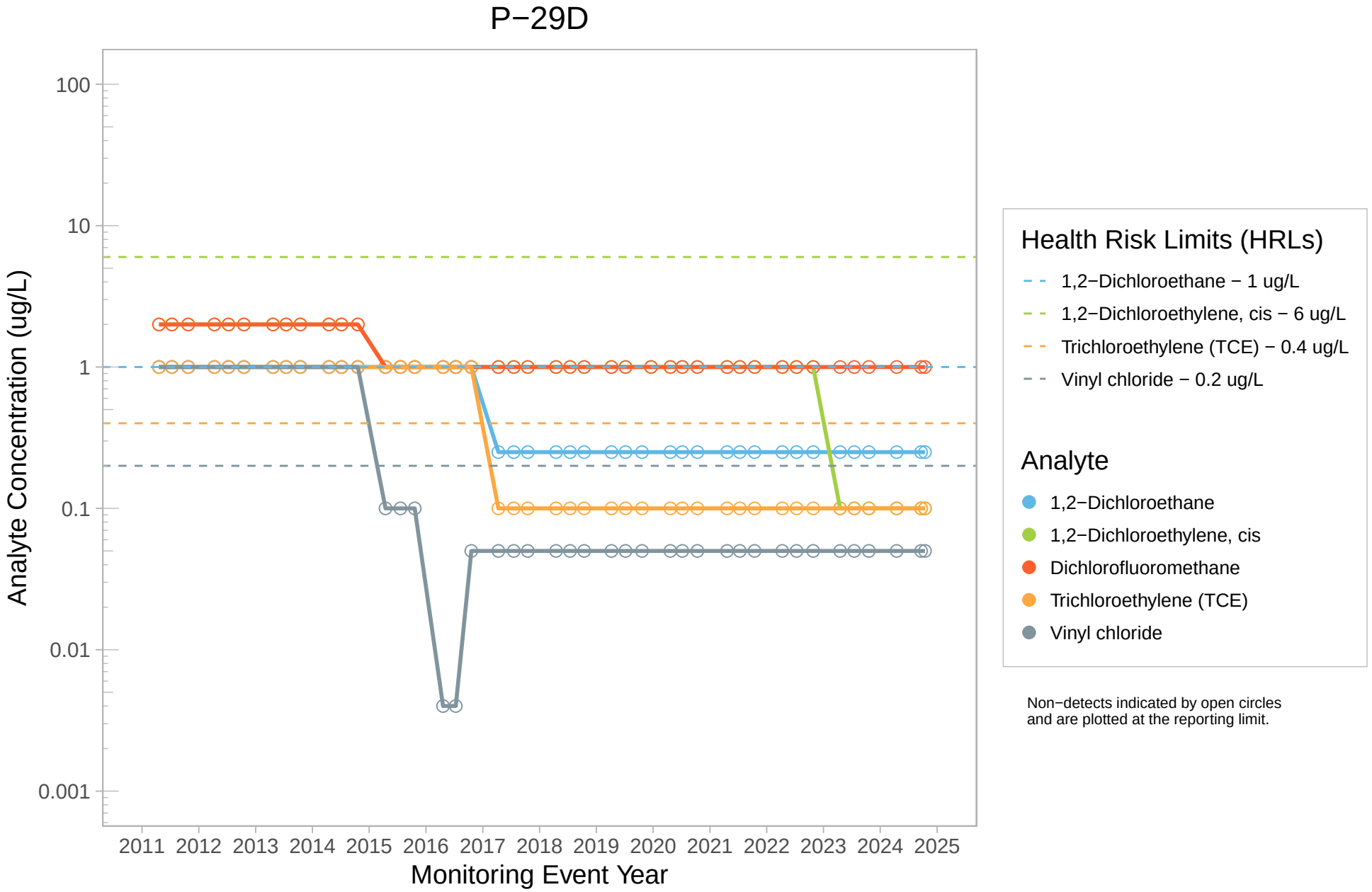
Non−detects indicated by open circles and are plotted at the reporting limit.



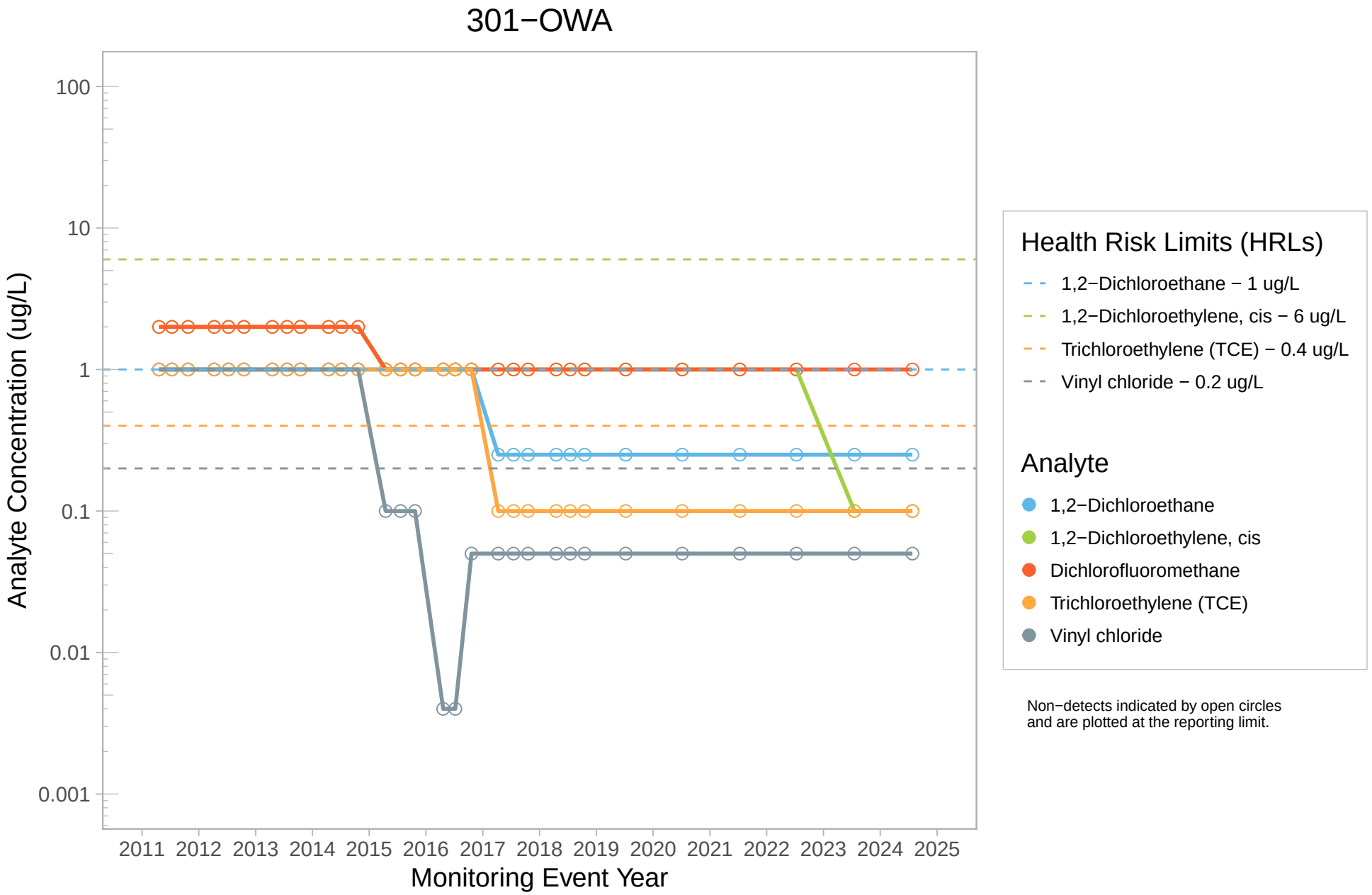
Non−detects indicated by open circles and are plotted at the reporting limit.



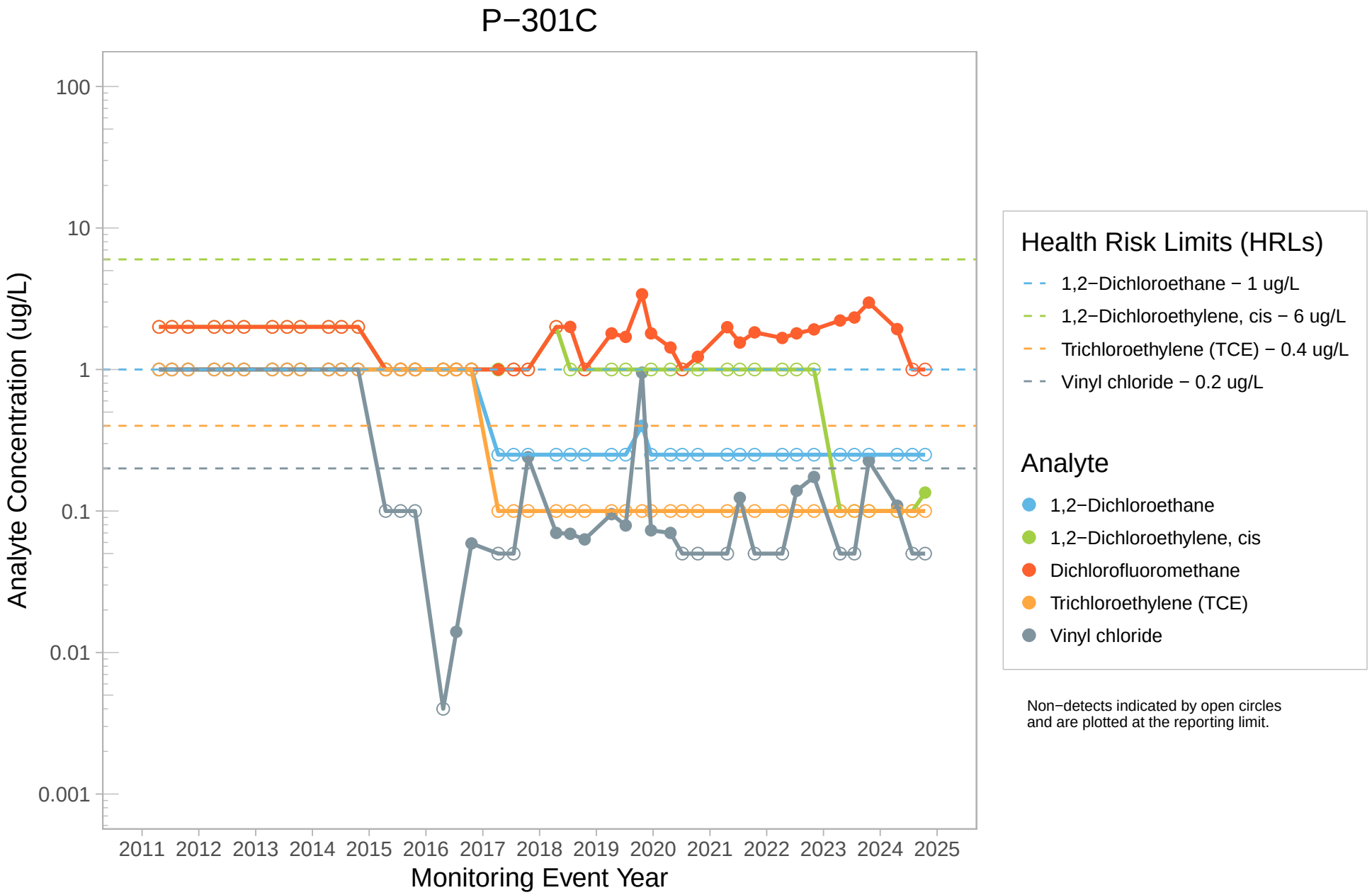
Non−detects indicated by open circles and are plotted at the reporting limit.



Non−detects indicated by open circles and are plotted at the reporting limit.

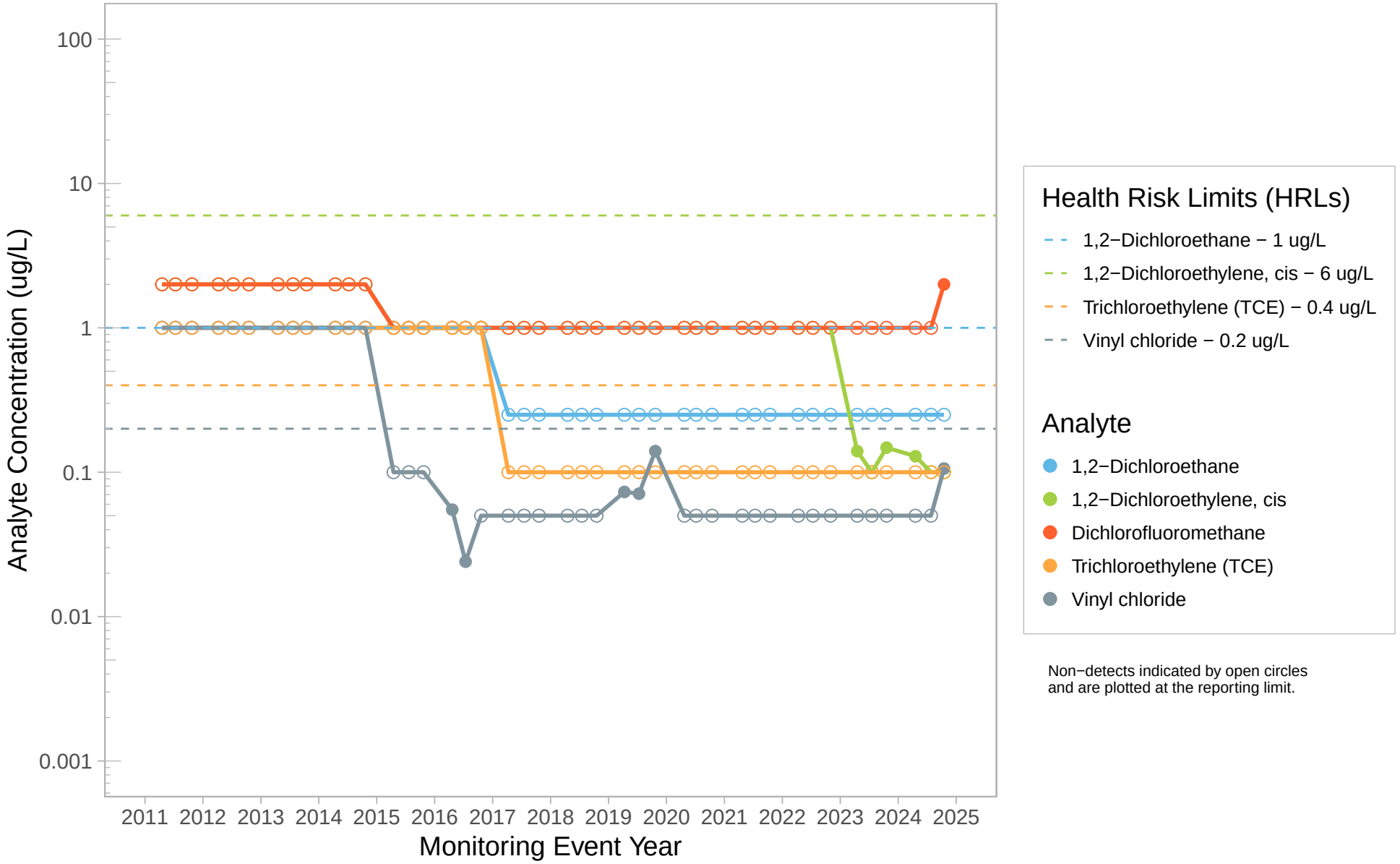


Non−detects indicated by open circles and are plotted at the reporting limit.

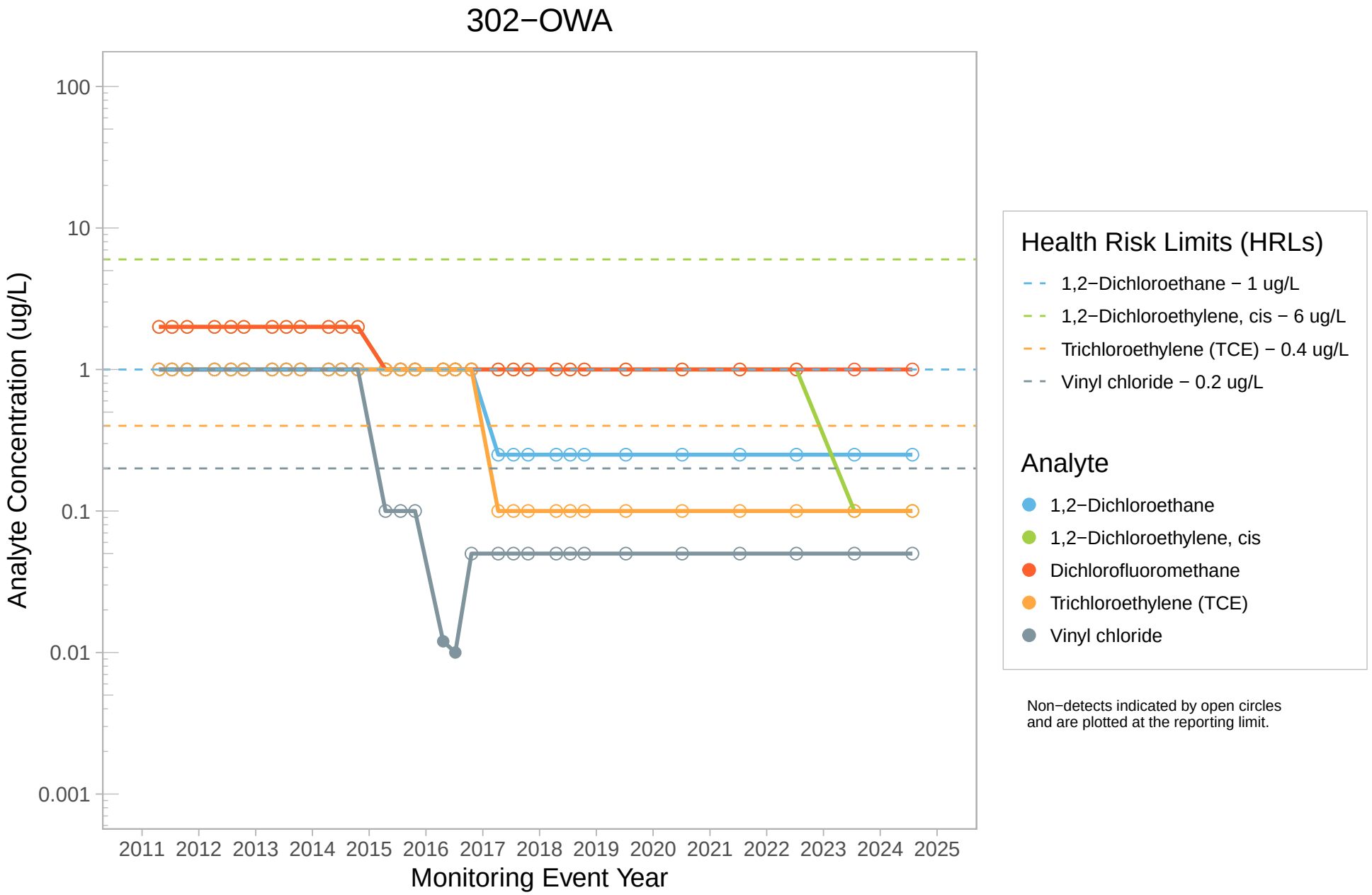


Non−detects indicated by open circles and are plotted at the reporting limit.

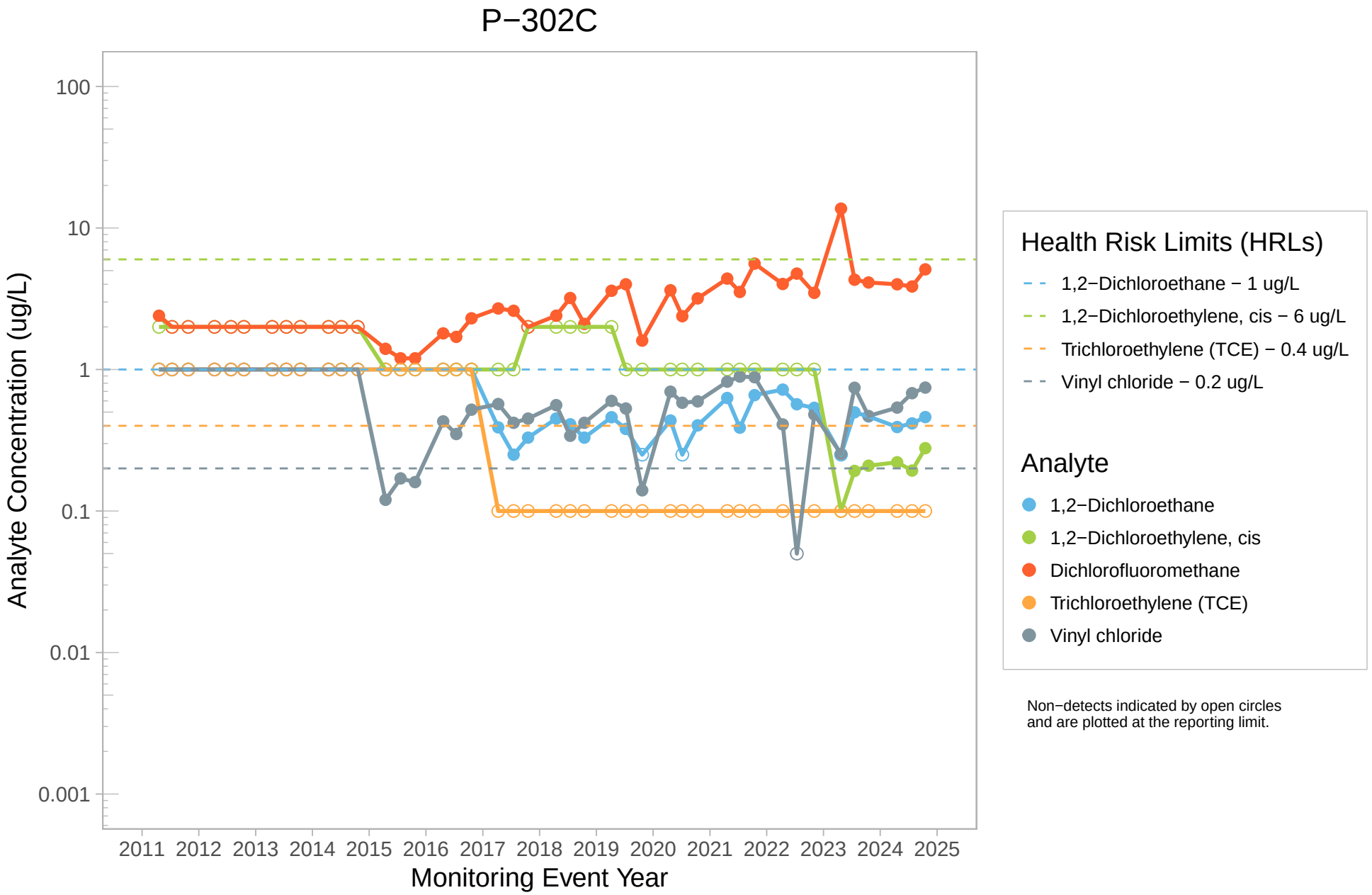
P−301L



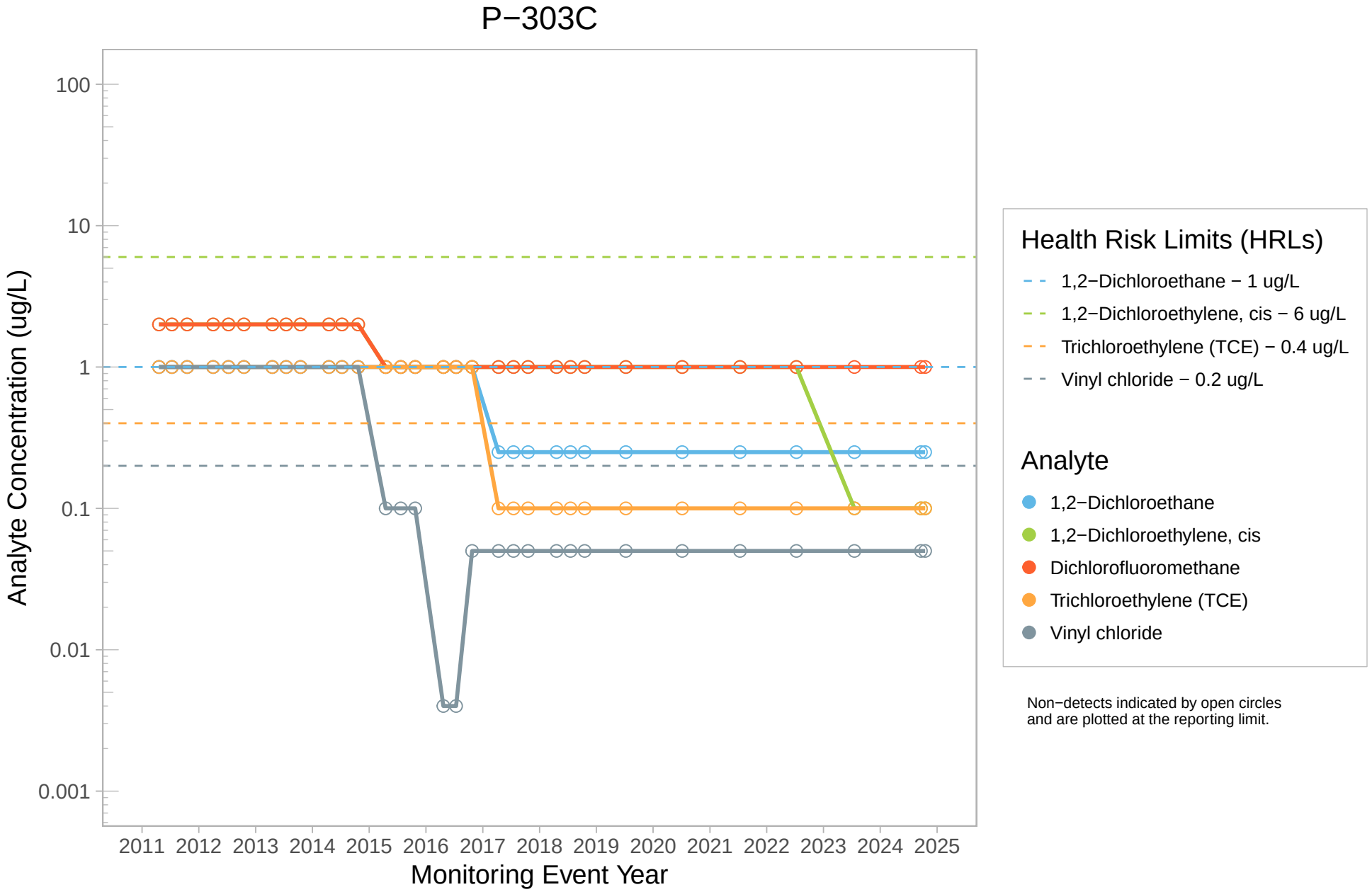
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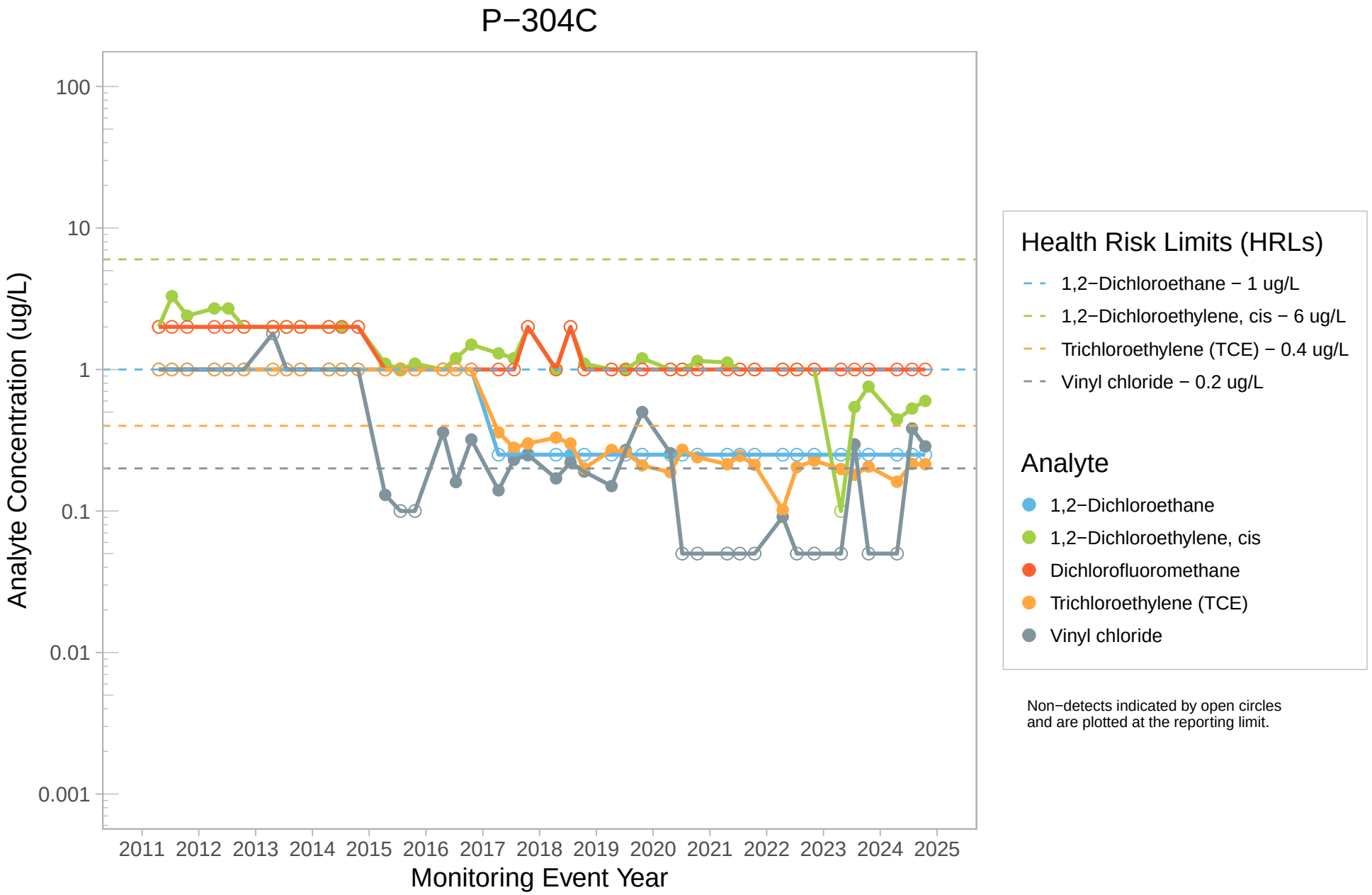
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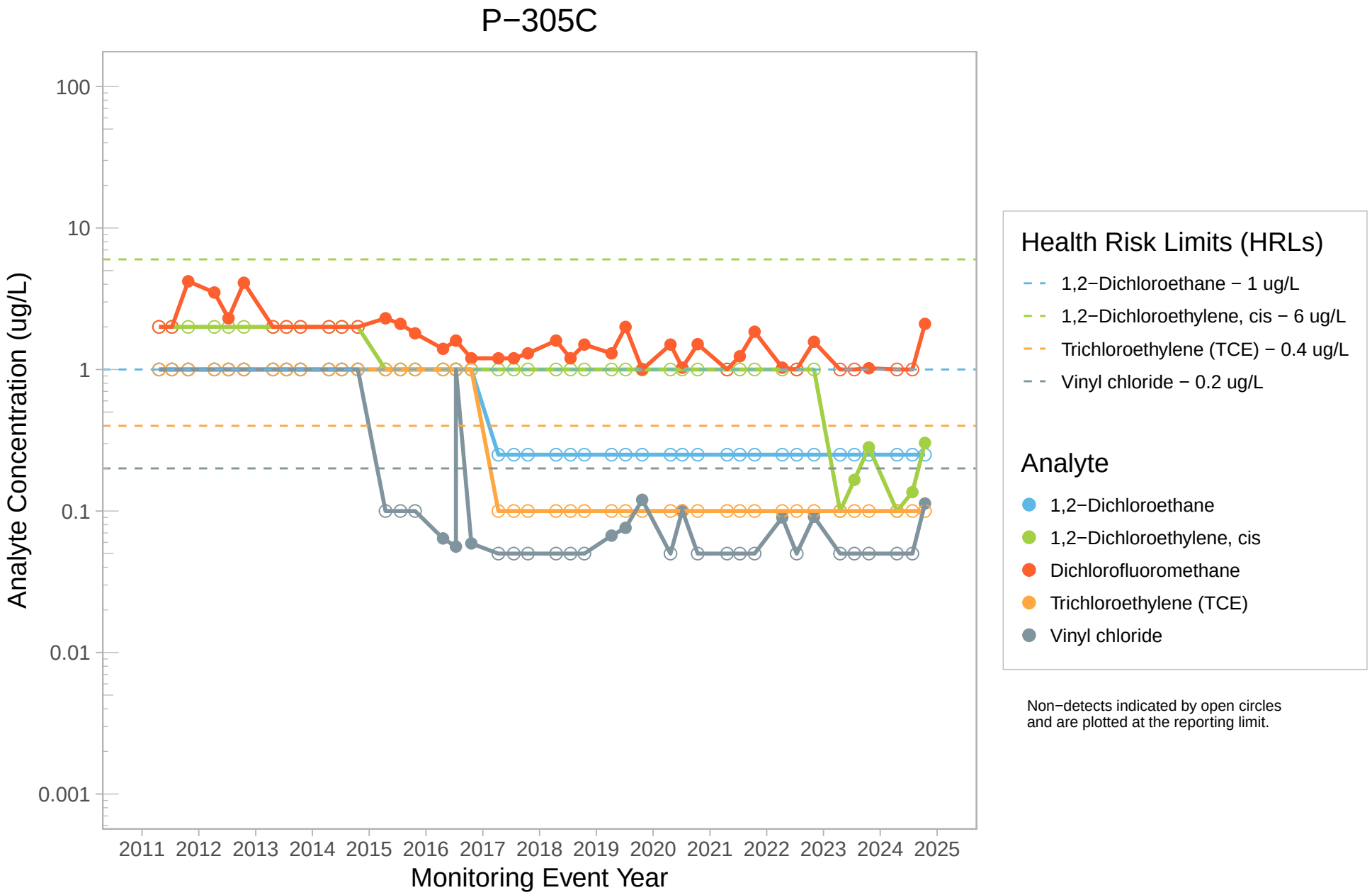
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Non−detects indicated by open circles and are plotted at the reporting limit.

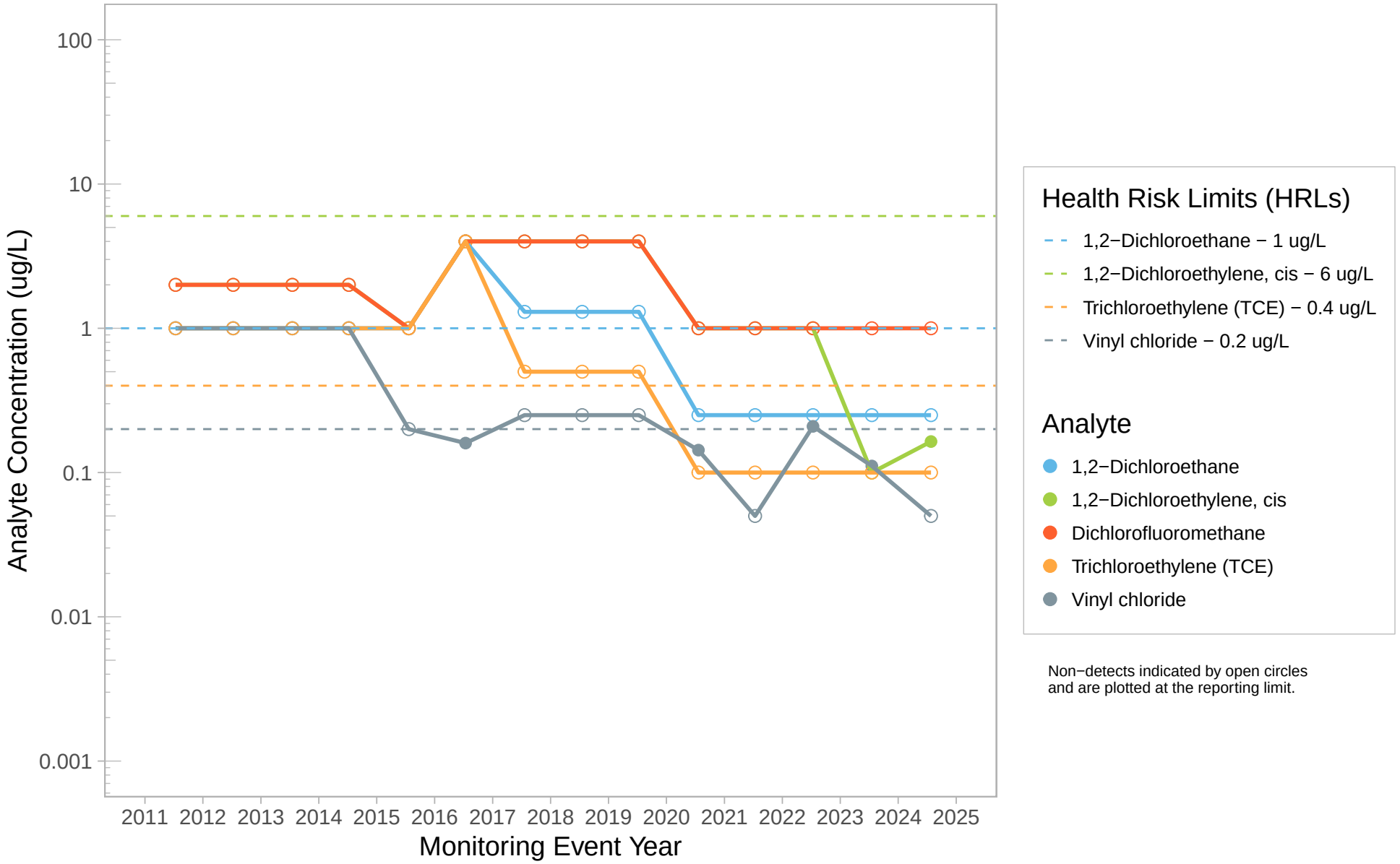


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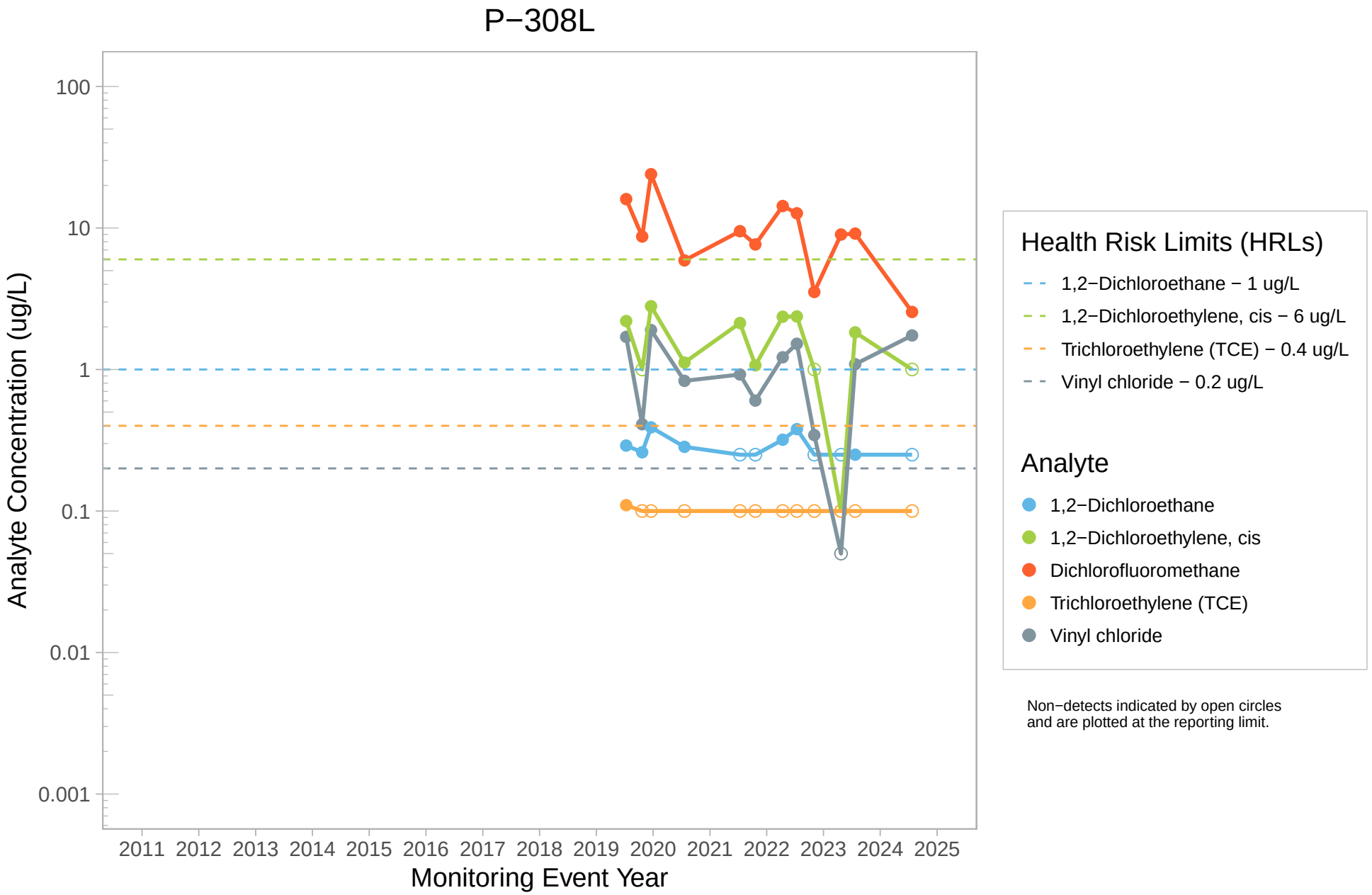


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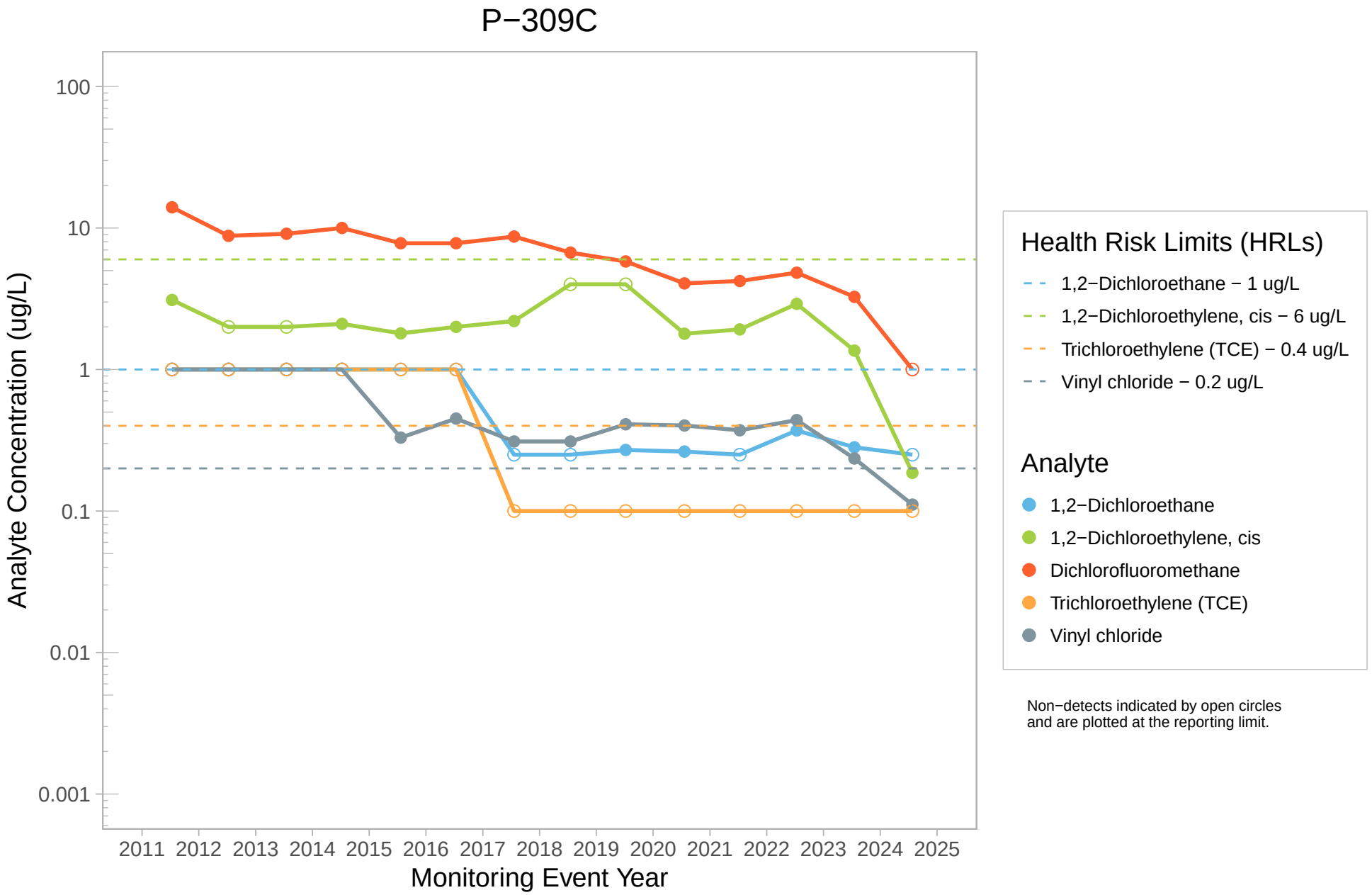
P−308C



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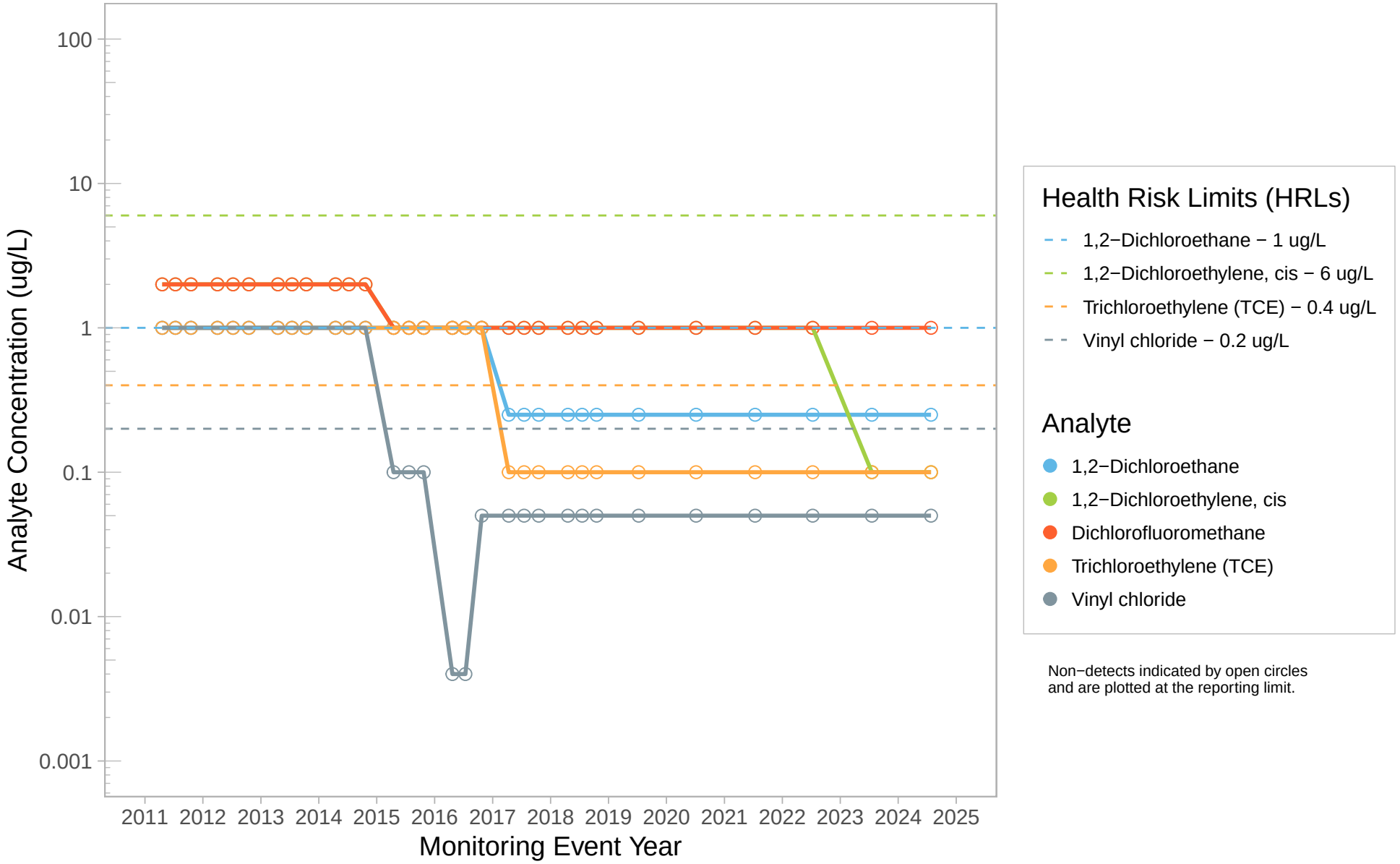


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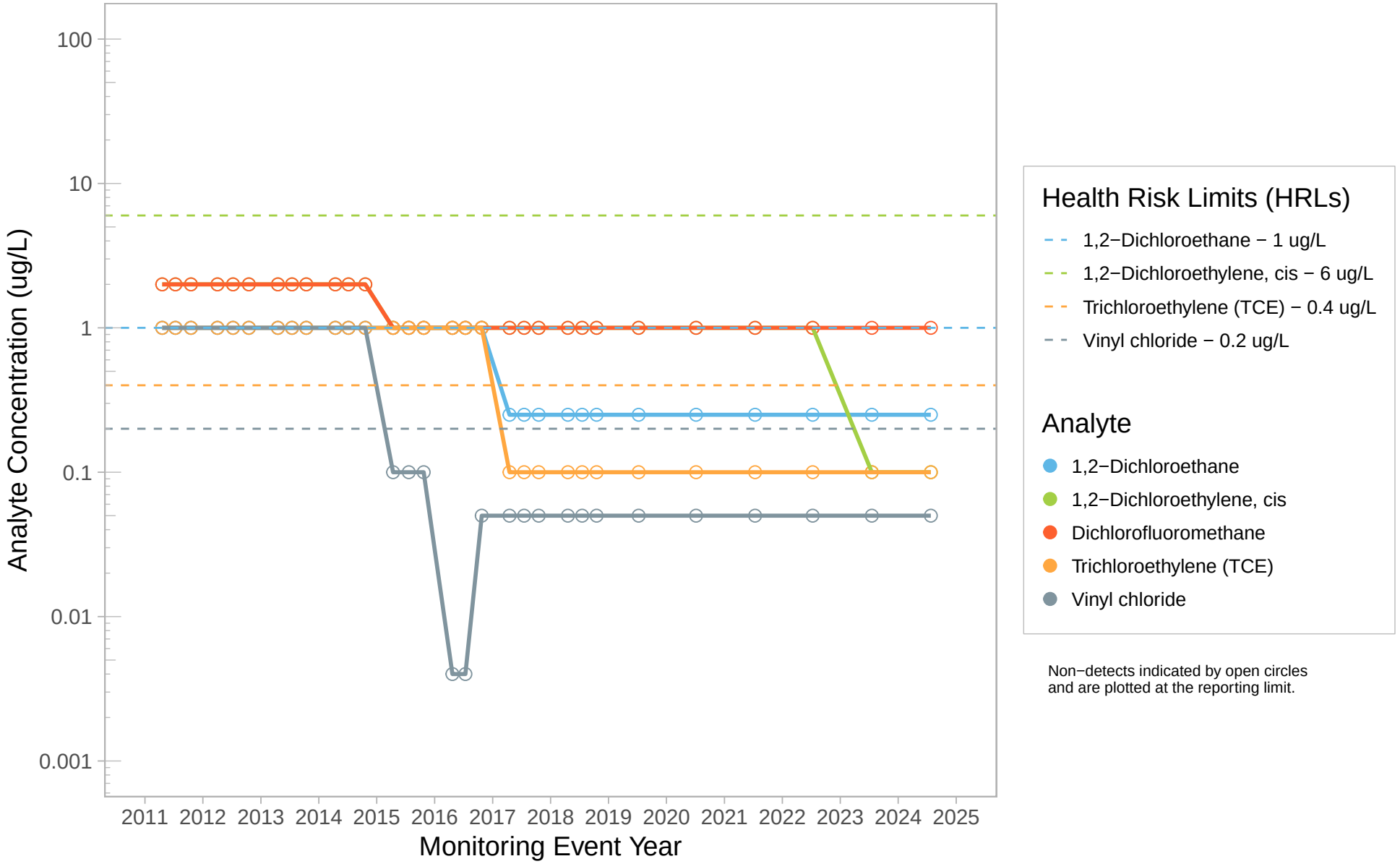
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P−310C

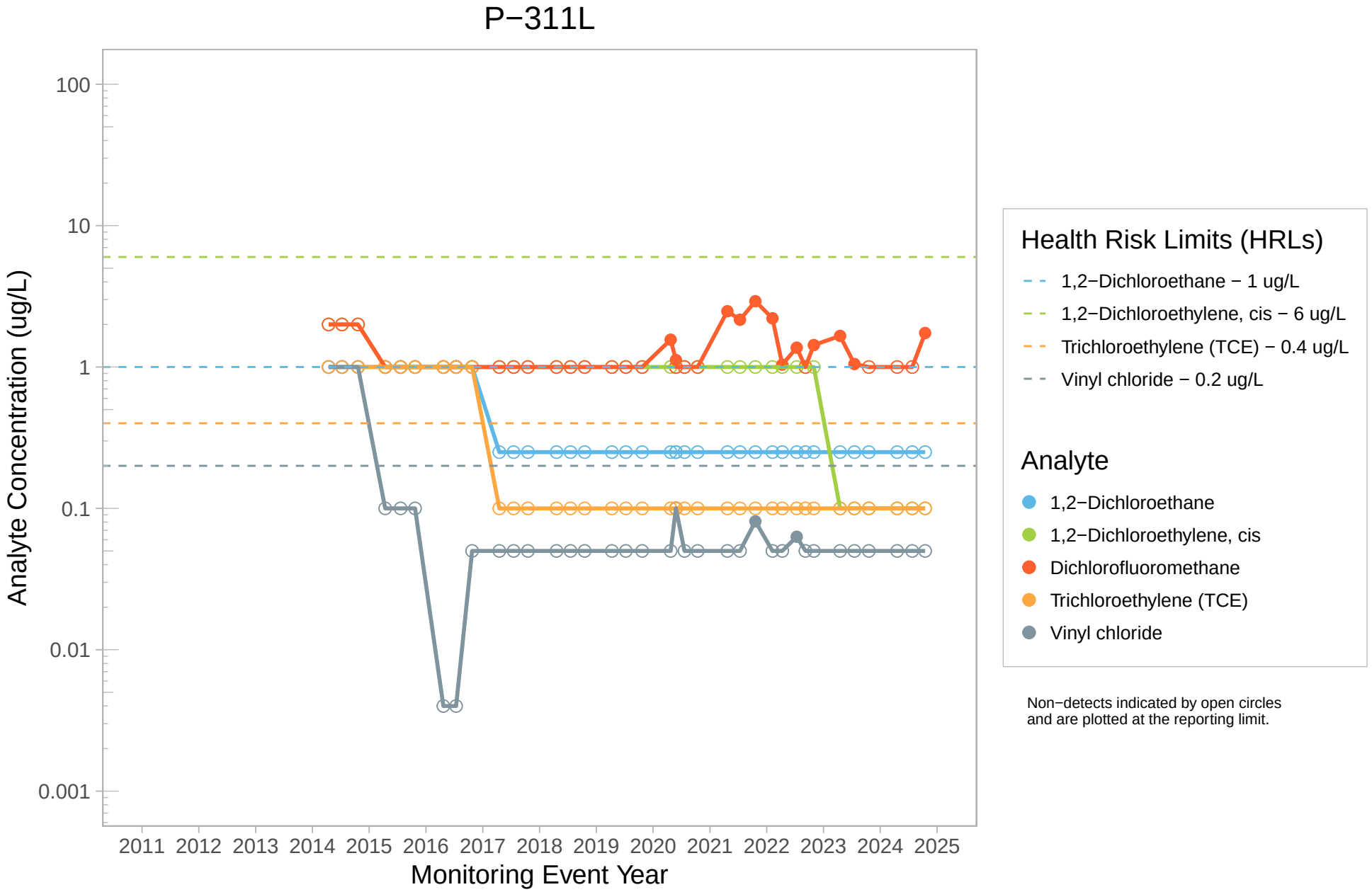


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P−311C

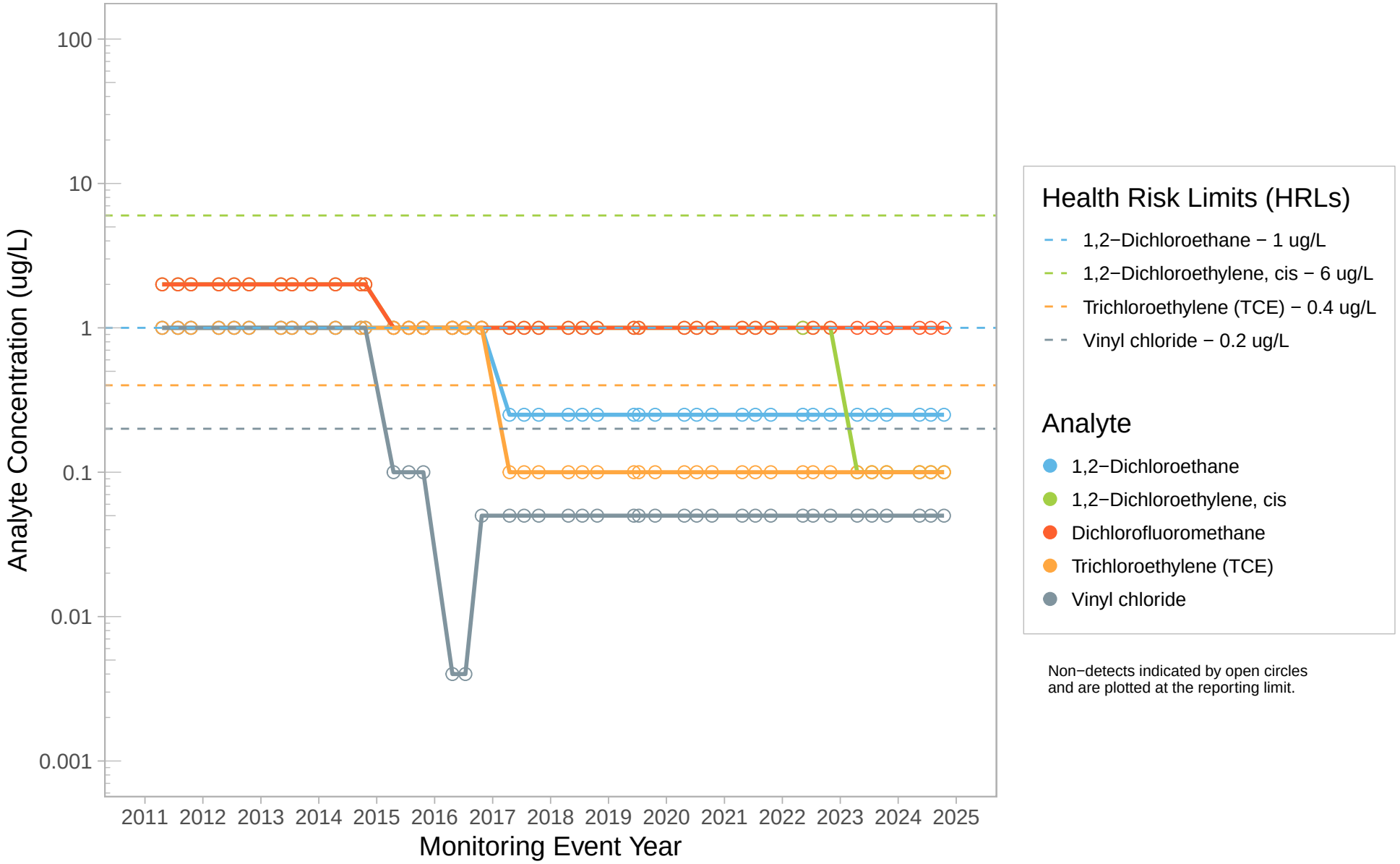


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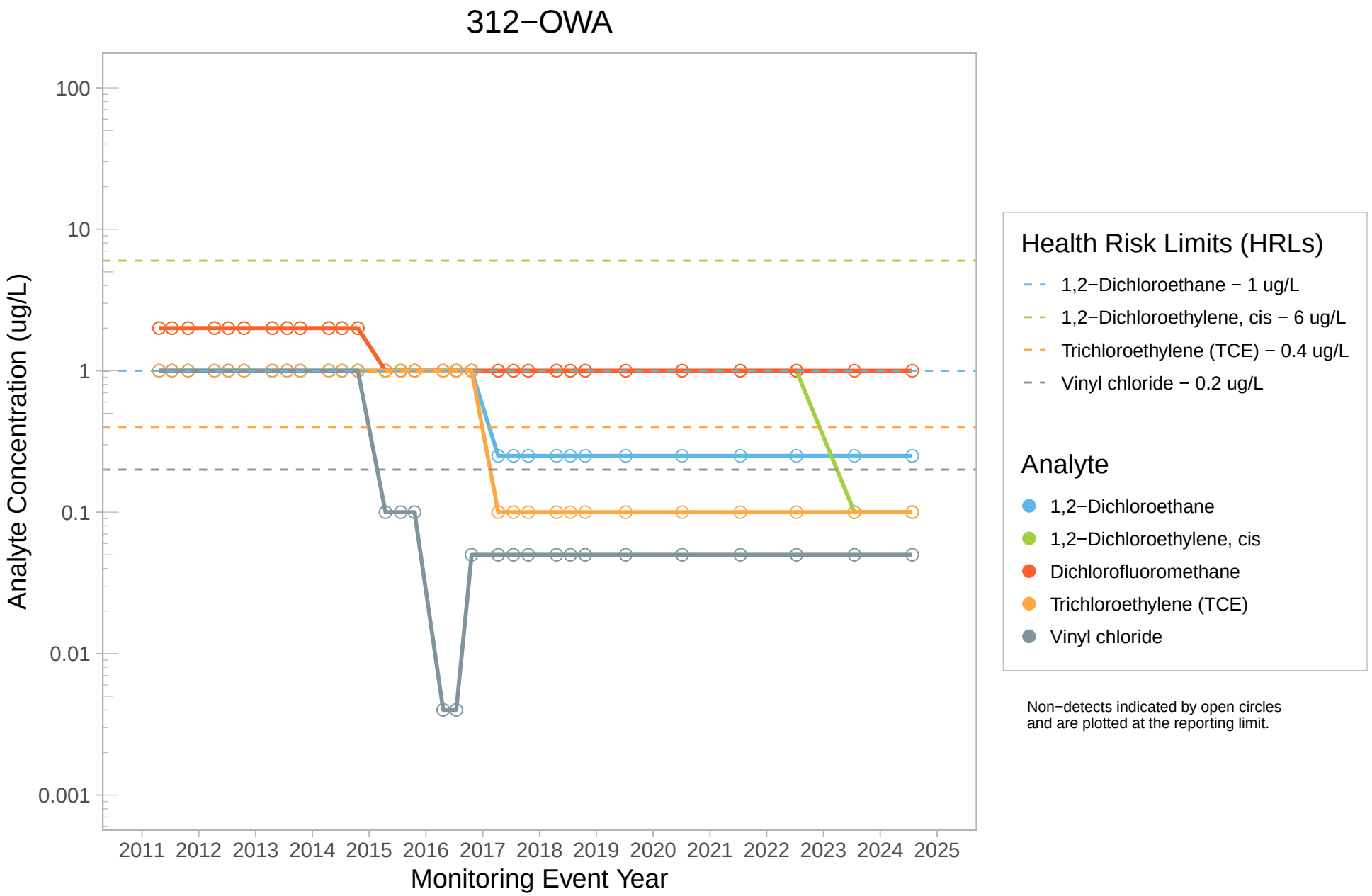


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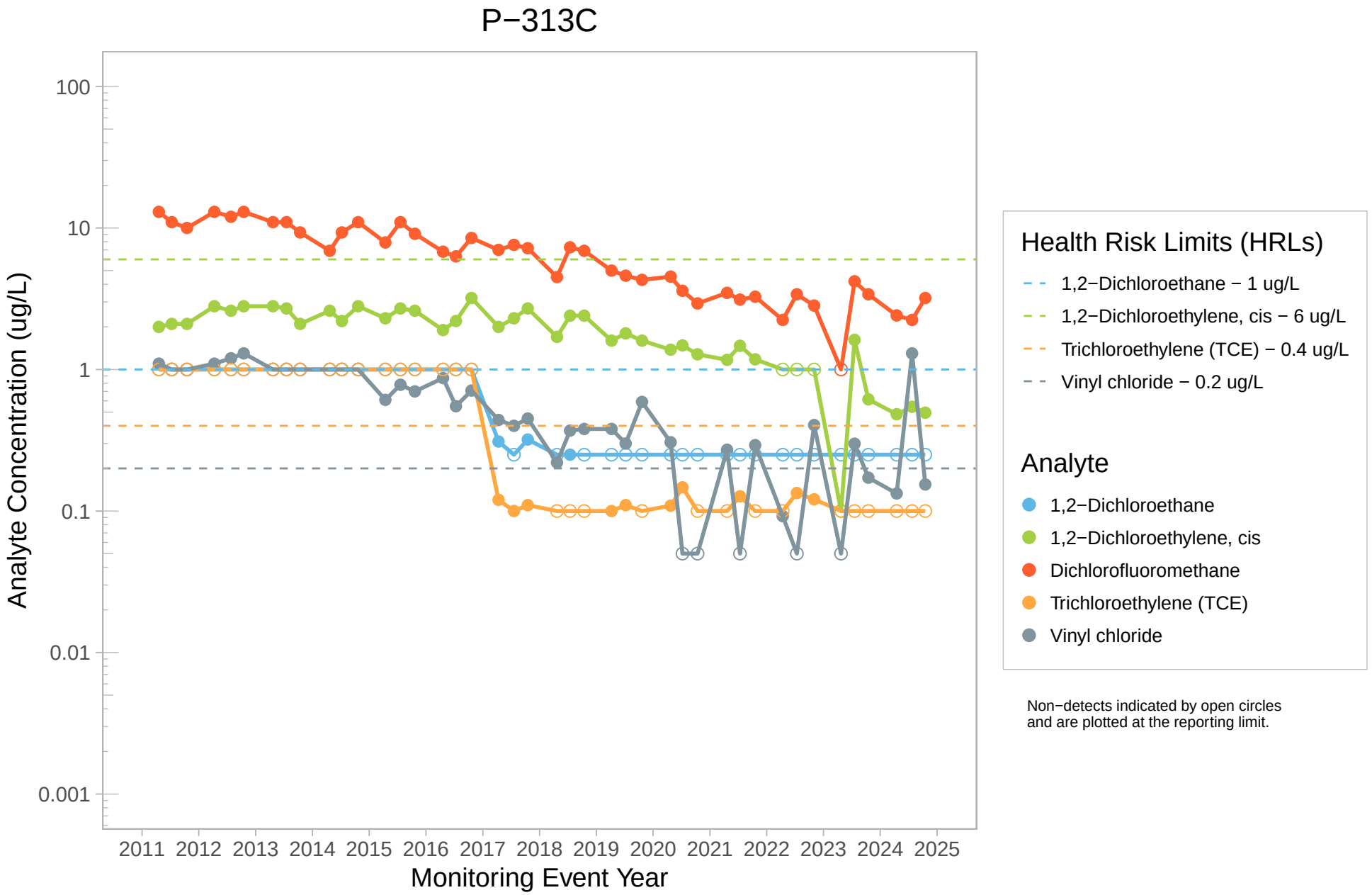
P−311D



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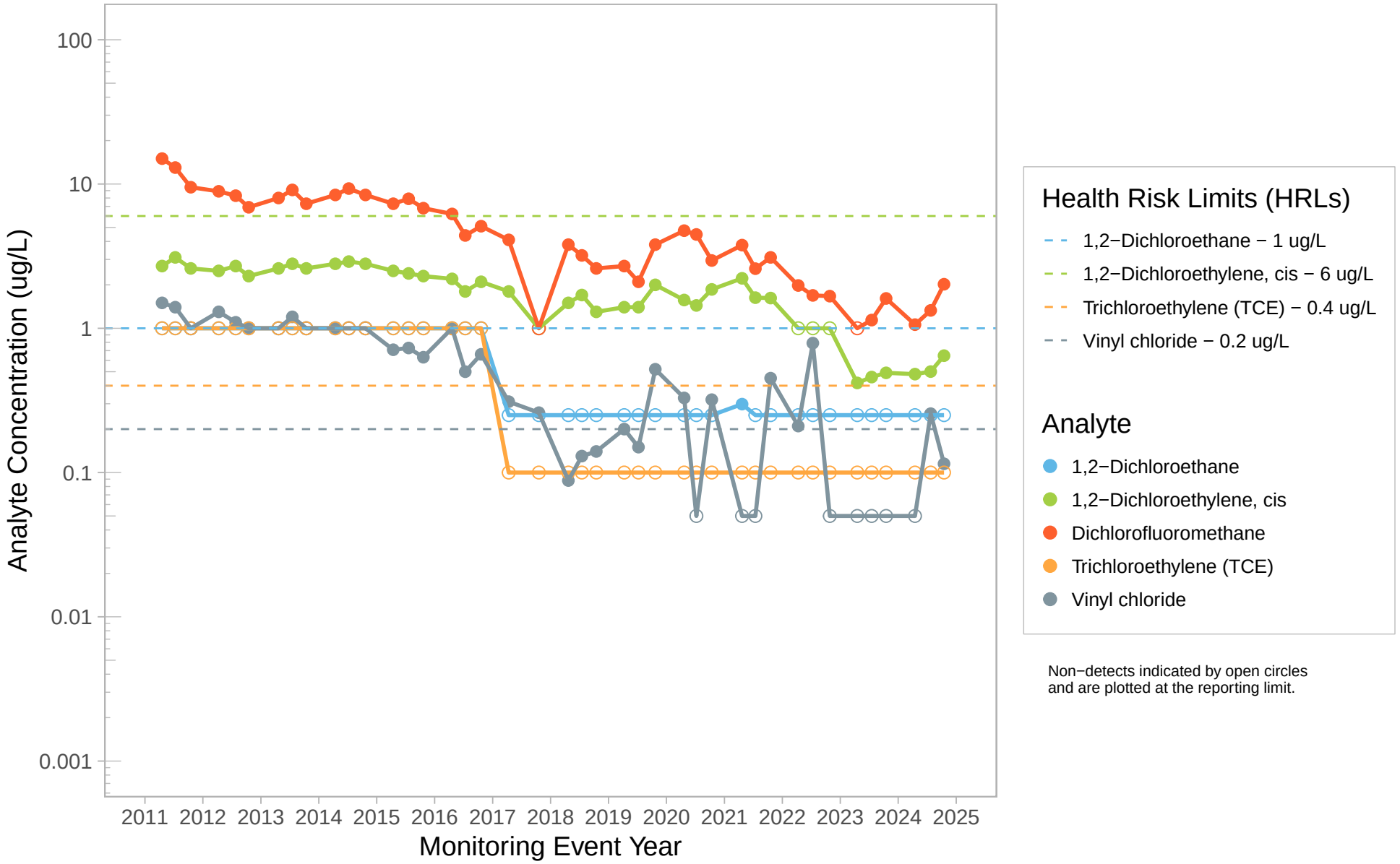


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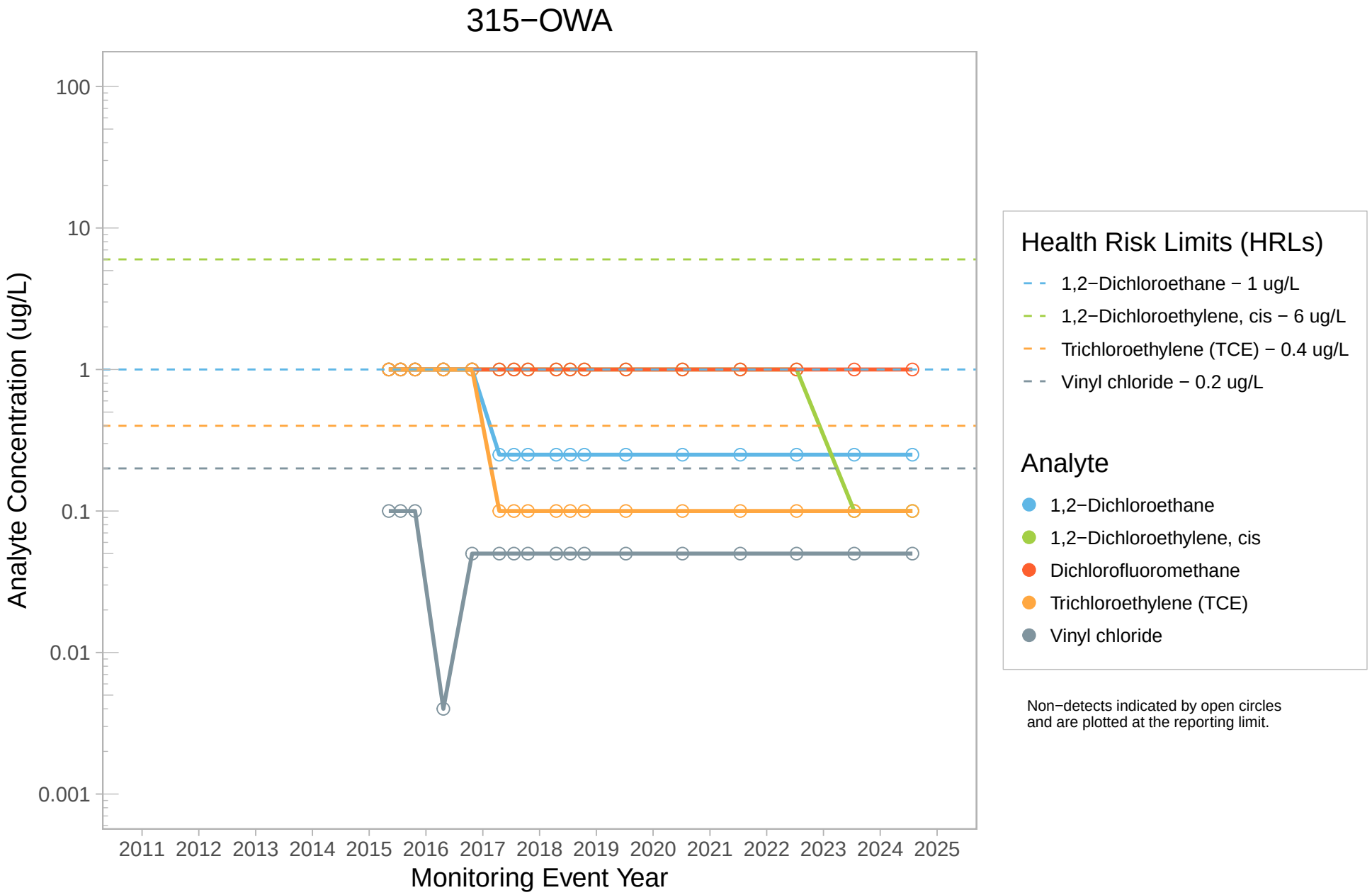


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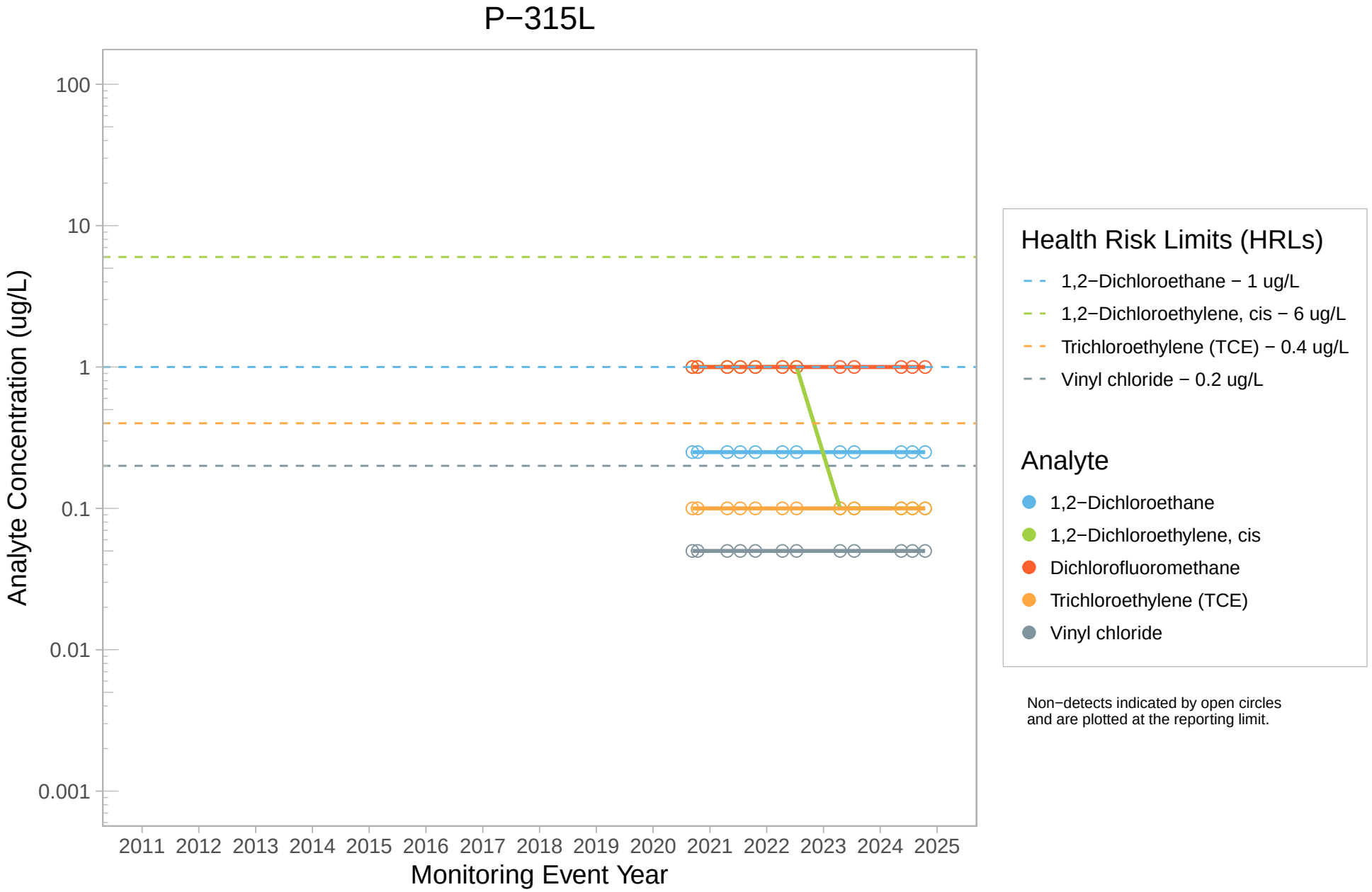
P−314C



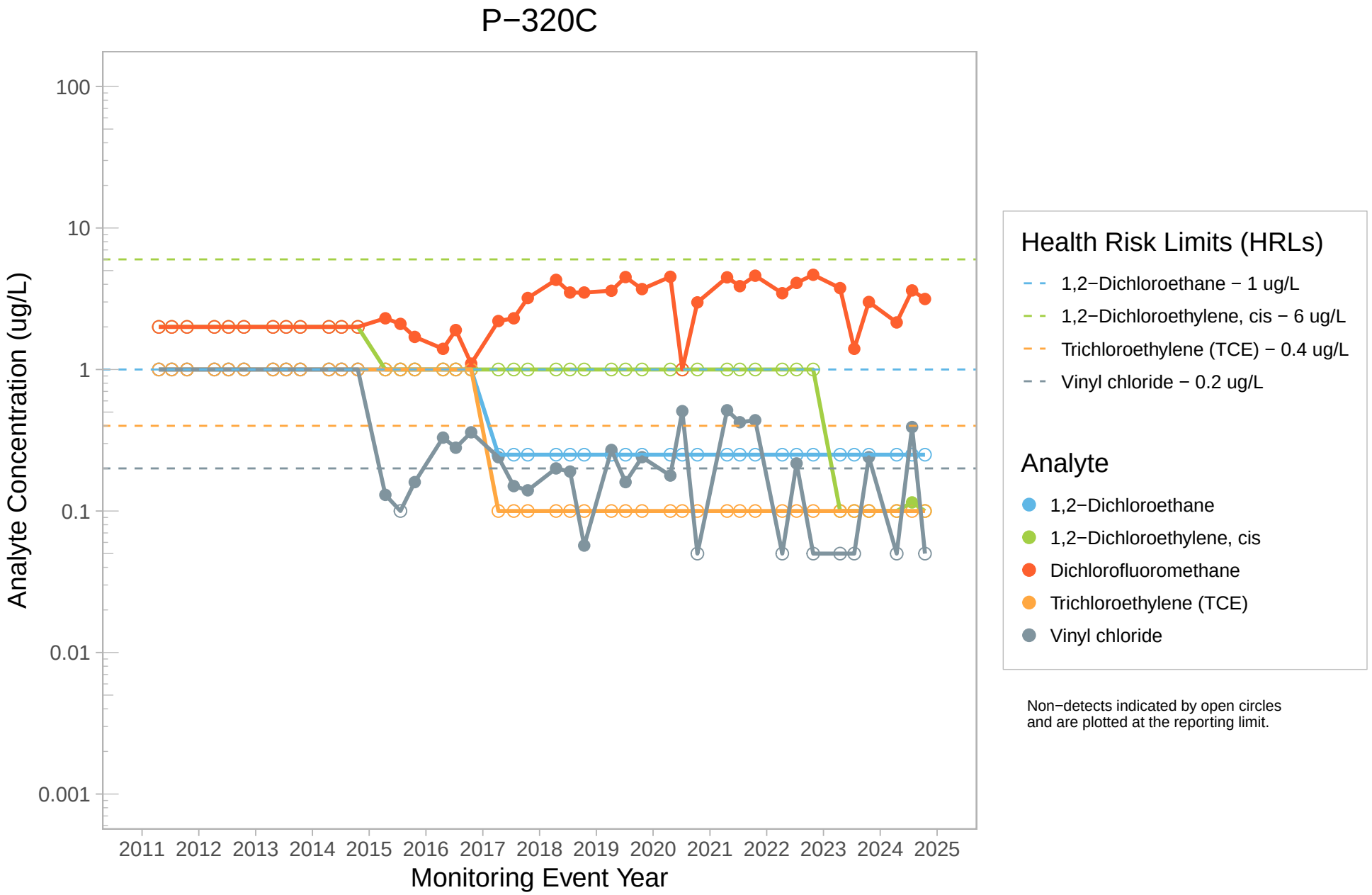
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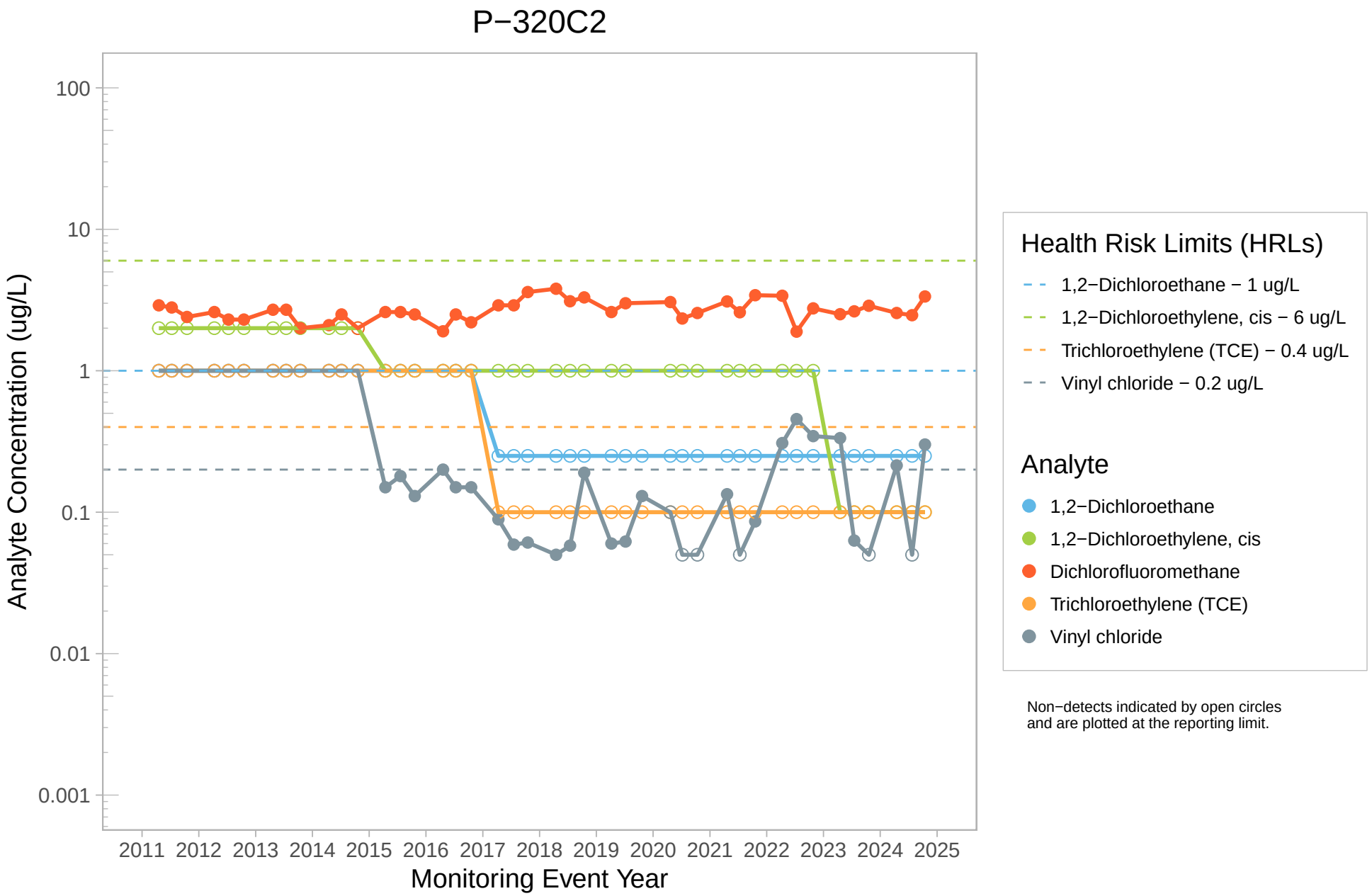
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Non−detects indicated by open circles and are plotted at the reporting limit.

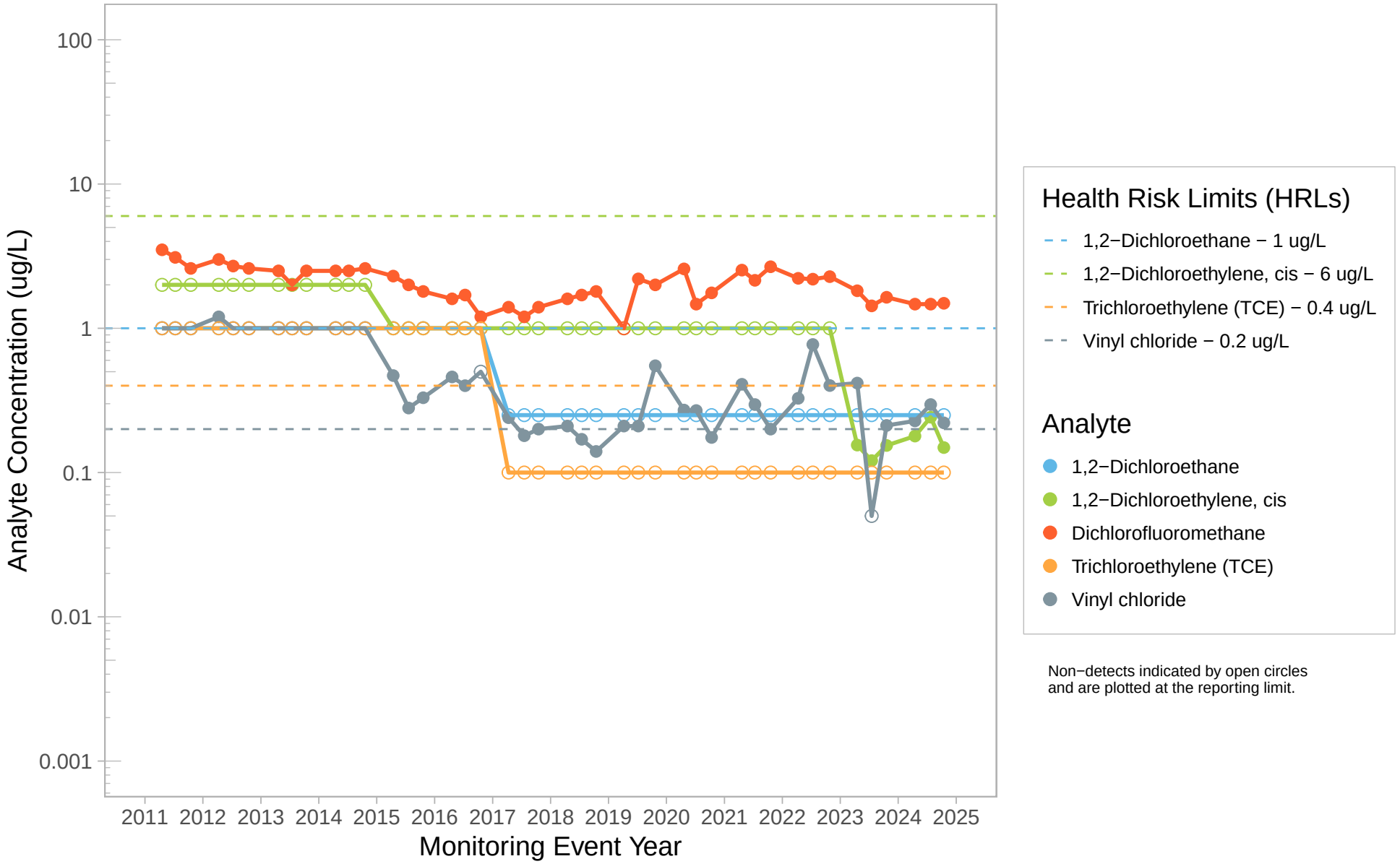


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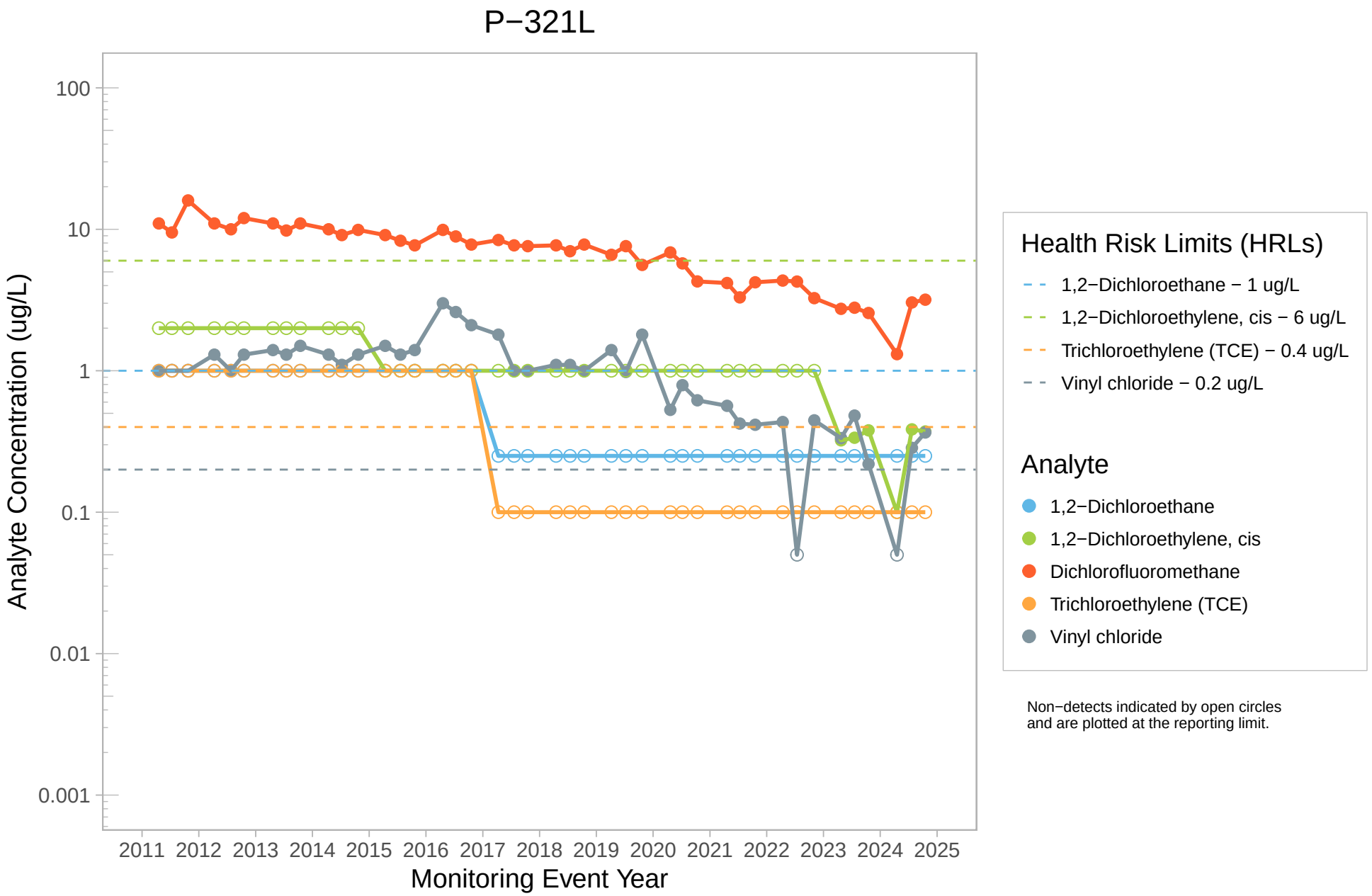


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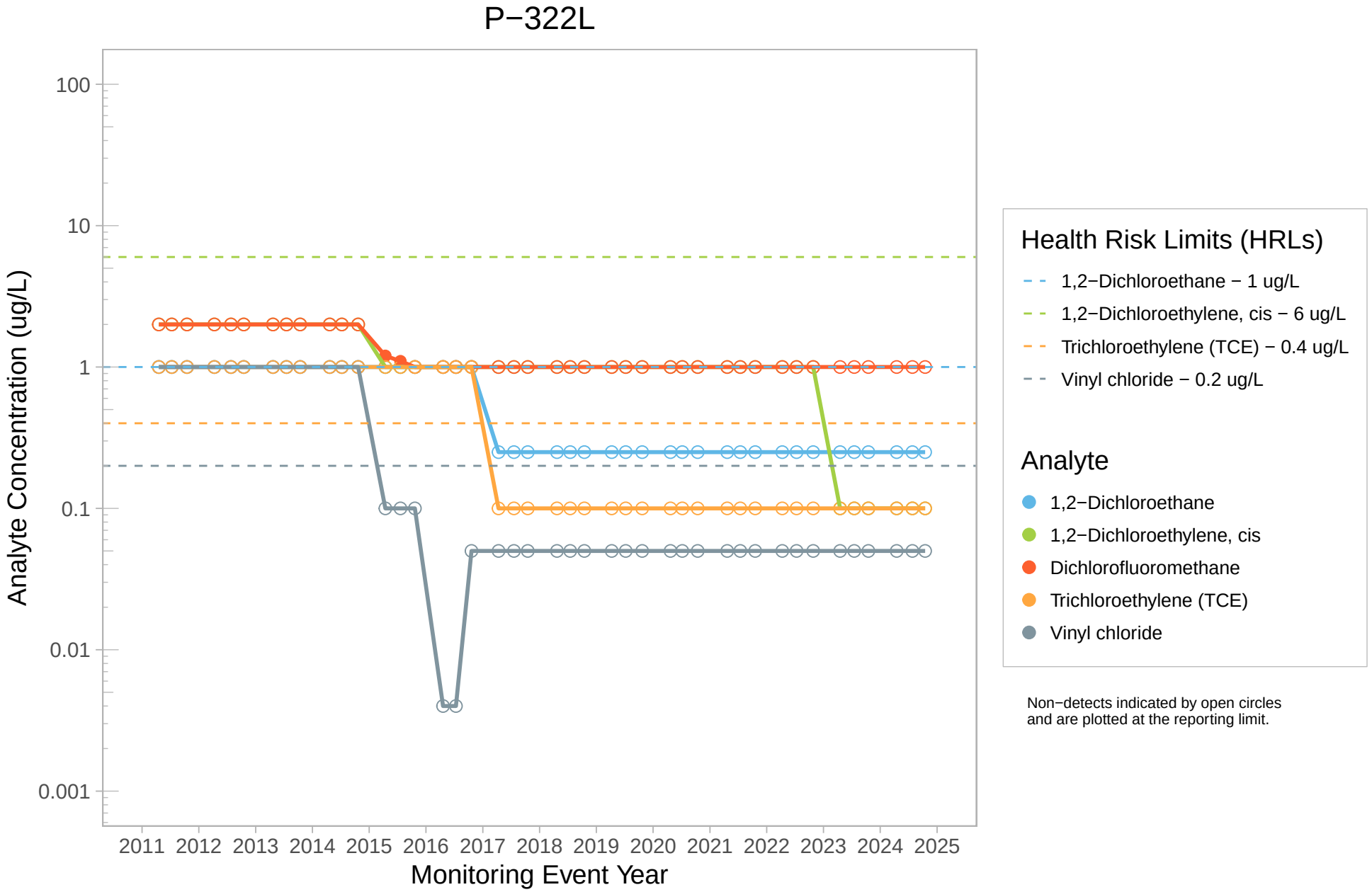
P−320L



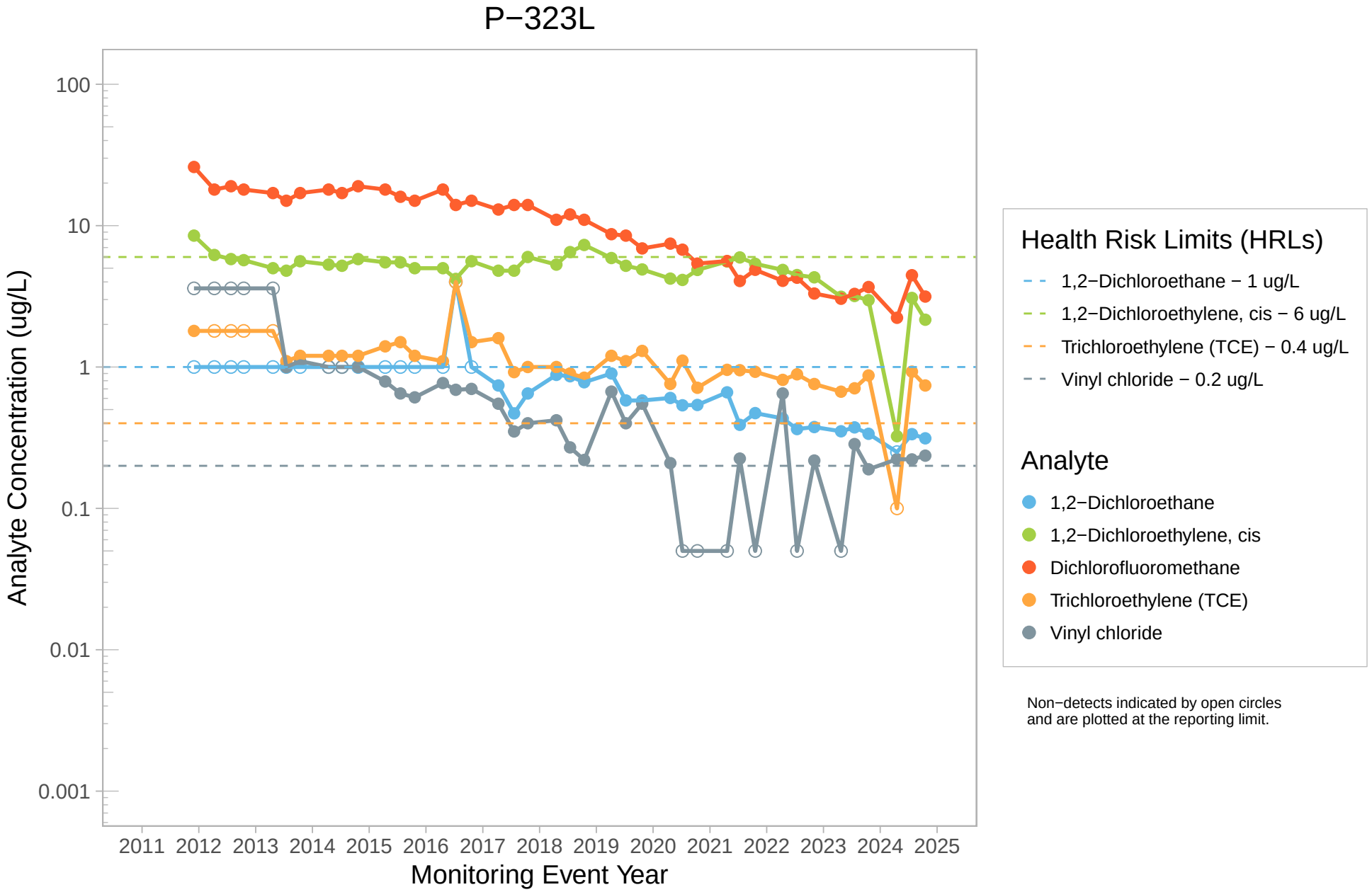
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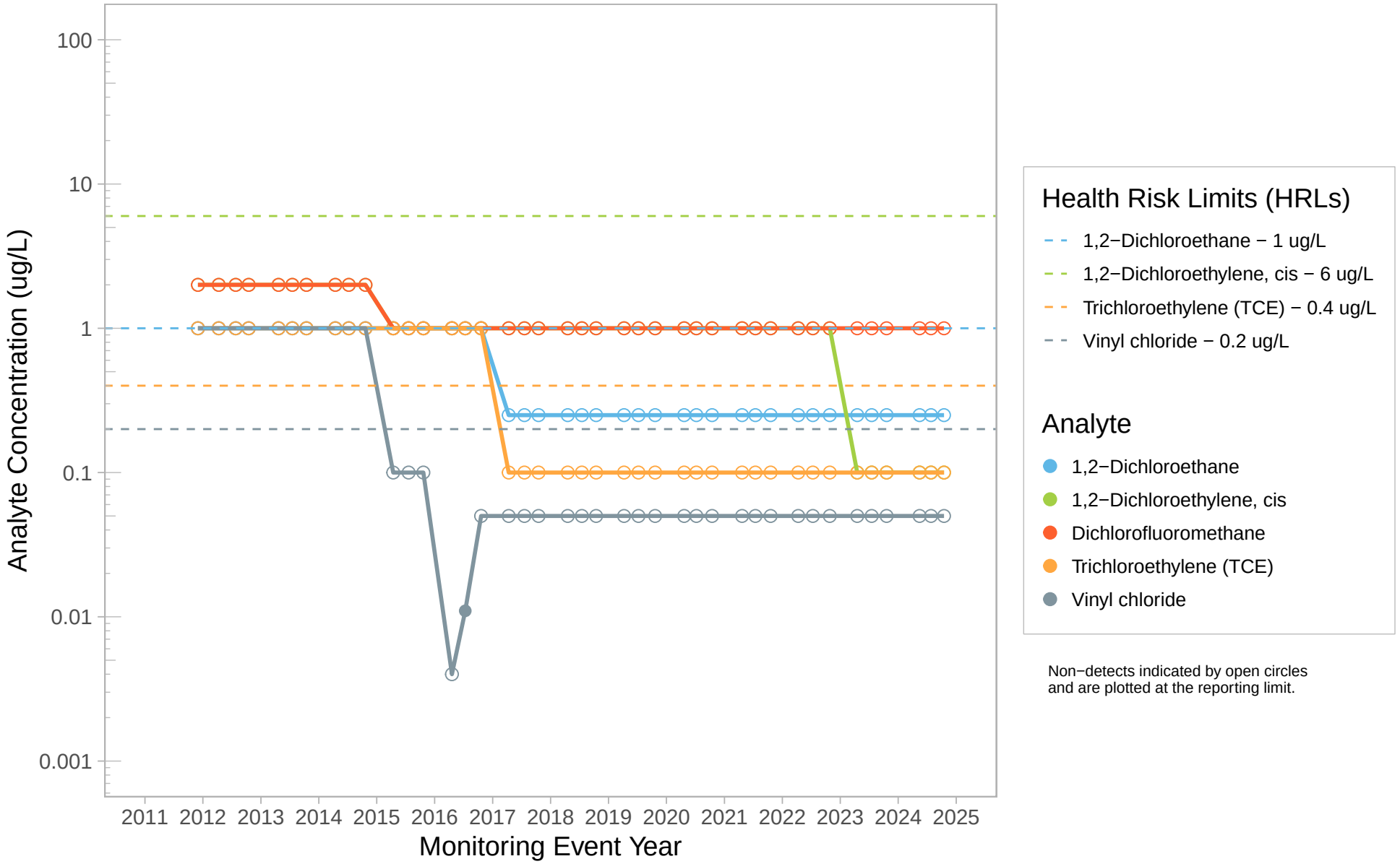


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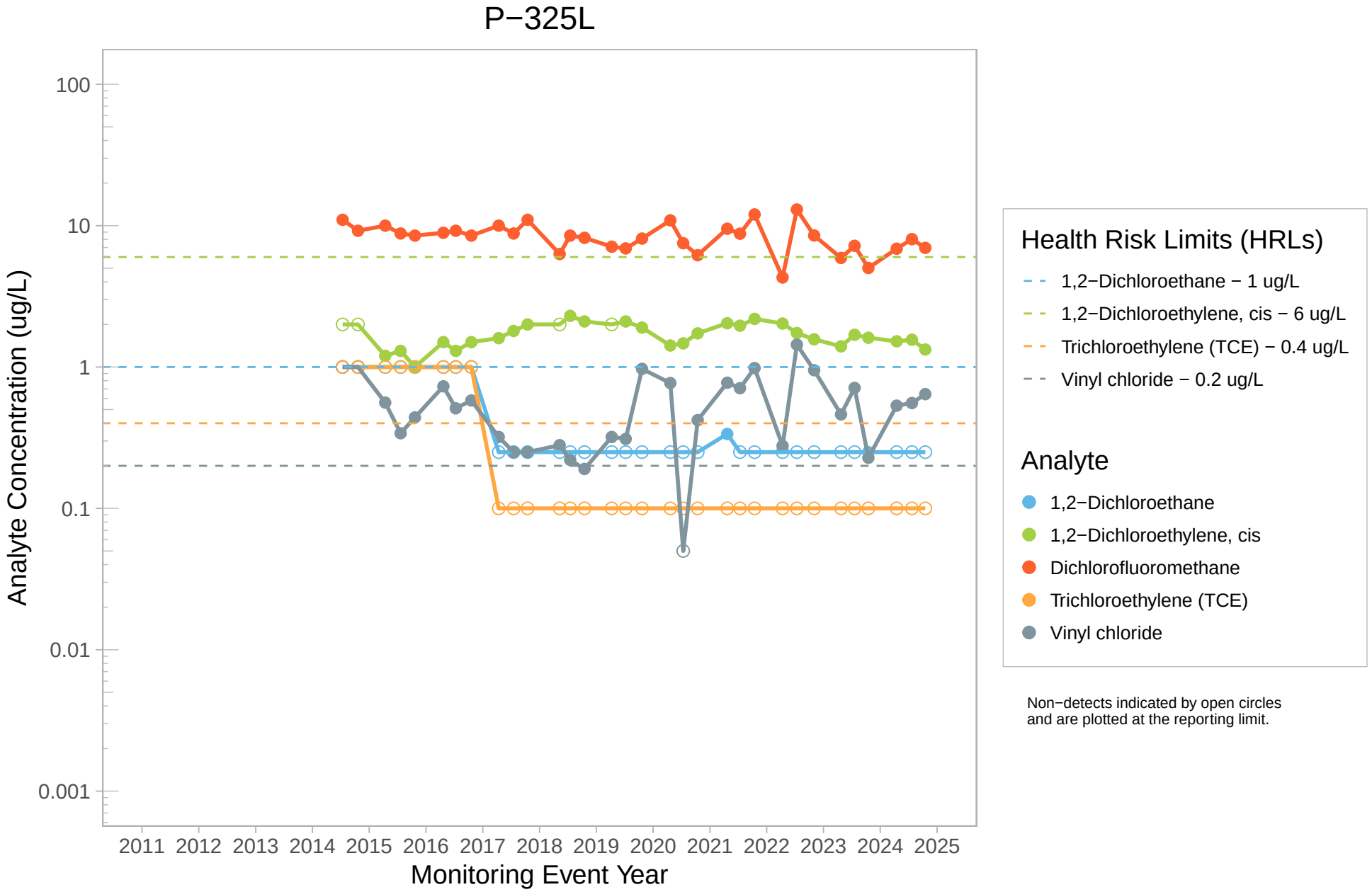


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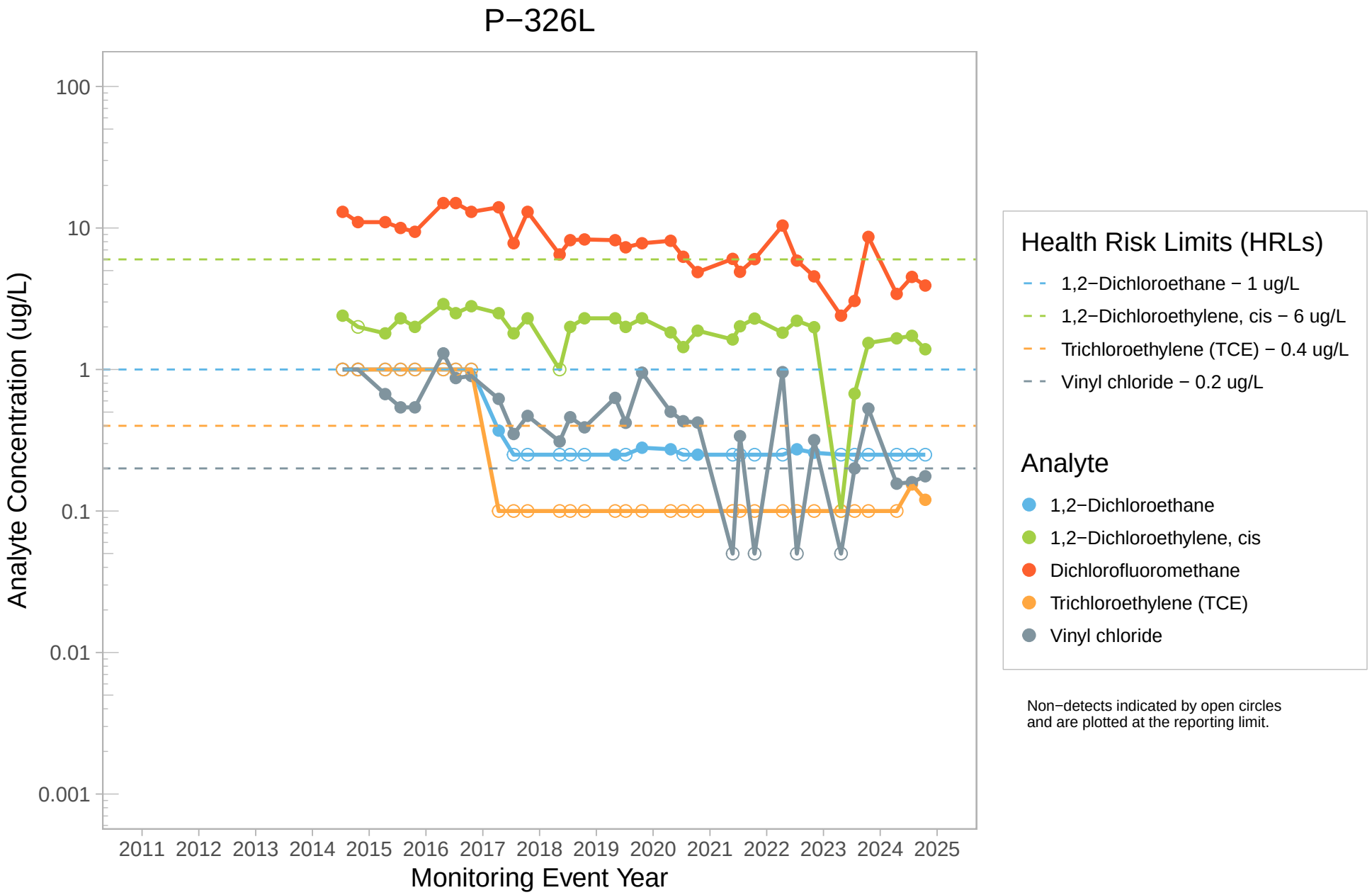
P−324L



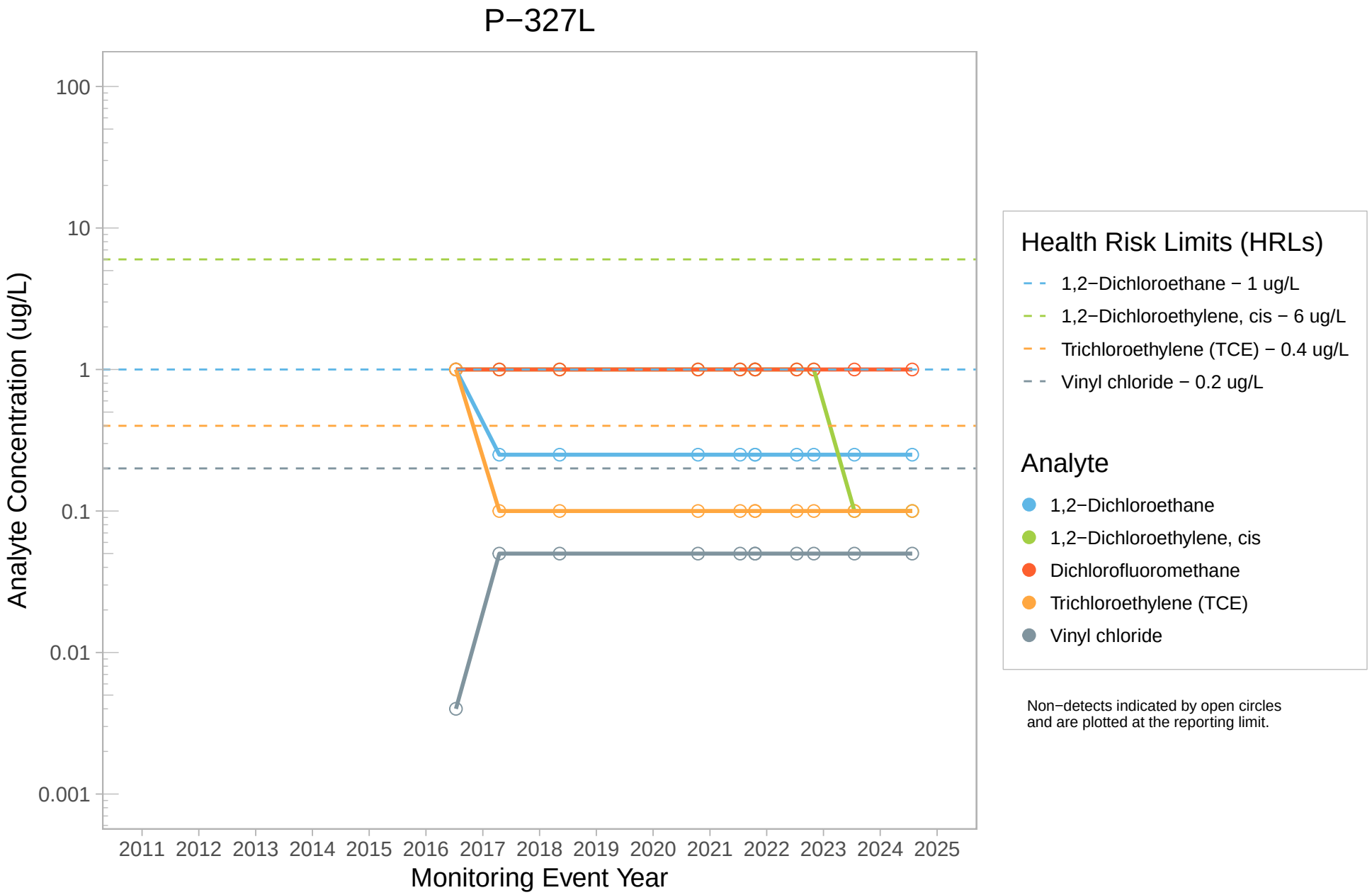
Non−detects indicated by open circles
and are plotted at the reporting limit.



Non−detects indicated by open circles and are plotted at the reporting limit.

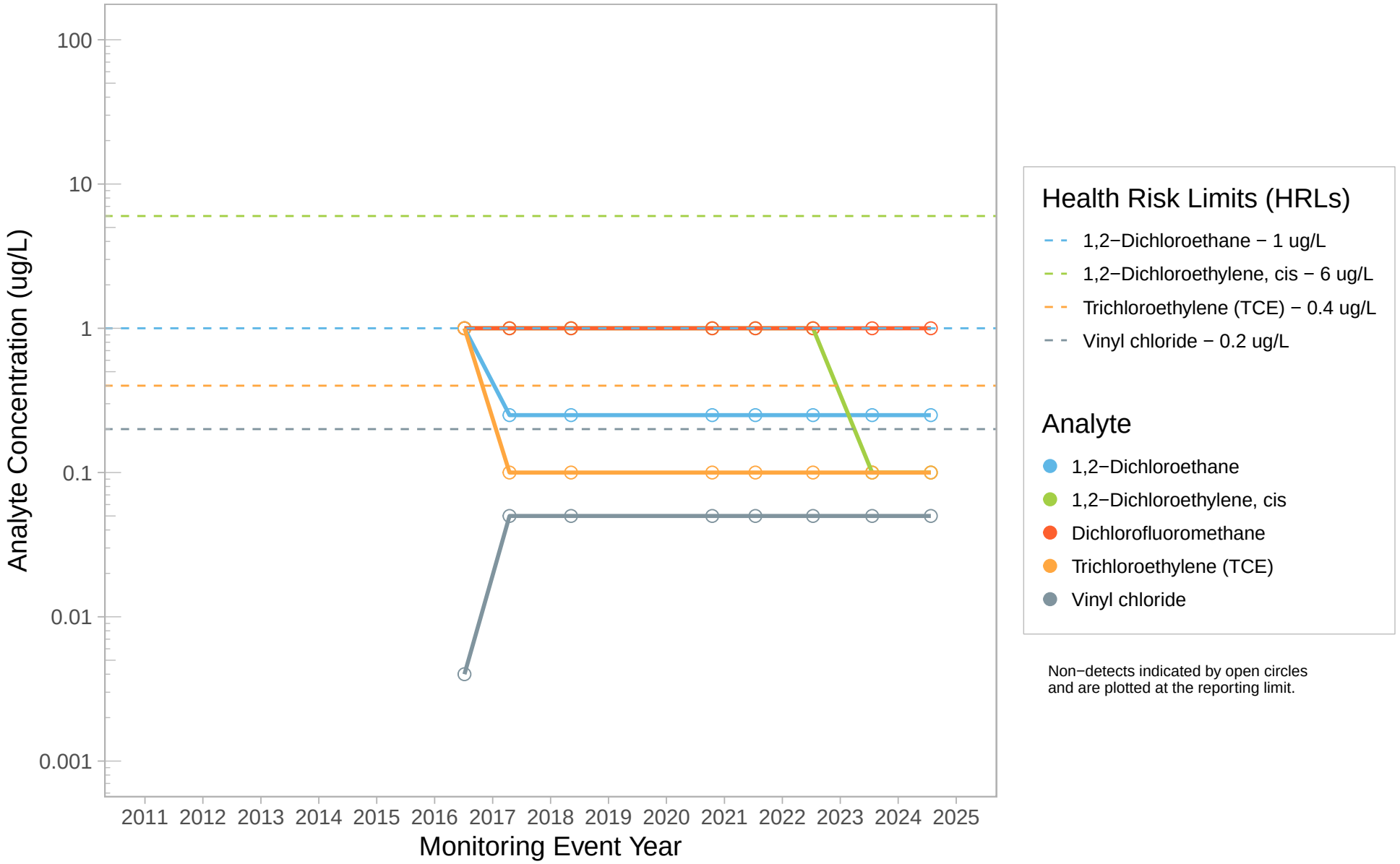


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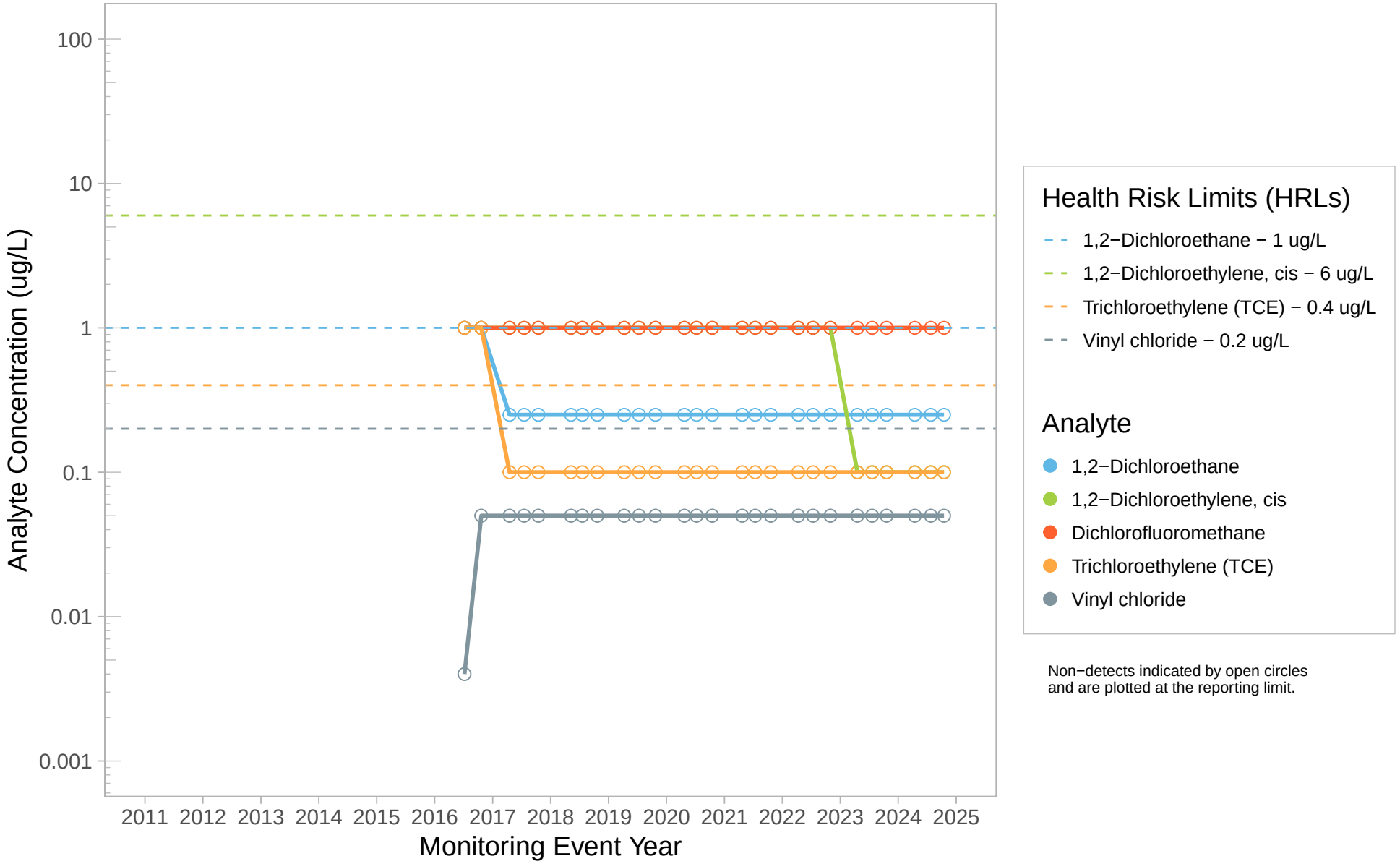
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P−328L



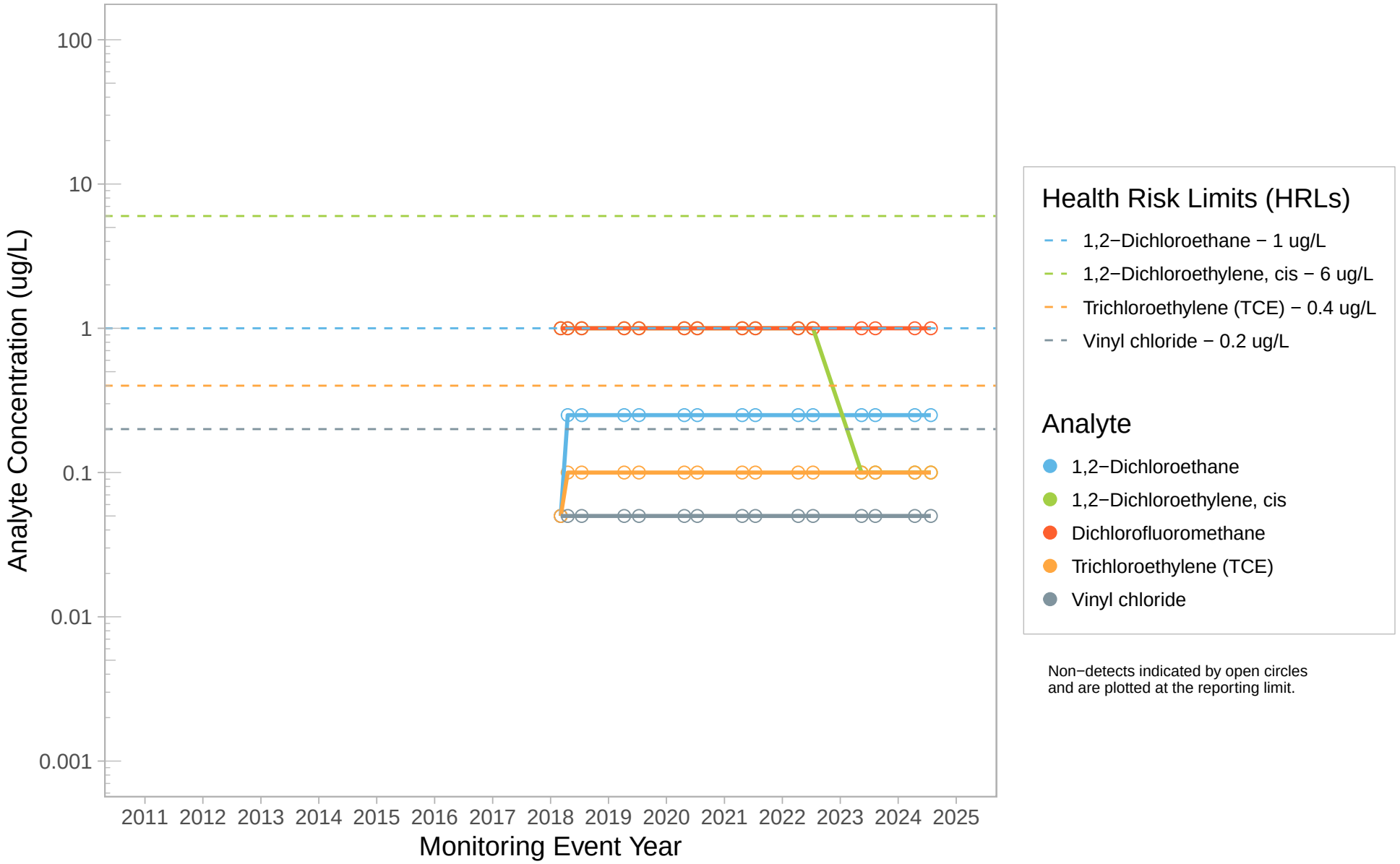
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P−329L



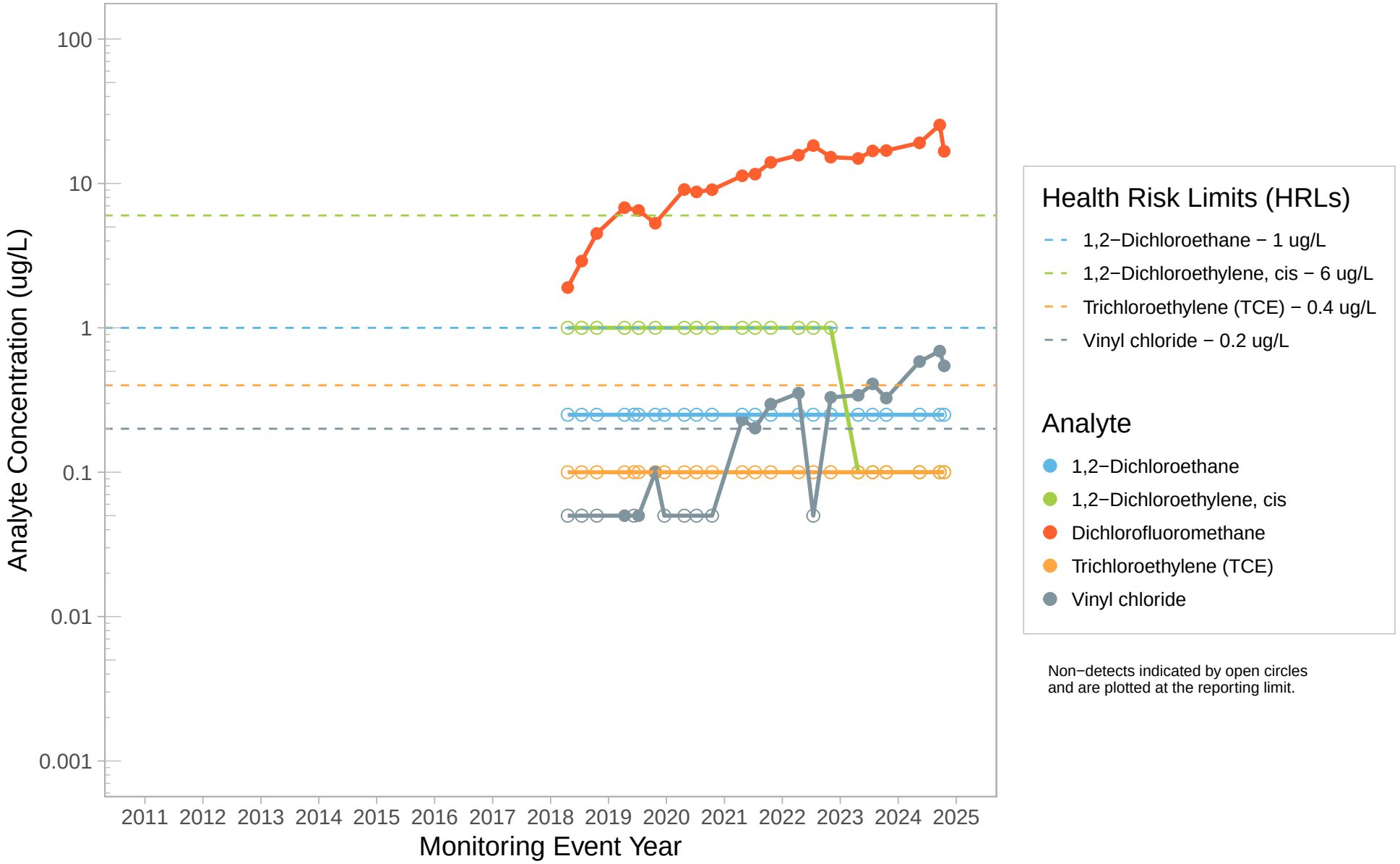
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P−333L

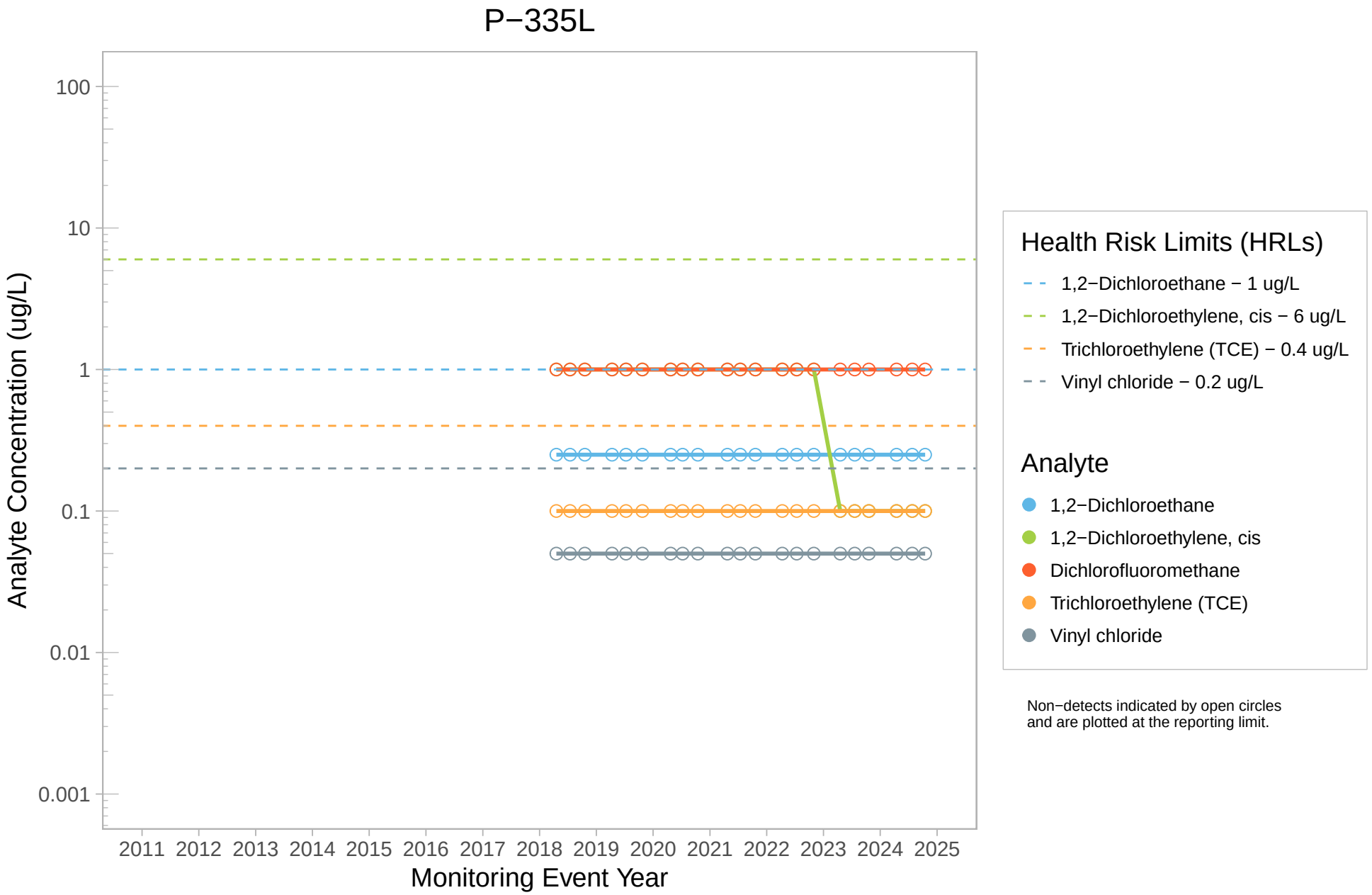


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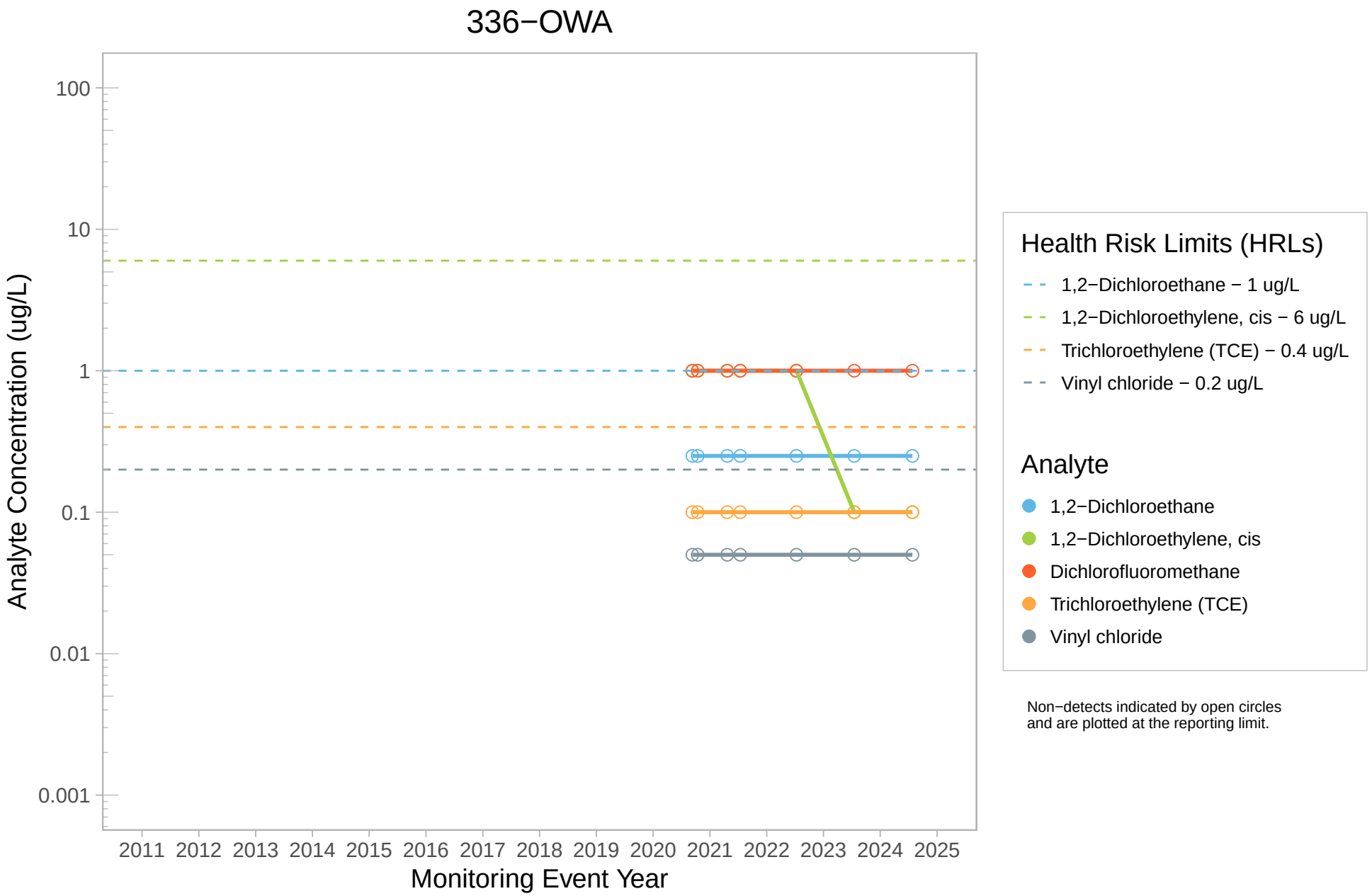
P−334L



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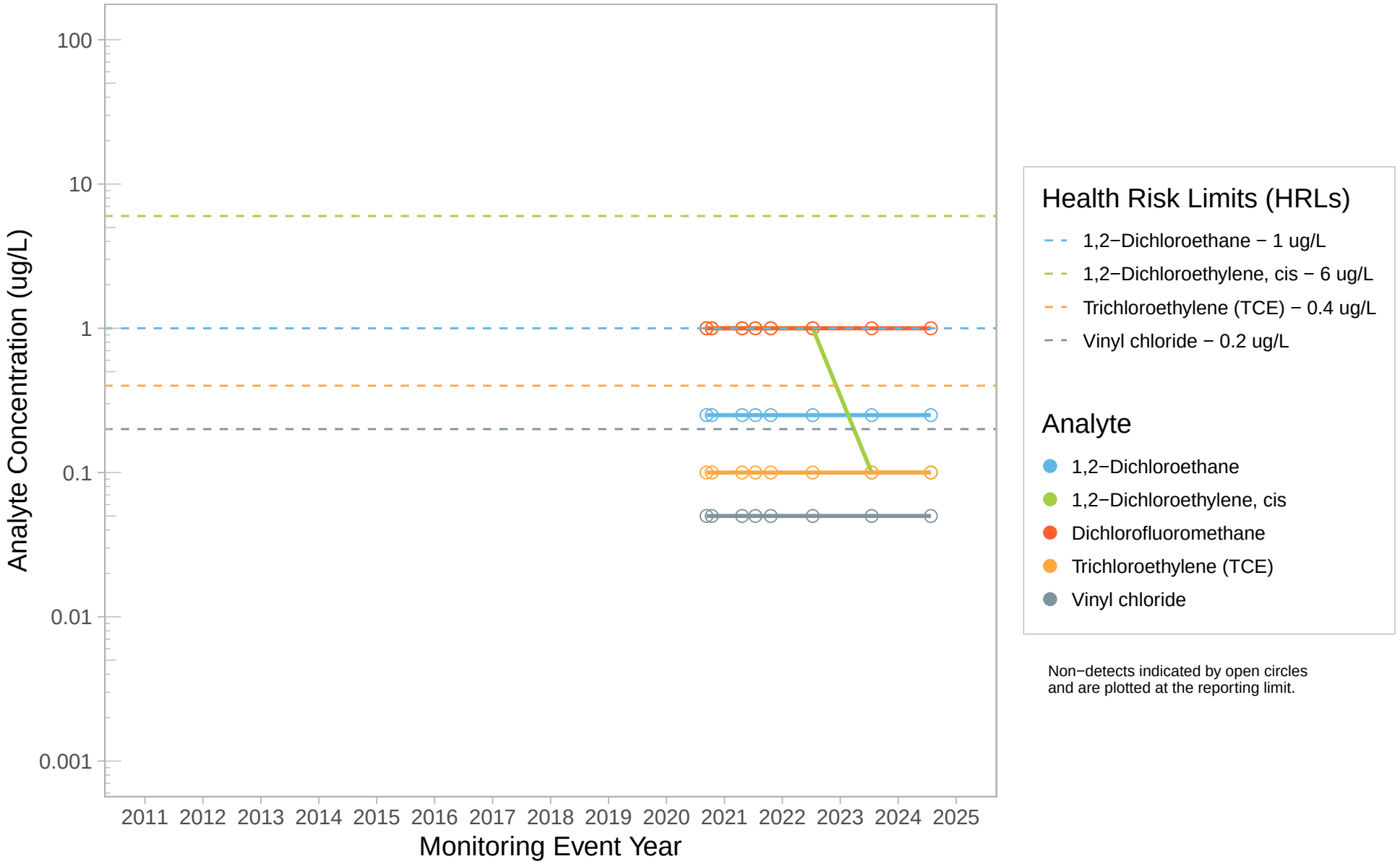


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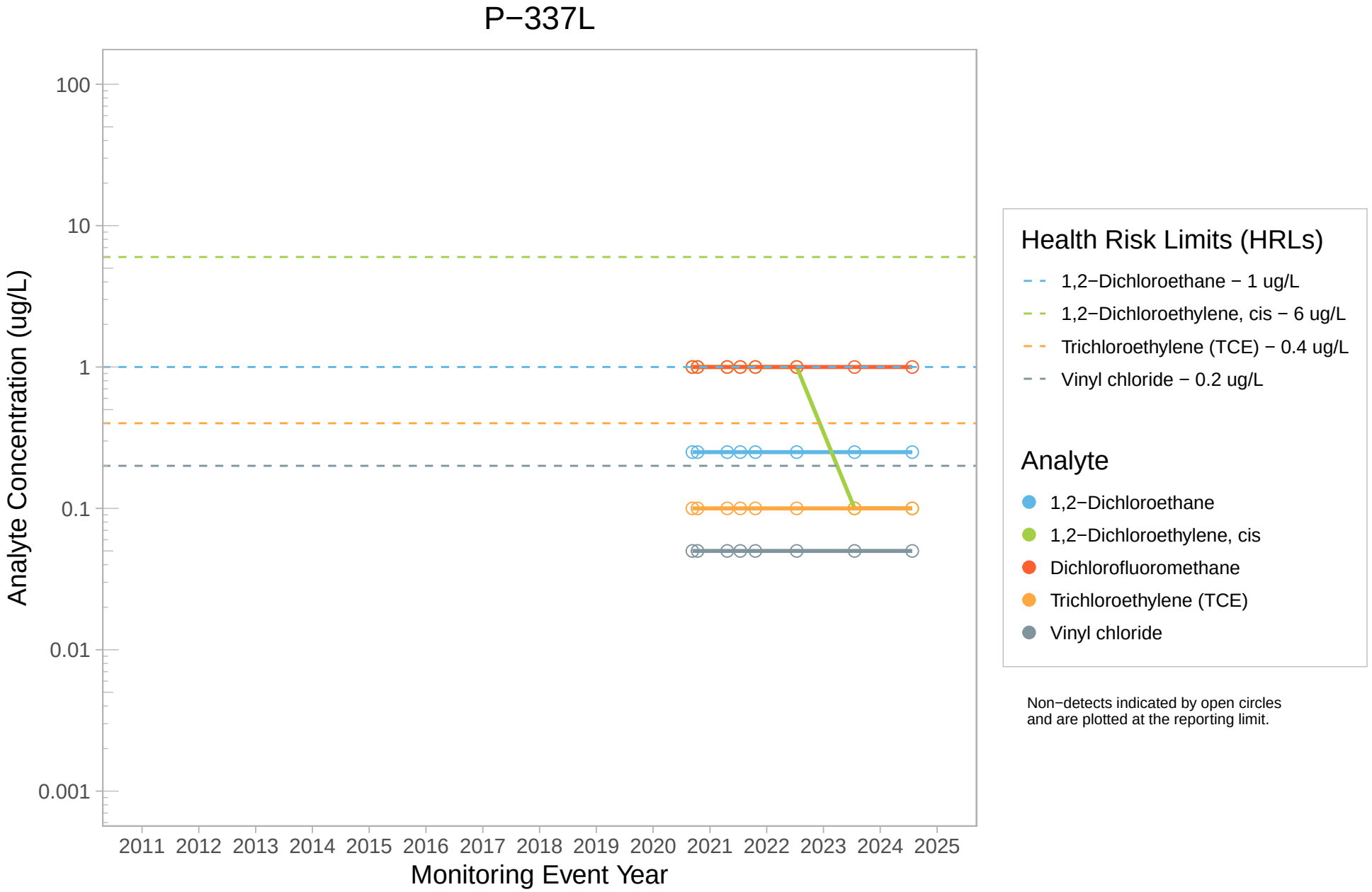


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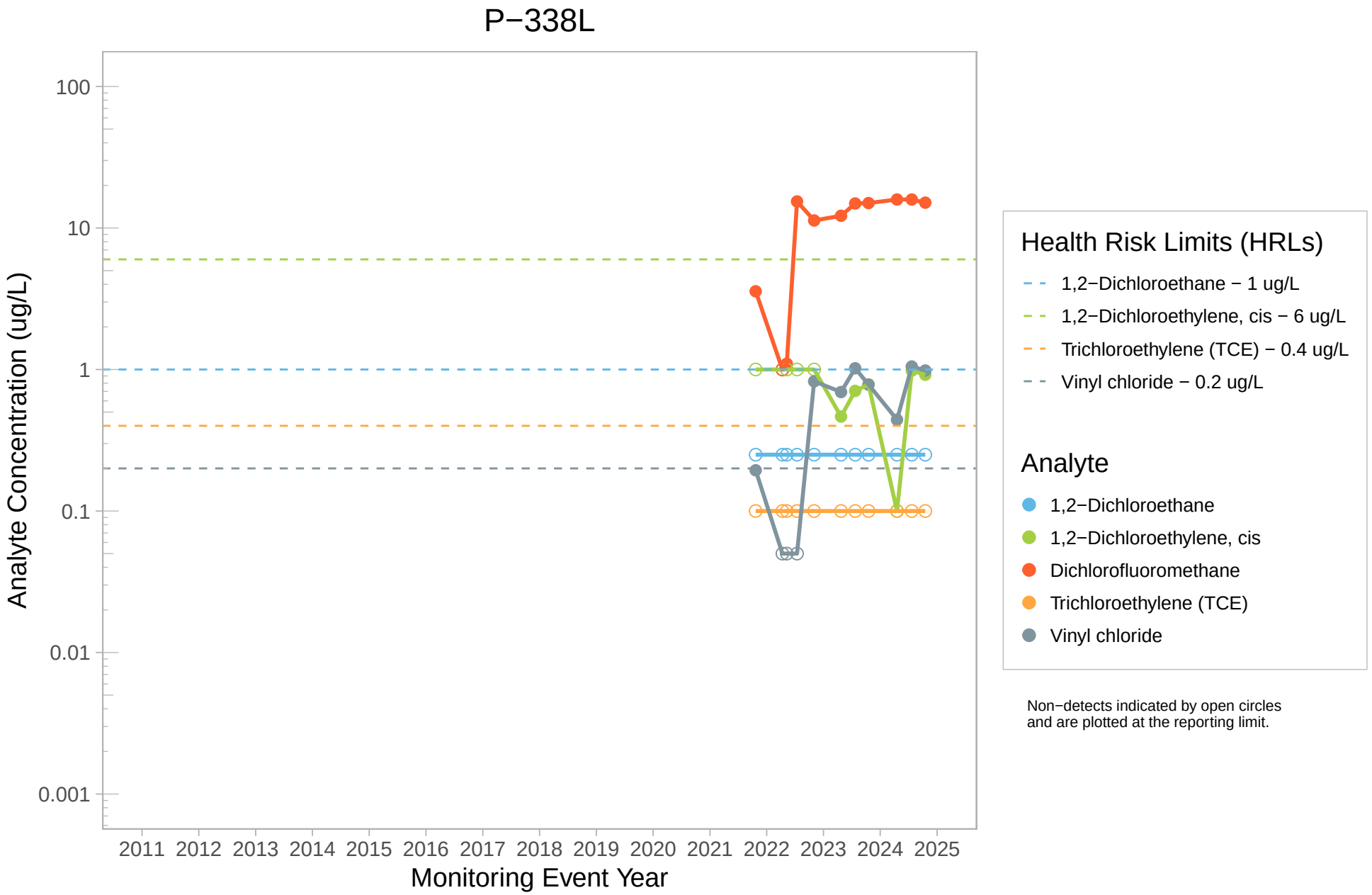
337−OWA



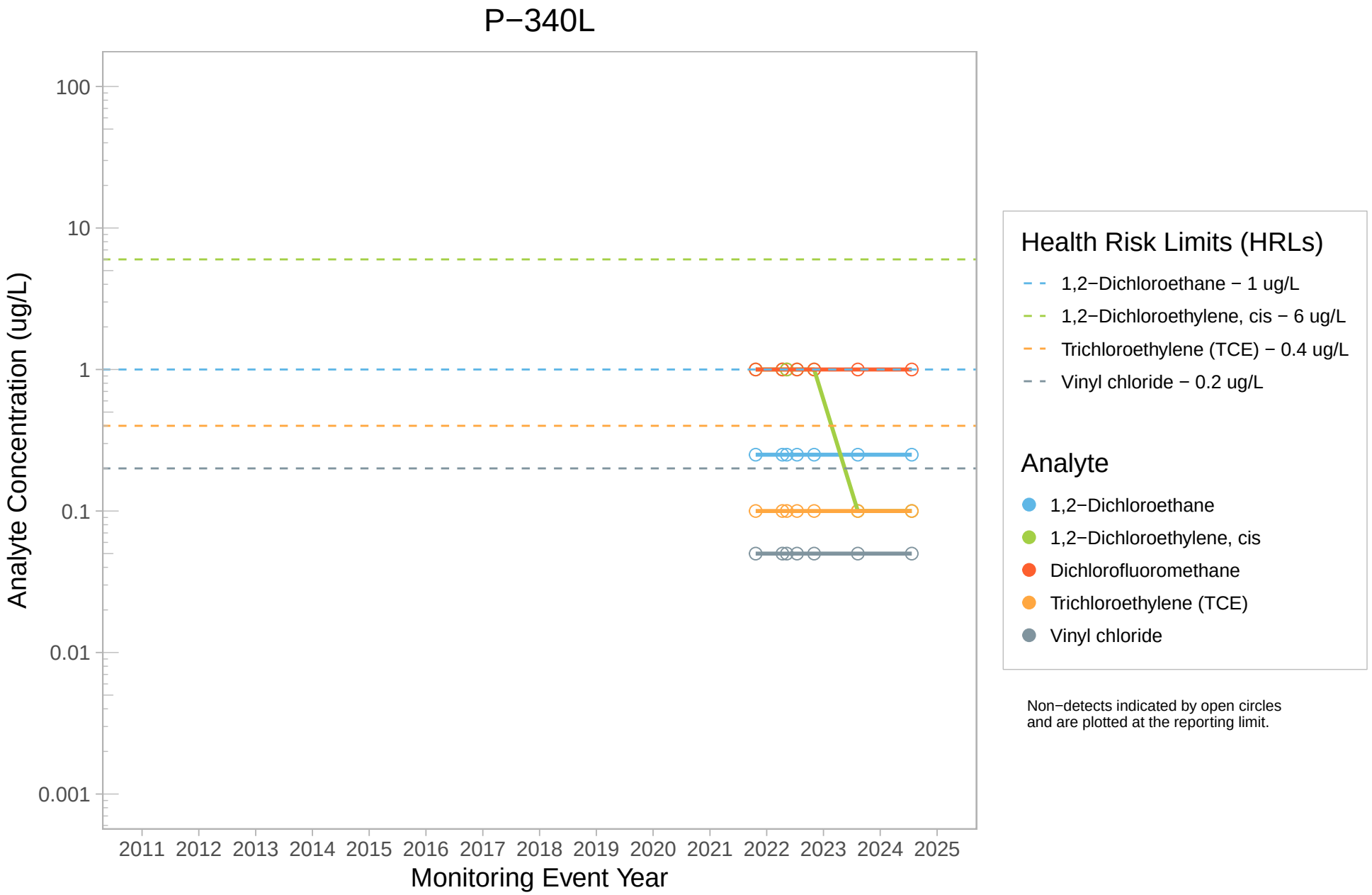
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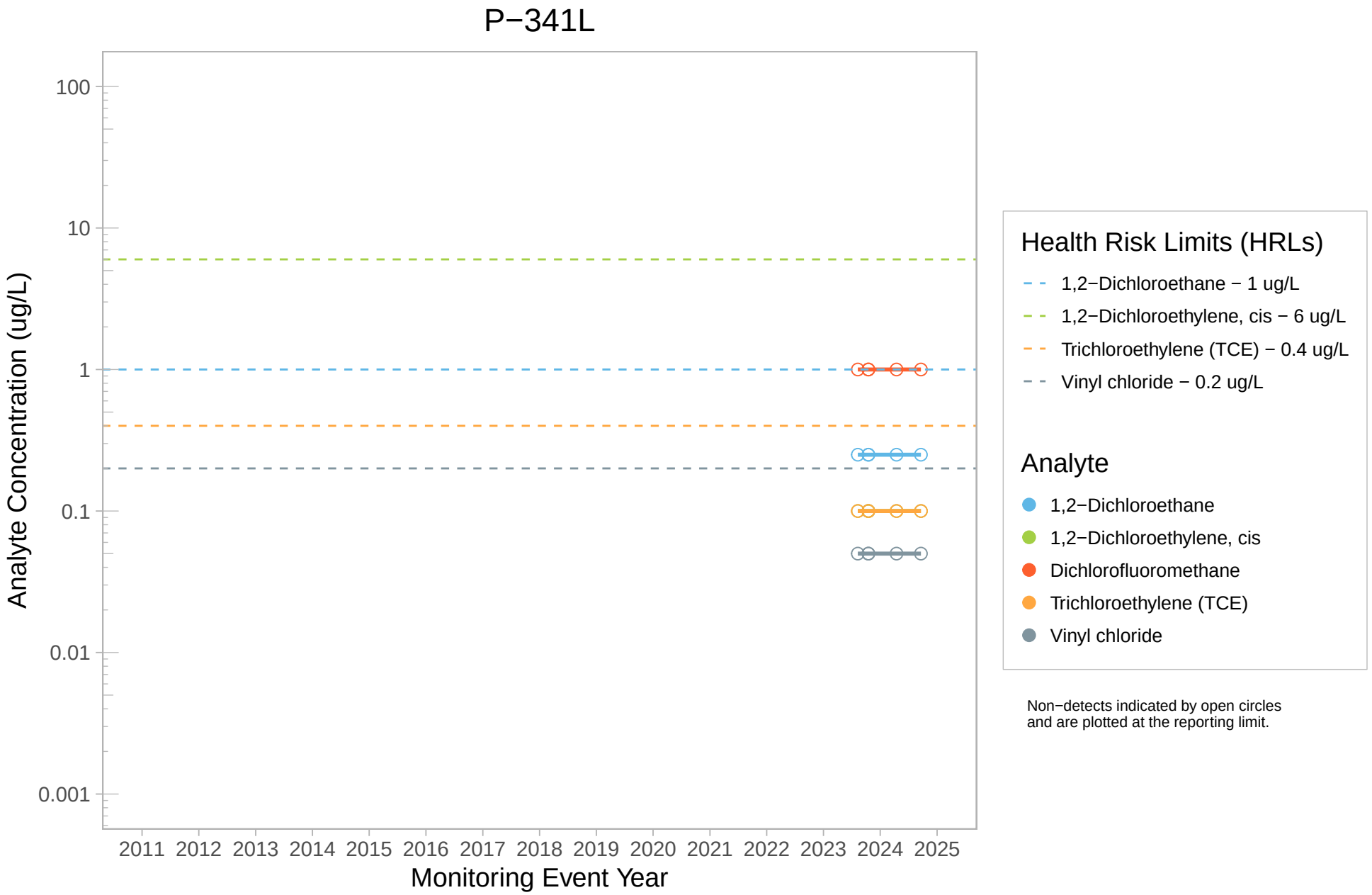


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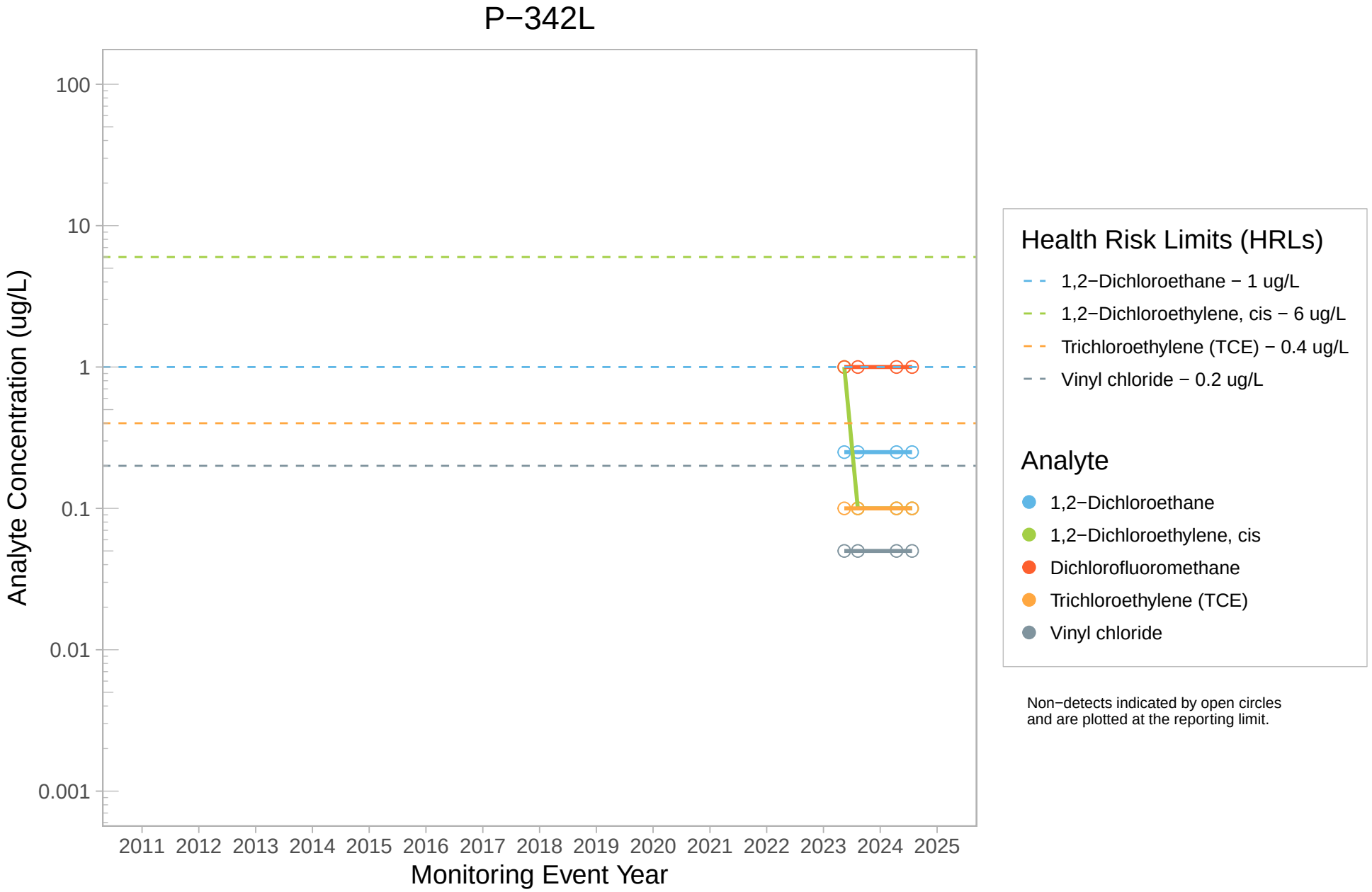


Non−detects indicated by open circles and are plotted at the reporting limit.


P−340L
Analyte Concentration (ug/L)
100
10
1
0.1
0.01
0.001
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Monitoring Event Year
Health Risk Limits (HRLs)
1,2−Dichloroethane − 1 ug/L
1,2−Dichloroethylene, cis − 6 ug/L
Trichloroethylene (TCE) − 0.4 ug/L
Vinyl chloride − 0.2 ug/L
Analyte
1,2−Dichloroethane
1,2−Dichloroethylene, cis
Dichlorofluoromethane
Trichloroethylene (TCE)
Vinyl chloride
Non−detects indicated by open circles
and are plotted at the reporting limit.

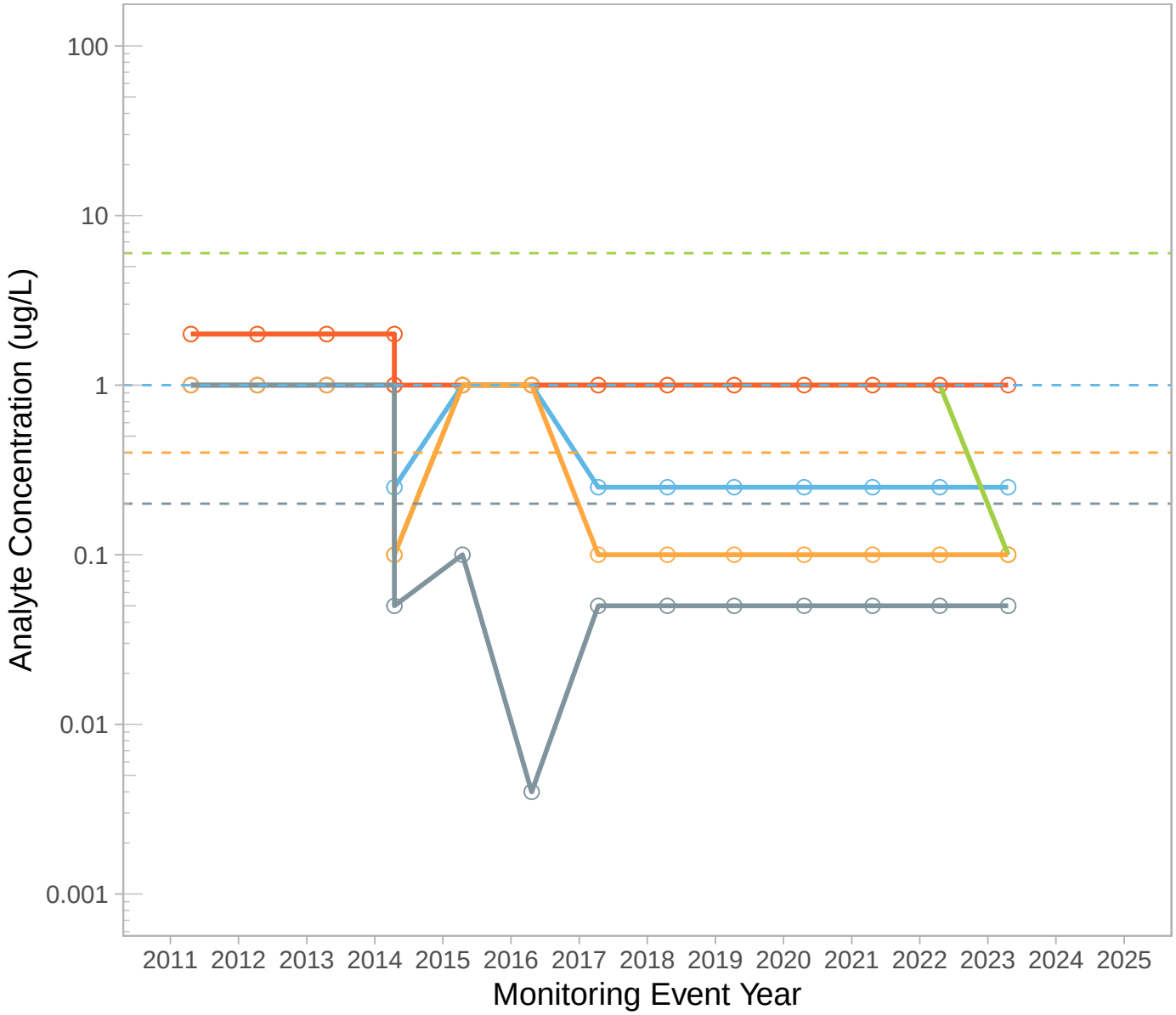


Non−detects indicated by open circles and are plotted at the reporting limit.



Non−detects indicated by open circles and are plotted at the reporting limit.

P−403C



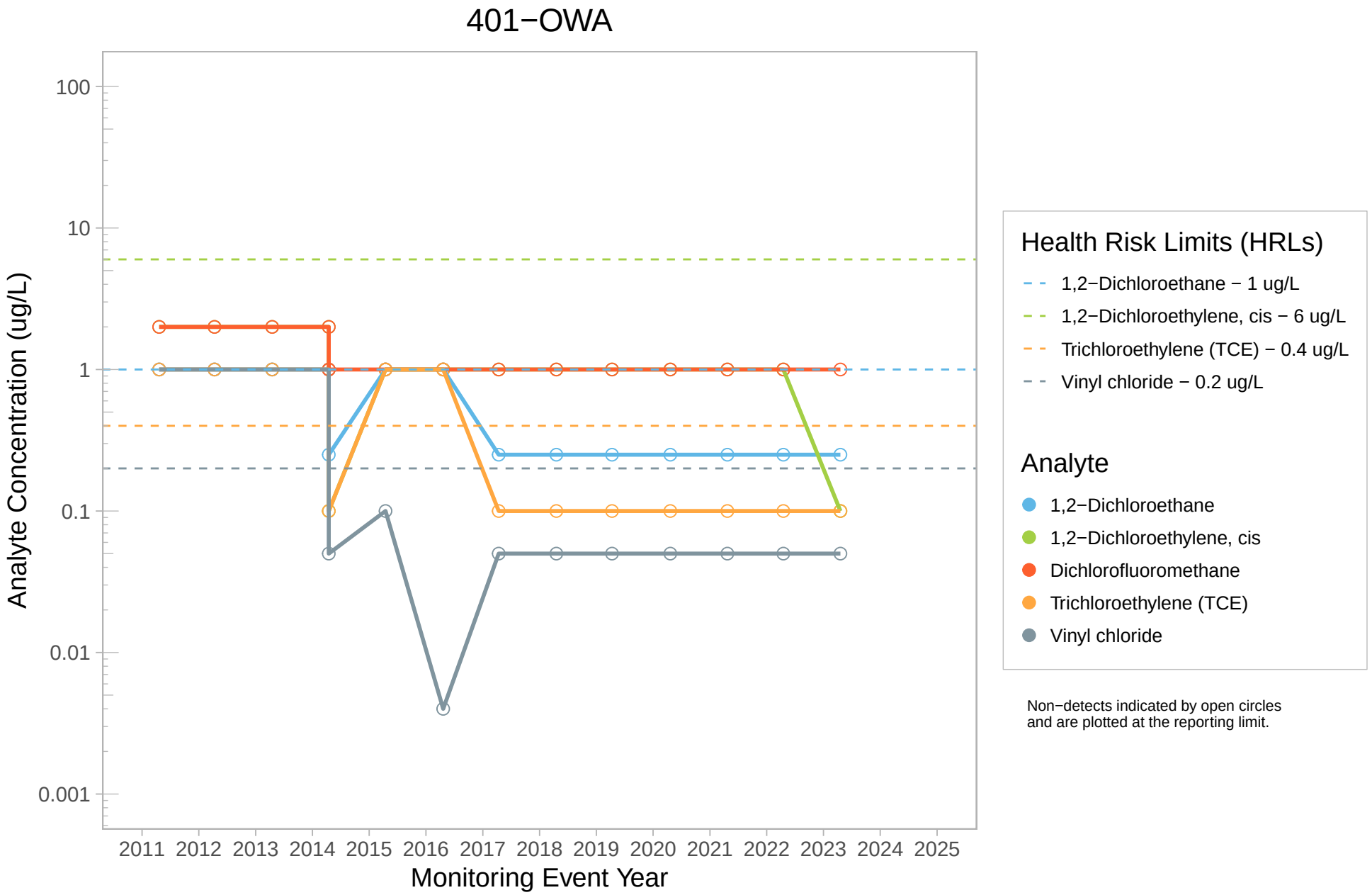
Health Risk Limits (HRLs)

- 1,2−Dichloroethane − 1 ug/L
- 1,2−Dichloroethylene, cis − 6 ug/L
- Trichloroethylene (TCE) − 0.4 ug/L
- Vinyl chloride − 0.2 ug/L

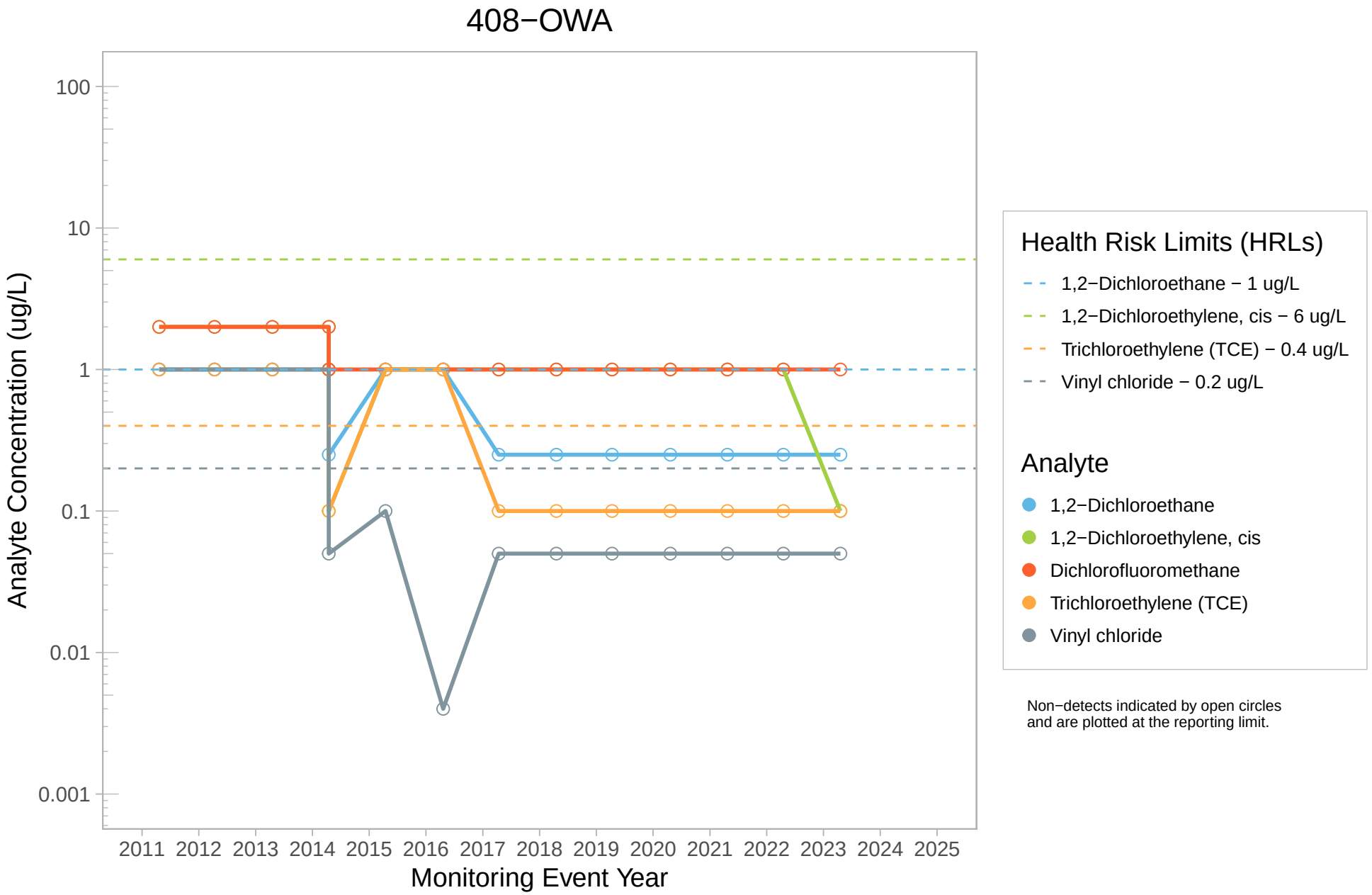
Analyte

- 1,2−Dichloroethane
- 1,2−Dichloroethylene, cis
- Dichlorofluoromethane
- Trichloroethylene (TCE)
- Vinyl chloride

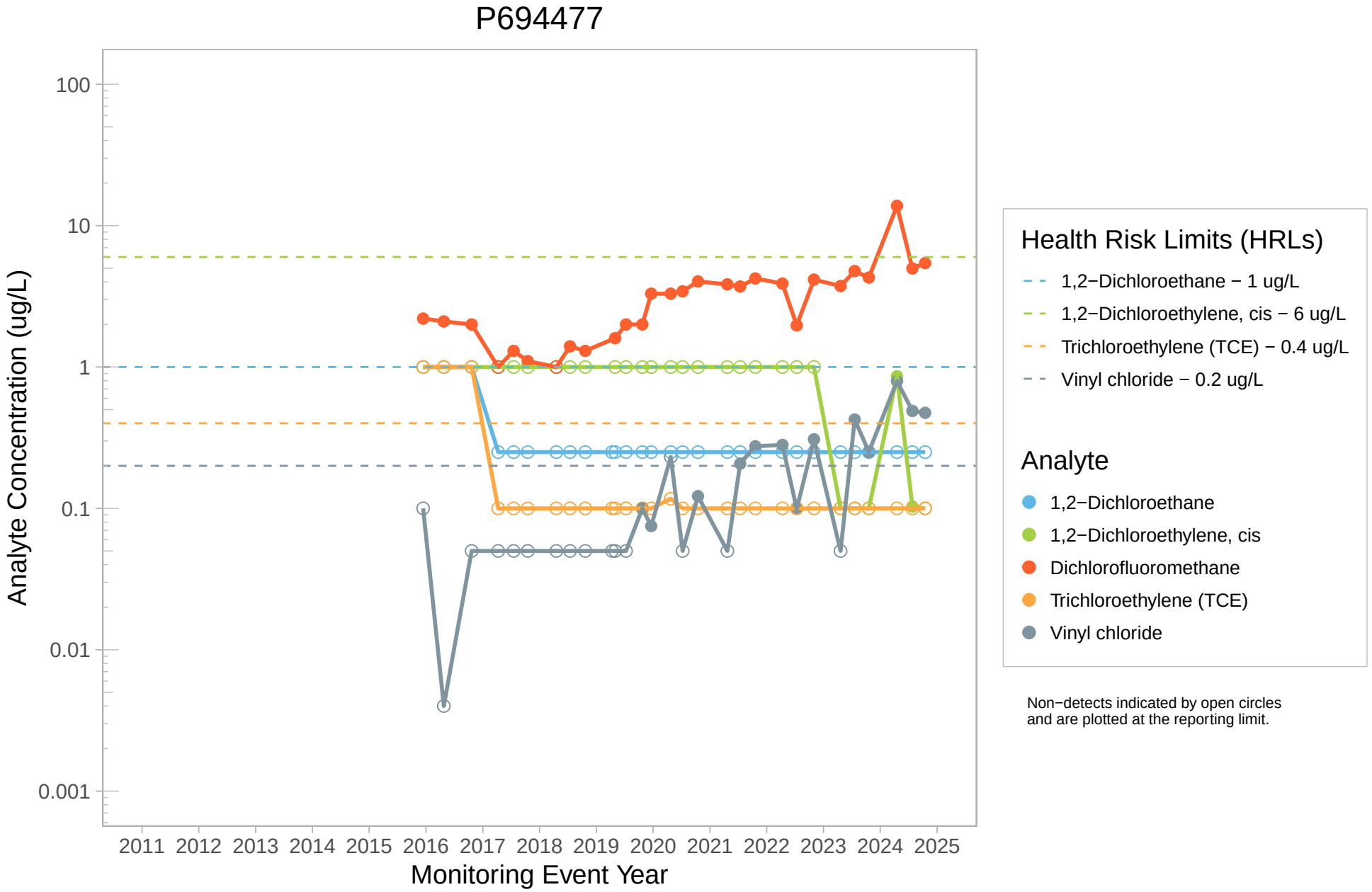
Non−detects indicated by open circles
and are plotted at the reporting limit.



Non−detects indicated by open circles and are plotted at the reporting limit.



Non−detects indicated by open circles and are plotted at the reporting limit.



Non−detects indicated by open circles and are plotted at the reporting limit.

Appendix E

Monitored Natural Attenuation Evaluation

2024 Monitored Natural Attenuation Data Summary

The natural attenuation monitoring program is designed to collect the data needed to complete the assessment of relevant trends in key constituents as well as ascertain if the performance of monitored natural attenuation (MNA) is a suitable corrective action approach for chlorinated organics at ERL. Initial MNA performance monitoring began in 2021 per the Groundwater Corrective Action Work Plan (CAWP; Barr, 2021), and the Initial Performance Evaluation report was completed in 2024 per the CAWP (Barr, 2024). The 5-Year performance evaluation will be completed in the first quarter of 2027 (Q1 2027) to assess the corrective action protectiveness to human health and the environment (see Section 5.3 of the CAWP for additional details).

The following sections provide an overview of 2024 MNA monitoring activities, well network updates, a comparison of relevant groundwater quality results to the contingency action plan presented in the CAWP, an evaluation of vinyl chloride trends, an assessment of geochemical conditions, and updates to the MNA monitoring plan for 2025.

MNA Monitoring Activities

The 2024 through 2026 natural attenuation monitoring schedule and parameters are shown in Table 1 and Table 2, respectively. The 2024 natural attenuation monitoring was conducted in accordance with Table 1.

Monitoring Network Updates

ERL completed a vertical groundwater profiling boring (B2-342) and installed one additional monitoring well (P-342C) in February 2025 per the recommendations in the Initial Performance Evaluation report (Barr, 2024). The groundwater profiling data and well installation plan were provided to MPCA, Sherburne County, and the City of Elk River on February 13, 2025. No organics (including vinyl chloride) were detected in the vertical groundwater profiling samples. A report summarizing the investigation, initial well monitoring results, and baseline and future monitoring plans for well P-342C will be submitted later in 2025.

Contingency Summary

The groundwater corrective action contingency plan is summarized in Table 3. Scenarios that would trigger contingency actions include:

- Organic compound detection attributable to ERL in a water supply well sample; and
- Confirmed organic compound detection attributable to ERL in a sentinel well sample.

The 2024 water quality monitoring data collected from the MNA well network and sentinel wells is included in Table 4. Groundwater quality monitoring results did not trigger contingency actions in 2024.

Vinyl Chloride Extent and Concentration Trends

Plots of vinyl chloride concentrations are included on Figure 2 and shown spatially at ERL on Figure 3. A summary of the statistical evaluation of vinyl chloride concentration trends is provided in Table 5. The following observations are provided:

- The extent of the vinyl chloride plume downgradient of the landfill is delineated by the existing monitoring well network based on the 2024 (and previous) water quality monitoring results. Vinyl chloride (and other organics) have not been detected in samples collected from monitoring well

P-342L (or in groundwater profile samples collected there in early 2025 as mentioned above), or monitoring wells to the north (i.e., P-333L, P-329L, P-328L, P-340L, and P-327L), or monitoring wells to the south (i.e., P-335L, P-341L,).

- Vinyl chloride concentrations continue to decrease or have no trend (stable) below/near the Health Risk Limit [HRL] of 2 micrograms per liter [µg/L] in groundwater in the central and southern portions of the plume along the western edge of the landfill (Table 5; Figures 3 and 4). Vinyl chloride concentrations in groundwater at the nearest monitoring well located downgradient of the southern two-thirds of the plume (P-326L) are decreasing.
- In the northern third of the plume, along the western edge of the Pre-Subtitle D (unlined) portion of the landfill, vinyl chloride concentrations are increasing in groundwater at one well (P-302C) and stable at nearby wells P-29C and P-320C/320C2/320L. Vinyl chloride concentrations in groundwater downgradient of well P-302C are decreasing at P-321L and stable at P-325L (Table 5; Figures 3 and 4). Vinyl chloride concentrations are stable and below the HRL at well P-301C immediately north of this area.
- Vinyl chloride concentrations in groundwater at well P-321L, located upgradient of well P-325L, peaked around 2016 and have since decreased (Figure 2). The peak vinyl chloride concentration in groundwater occurred at well P-325L in 2022 and may be related to downgradient migration of peak concentrations in groundwater previously observed at P-321L.
- Vinyl chloride concentrations at monitoring wells P-334L, P-338L, and P694477, which are located closer to the middle and distal edge of the plume (Figure 3), have been increasing since approximately 2020 (Table 5; Figures 3 and 4). Based on historic organics concentration data at ERL and estimated groundwater flow velocities, it appears that the remnants of the slug of elevated organics concentrations observed at P-17C in 1994 may be reaching the distal portion of the plume. The slug of elevated organics was estimated to reach P-334L between approximately 2024 and 2033 (Barr, 2024). Water quality at monitoring well P-342L and recently installed well P-342C will continue to be monitored, and the data will be used to evaluate the extent of the vinyl chloride plume. The observed vinyl chloride concentration trends (i.e., increasing at wells P-334L/P-338L/P694477 and stable to decreasing at most wells located closer to the landfill) are consistent with the anticipated migration of peak vinyl chloride concentrations to the west and may be followed by decreasing concentrations in the future.
- Because vinyl chloride is a daughter product of cis-1,2-dichloroethylene (cDCE) dechlorination, the concentration and extent of vinyl chloride in groundwater can be directly related to where cDCE degrades to vinyl chloride along the flowpath. For example, 1 µg/L of cDCE will degrade to an equivalent micromolar mass of vinyl chloride with a concentration of 0.6 µg/L (the concentration is lower because the molecular weight of vinyl chloride is lower than cDCE); therefore, the low concentrations of cDCE that are observed in groundwater can degrade to vinyl chloride concentrations well above the reporting limit (0.05 µg/L). To further explore the relationship of cDCE to vinyl chloride downgradient of ERL, a low-level analysis of cDCE was

implemented for 2023-2024 to achieve a lower reporting limit (the reporting limit reduced from 1.0 µg/L to 0.1 µg/L). The low-level analysis results in 2023 and 2024 show that cDCE is present in groundwater at P-338L and absent at P-334L, where vinyl chloride concentrations currently demonstrate an increasing trend. As a result, it appears that the degradation of cDCE to vinyl chloride in the P-338L area is contributing to the vinyl chloride concentrations in the groundwater system, thereby extending the vinyl chloride plume downgradient (i.e., to well P-334L).

- The estimated mass flux of vinyl chloride in groundwater flowing from the western edge of the landfill was 0.017 pounds per year (lb/yr) in 2023, which is 82% less than the estimated mass flux in April 2010 (0.11 lb/yr) (Barr, 2024). The estimated overall mass of vinyl chloride in groundwater downgradient of the landfill is approximately one pound (Barr, 2020a).

Other Organics

Plots of vinyl chloride precursor compounds (e.g., trichloroethene (TCE), cDCE, etc.) concentrations are included on Figure 4, and plots of ethyl ether concentrations are included in Attachment A. The following observations are provided:

- Concentrations of vinyl chloride precursor compounds are generally consistent with previous years (Barr, 2020b).
- Ethyl ether concentration trends (Attachment A) are similar to vinyl chloride trends. Ethyl ether concentrations remain below the Intervention Limit (50 µg/L) at each well it is detected. A HRL has not been developed for ethyl ether.

Geochemical Conditions

Geochemical data (terminal electron acceptors, general indicator parameters) collected in 2024 were generally consistent with previous years.

This data shows that conditions are suitable for reductive dechlorination near the western edge of ERL, particularly in and downgradient of the P-17C Area (Barr, 2020b and 2024). The decrease in concentrations of chlorinated compounds over time in this area and the sparsity of vinyl chloride precursors in groundwater support this finding. The dominant reducing environment in the groundwater system downgradient of the landfill appears to be iron/manganese reduction (which is favorable for reductive dechlorination). It is also important to note that previous magnetic susceptibility testing demonstrated that abiotic pathways are also supporting the degradation of cDCE and VC.

Future Work

MNA monitoring will be conducted in 2025 (Table 1). Per the CAWP (Barr, 2021), a 5-Year performance evaluation will be conducted in the first quarter of 2027 (Q1 2027) to assess the corrective action protectiveness to human health and the environment. A report summarizing the vertical groundwater profiling results, well installation work, and initial groundwater monitoring results will be submitted within 60 days of receipt of the initial monitoring well sampling results from well P-342C.

References

Barr, 2025. 2024 Annual Water Quality Report, Elk River Landfill, March.

Barr, 2024. Groundwater Corrective Action Report – Initial Performance Evaluation, Elk River Landfill. April.

Barr, 2021. Groundwater Corrective Action Work Plan, Elk River Landfill, March.

Barr, 2020a. Groundwater Corrective Action Evaluation Report, Elk River Landfill, August.

Barr, 2020b. Groundwater Natural Attenuation Evaluation Report, Elk River Landfill, February.

USEPA, 2013. Introduction to In Situ Bioremediation of Groundwater. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, EPA 542-R-13-018, December.

Attachments

Table 1 Natural Attenuation Monitoring Plan
Table 2 Natural Attenuation Monitoring Parameters
Table 3 Groundwater Corrective Action Contingency Plan Summary
Table 4 2024 Natural Attenuation Monitoring Results
Table 5 Mann-Kendall Trend Review for Vinyl Chloride
Figure 1 Natural Attenuation Monitoring
Figure 2 Vinyl Chloride Trends (2011-2024)
Figure 3 Vinyl Chloride Trend Summary
Figure 4 Vinyl Chloride, Potential Precursor Compound (TCE, DCE), and Total Molar Chlorinated Ethene Trends (2011-2024)
Attachment A Ethyl Ether Concentration Charts

Tables

Table 1
Natural Attenuation Monitoring Plan
Elk River Landfill
Elk River, Minnesota

Relative Position to Source / Plume		Well ID	Natural Attenuation Monitoring Schedule								
			2024			2025			2026		
			Spring[1]	Summer[1,2]	Fall[1]	Spring[1]	Summer[1,2]	Fall[1,2]	Spring[1]	Summer[1,2]	Fall[1]
Within Plume	Near Source (Landfill Edge)	P-302C	X	X	X	X	X	X	X	X	X
		P-17C		X			X			X	
		P-308L		X			X			X	
		P-304C	X	X	X	X	X	X	X	X	X
	Downgradient (Compliance Boundary)	P-321L	X	X	X	X	X	X	X	X	X
		P-323L	X	X	X	X	X	X	X	X	X
		P-313C	X	X	X	X	X	X	X	X	X
	Mid-Plume (Property Boundary)	P-325L	X	X	X	X	X	X	X	X	X
		P-326L	X	X	X	X	X	X	X	X	X
		P-338L	X	X	X	X	X	X	X	X	X
	Distal Plume	P-334L	X	X[3]	X	X	X	X	X	X	X
Outside Plume	Downgradient	P-342L	X	X		X	X		X	X	
	Sentinel	P-339L*				X	X	X	X	X	X
	Upgradient	P-22L		X			X			X	
	Sidegradient	P-340L		X			X			X	
		P-341L	X	X[3]	X		X			X	

Notes:

* To be installed if landowner grant permission.

[1] Samples will be analyzed for List 1 parameters shown on Table 2.

[2] Samples will be analyzed for List 2 parameters shown on Table 2.

[3] List 1 data were rejected due to laboratoy error (Barr, 2025).

The anticipated schedule is subject to change. The monitoring plan will be reviewed annually as part of Annual Water Quality Monitoring Reports.

Table 2
Natural Attenuation Monitoring Parameters
Elk River Landfill

Parameter List	Analyte Group	Parameters	Analytical Method
List 1	Organics	Vinyl Chloride (and additional organic compounds included on the EPA Method list)	EPA Method 8260D
	Field Parameters	Conductivity	Field Water Quality Meter Measurement
		Dissolved Oxygen	
		Temperature	
		Oxidation-Reduction Potential	
		pH	
List 2	Natural Attenuation Indicator Parameters	Sulfate	EPA Method 300.0
		Nitrate	EPA Method 300.0
		Chloride	EPA Method 300.0
		Total organic carbon	EPA Method 9060A
		Alkalinity	EPA Method 310.2
		Reduced Iron [Fe (II)]	Field Test Kit Measurement
		Reduced Manganese [Mn (II)]	
		Sulfide	
		Dissolved Oxygen	
		Methane/Ethane/Ethene	AM20 GAX

Table 3
Groundwater Corrective Action Contingency Plan Summary
Elk River Landfill

Scenario	Description	Applicable Wells	Actions	Approximate Timing
1 Organics detection in a water supply well sample	A detection of an organic compound[1] in a sample from a downgradient water supply well will trigger data review and follow-up sampling[2] (to confirm/verify the initial result) and action to protect the health of the well users.	Downgradient monitored water supply wells.	Review the data to assess quality control/quality assurance results (including field and laboratory control sample) and potential of alternate sources[3].	As soon as feasible (but within two weeks of receiving sample results).
			Notify the owner/resident and MPCA (and others) and coordinate/collect/analyze a confirmation sample.	Within 48 hours of identifying the organics detection. Confirmation sample analysis will be expedited if possible.
			If the detected concentration is above Minnesota drinking water criteria, provide bottled water to the resident until the detection is resolved through confirmation sampling/analysis or addressed by further action.	Within 48 hours of identifying the organics detection.
			If confirmed[4], address the detected organic to prevent exposure to groundwater users[5].	As soon as feasible (after confirmation).
			Evaluate the need for additional or alternate correction action.	To be determined.
2 Organics detection at sentinel well	A first-time detection of an organic compound[1,4] at a concentration greater than the IL will trigger rapid notification (i.e., within 48 hours of identification) and resampling unless obvious sampling or laboratory QA/QC issues are evident.	Sentinel monitoring wells: P-327L, P-328L, P-329L, P-333L, P-335L, P-339L (contingent on final location), P-340L, and P-341L .	Notify the MPCA (and others) and coordinate/collect/analyze a verification sample.	Notify within 48 hours of identifying the organics detection above the IL. Verification resample will be conducted as soon as feasible.
			Review the evaluation criteria for nearby water supply wells in context of the detection (see Table 4) and determine if additional water supply well actions are appropriate.	Annual Water Quality Monitoring Report (or separate submittal).
			Review monitoring results from the following three triannual events and determine if additional investigation and/or well installation activities are appropriate.	Subsequent Annual Water Quality Monitoring Report.
			If appropriate, prepare plans for additional investigation activities and/or evaluate the need for additional or alternate corrective action.	To be determined.

Notes:

[1] Attributed to the landfill.

[2] Sampling and additional actions require permission of the well owner.

[3] Common sources of low level organics not attributed to the landfill include sample cross contamination (during sample collection, transport, or analysis), well disinfection byproducts (e.g., well disinfection), water pumping/transmission/storage system components, separate sources.

[4] A confirmed detection is defined as comparable detections for at least two consecutive sampling events that are not attributed to sampling, handling, or laboratory cross contamination.

[5] May include installation of a point of entry water treatment system, installation of a replacement water supply well, providing a long-term water delivery, or other options/combined approach

Table 4
2024 Natural Attenuation Monitoring Results
Elk River Landfill
Elk River, Minnesota

			GWCAM															
		Location	P-17C	P-22L	P-302C	P-302C	P-302C	P-304C	P-304C	P-304C	P-308L	P-313C	P-313C	P-313C	P-321L	P-321L	P-321L	P-323L
		Date	7/24/2024	7/22/2024	4/19/2024	7/24/2024	10/17/2024	4/18/2024	7/24/2024	10/17/2024	7/24/2024	4/16/2024	7/24/2024	10/17/2024	4/18/2024	7/23/2024	10/17/2024	4/18/2024
		Sampling Event Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Units	MDH Human Health-Based Water Guidance Table																
Last Updated		01/16/2024																
Exceedance Key		**Bold**																
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	2.60	2.63	2.63	2.85	1.46	2.57	2.88	1.94
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	0.392	0.416	0.461	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	0.276	< 0.100 U	0.221	0.193	0.278	0.444	0.530	0.599	< 1.00 U	0.483	0.545	0.495	< 0.100 U	0.385	0.372	0.324
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l		< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	2.06	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l		< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U	< 1.00 U	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U	< 10.0 U	< 10.0 U J4	< 10.0 U
Allyl chloride	ug/l	30 HRL94	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	0.952	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	40 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U
Bromomethane	ug/l	10 HRL93	< 1.00 U C3	< 1.00 U	< 1.00 UC3J3J4	< 1.00 U C3	< 1.00 U	< 1.00 UC3J3J4	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U C3	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3
Butylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	3.15	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	ND RAA16	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	4.91 C3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U
Chloroform	ug/l	20 HRL18	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U
Chlorotoluene, o	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	1.50	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	1.52	< 1.00 U	< 1.00 U	< 1.00 U C5	< 1.00 U	< 1.00 U C5	< 1.00 U C5	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**	< 1.00 U J3	< 1.00 U	4.00	3.86 J3	5.10	< 1.00 U	< 1.00 U J3	< 1.00 U	2.55 J3	2.41	2.24 J3	3.20	1.31	3.04 C5	3.18	2.23
Ethyl benzene	ug/l	40 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	18.9 J3	< 1.00 U	28.2	23.4 J3	33.2	8.54	4.52 J3	8.29	22.0 J3	10.1	9.64 J3	12.5	2.50	6.68	8.71	6.92
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U
Naphthalene	ug/l	70 HRL13	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U
Propylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U
Styrene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U

Table 4
2024 Natural Attenuation Monitoring Results
Elk River Landfill
Elk River, Minnesota

			GWCAM															
Location			**P-17C**	**P-22L**	**P-302C**	**P-302C**	**P-302C**	**P-304C**	**P-304C**	**P-304C**	**P-308L**	**P-313C**	**P-313C**	**P-313C**	**P-321L**	**P-321L**	**P-321L**	**P-323L**
Date			**7/24/2024**	**7/22/2024**	**4/19/2024**	**7/24/2024**	**10/17/2024**	**4/18/2024**	**7/24/2024**	**10/17/2024**	**7/24/2024**	**4/16/2024**	**7/24/2024**	**10/17/2024**	**4/18/2024**	**7/23/2024**	**10/17/2024**	**4/18/2024**
Sampling Event Type			**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18	5.45	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	16.1	15.7	15.5	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Toluene	ug/l	70 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	0.161	0.215	0.214	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	**0.289**	< 0.0500 U	**0.538 C3**	**0.680**	**0.745**	< 0.0500 U C3	**0.383**	**0.286**	**1.74**	0.133 C3	**1.30**	0.154	< 0.0500 U	**0.285**	**0.366**	**0.223**
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U
General Parameters																		
Alkalinity, total, as CaCO3	mg/l		1110	177	--	845	798	--	667	680	510	--	580	540	--	423	413	--	
Anions	meq/l		30.7	4.94	--	22.0	--	--	14.9	--	--	--	14.1	--	--	10.8	--	--
Carbon, total organic	mg/l		44.6	< 1.00 U	--	18.6	16.3	--	8.01	6.77	3.84	--	4.68	3.23	--	1.68	1.21	--
Cations	meq/l		28.5	4.68	--	22.5	--	--	15.2	--	--	--	13.9	--	--	10.9	--	--
Chloride	mg/l		304	31.5	--	158	164	--	28.9 J6	32.6	42.5	--	70.2	74.1	--	57.9	51.5	--
Dissolved oxygen, field YSI	mg/l		1	0.8	0	0.2	0.2	0.1	0.3	0.2	--	1.1	0.5	0.5	0.7	1.1	1	0
Dissolved oxygen, field test kit	mg/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethane	mg/l		< 0.00129 U	< 0.00129 U	--	< 0.00129 U	0.00166	--	< 0.00129 U	< 0.00120 U	< 0.00129 U	--	< 0.00129 U	< 0.00120 U	--	0.00339	< 0.00120 U	--
Ethylene	mg/l		< 0.00127 U	< 0.00127 U	--	< 0.00127 U	< 0.00120 U	--	< 0.00127 U	< 0.00120 U	< 0.00127 U	--	< 0.00127 U	< 0.00120 U	--	< 0.00127 U	< 0.00120 U	--
Ion Balance	%		12.5	-2.74	--	1.32	--	--	0.931	--	--	--	-0.691	--	--	-1.32	--	--
Iron, ferrous, FE II, field	mg/l		> 3.30	0.32	--	2.89	--	--	2.94	--	> 3.30	--	1.67	--	--	0.56	--	--
Manganese II, field	mg/l		0.400	0.057	--	0.237	--	--	0.749	--	0.290	--	0.231	--	--	0.200	--	--
Methane	mg/l		1.39	0.0684	--	43.5	31.3	--	0.124	0.0941	3.61	--	0.773	0.558	--	0.298	0.329	--
Nitrogen, ammonia, as N	mg/l		44.4	< 0.100 U	--	< 0.100 U	--	--	< 0.100 U	--	--	--	< 0.100 U	--	--	< 0.100 U	--	--
Nitrogen, nitrate + nitrite, as N	mg/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	10000 HRLMCL	< 1.00 U	< 1.00 U T8	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	--	< 1.00 U P1	< 1.00 U	--
pH, field	pH units		6.85	8.62	7.34	7.27	7.17	6.92	6.94	6.8	--	7.23	7.26	7.03	7.29	7.45	7.29	6.9
Redox (oxidation potential), field	mV		-75	-81	-16.9	-159	-172	-89	-91	-93	--	-87	-25	-55	-102	-98	-105	-96
Solids, total dissolved	mg/l		1550	278	--	1070	--	--	692	--	--	--	672	--	--	554	--	--
Solids, total suspended	mg/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm		2611	429	1914	1917	1708	1172	1257	1198	--	1254	946	1135	975	986	919	1577
Sulfate, as SO4	mg/l		< 5.00 U	24.6	--	30.4	26.8	--	34.7 J6	33.5	< 5.00 U	--	26.0	24.5	--	33.8	32.6	--
Sulfide, as S^{2-}, field	mg/l		0.03	> 0.80	--	0.02	--	--	0.04	--	0.03	--	> 0.80	--	--	0.07	--	--
Temperature, field	deg C		15.2	11.2	12.9	13.3	13.6	10.3	10.9	11.2	--	8.5	12.2	9.7	10.8	11.5	11.8	9.9
Turbidity, field	NTU		32	6.3	4	7	3.5	15	6	7.2	--	8	5	3.5	2	1	0.5	15
Dissolved Metals																		
Arsenic	ug/l		22.3	< 2.00 U	--	9.99	--	--	3.34	--	--	--	2.73	--	--	< 2.00 U	--	--
Boron	ug/l	**500 RAA17**	**4330**	< 200 U	--	**559**	--	--	309	--	--	--	< 200 U	--	--	< 200 U	--	--
Cadmium	ug/l	0.5 HRL15 (1)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/l		143	32.6	--	171	--	--	166	--	--	--	160	--	--	130 O1 V	--	--
Chromium	ug/l	100 CR HRL93	< 4.00 U	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	--	--	< 4.00 U	--	--	< 4.00 U	--	--
Copper	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	ug/l		12800	290	--	14800	--	--	6200	--	--	--	1820	--	--	957 O1	--	--
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l		90.8	32.6	--	131	--	--	63.4	--	--	--	60.1	--	--	49.6	--	--
Manganese	ug/l	**100 HRL23**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l		28.9	4.75	--	5.33	--	--	2.19	--	--	--	2.77	--	--	2.79	--	--
Sodium	mg/l		291	5.31	--	58.7	--	--	31.2	--	--	--	19.3	--	--	5.02	--	--
Zinc	ug/l	2000 HRL94	13.0	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	--	--	< 10.0 U	--	--	< 10.0 U	--	--

Notes
GWCAM - Groundwater Corrective Action Monitoring Well

Table 4
2024 Natural Attenuation Monitoring Results
Elk River Landfill
Elk River, Minnesota

			GWCAM															
Location			**P-323L**	**P-323L**	**P-325L**	**P-325L**	**P-325L**	**P-326L**	**P-326L**	**P-326L**	**P-334L**	**P-334L**	**P-334L**	**P-334L**	**P-338L**	**P-338L**	**P-338L**	**P-342L**
Date			**7/23/2024**	**10/17/2024**	**4/16/2024**	**7/23/2024**	**10/17/2024**	**4/16/2024**	**7/23/2024**	**10/17/2024**	**5/15/2024**	**7/22/2024**	**9/19/2024**	**10/17/2024**	**4/18/2024**	**7/22/2024**	**10/17/2024**	**4/15/2024**
Sampling Event Type			**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Parameter	Units	MDH Human Health-Based Water Guidance Table																
Last Updated		01/16/2024																
Exceedance Key		**Bold**																
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	--	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	8.04	6.18	6.21	7.09	6.47	4.13	4.91	4.40	4.20	--	4.86	3.89	3.77	10.5	10.0	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,1-Dichloropropene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.335	0.313	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	3.08	2.16	1.52	1.56	1.33	1.66	1.73	1.39	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	0.981	0.918	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichlorobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
2,2-Dichloropropane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U	< 10.0 UC5J3J4	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U	--	< 10.0 U J3 J4	< 10.0 U J3 J4	< 10.0 U	< 10.0 U	< 10.0 U J3 J4	< 10.0 U
Allyl chloride	ug/l	30 HRL94	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U
Bromobenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromochloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromoform	ug/l	40 HRL93	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Bromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3
Butylbenzene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, sec	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Butylbenzene, tert	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloroethane	ug/l	ND RAA16	< 1.00 U J4	< 1.00 U	< 1.00 U C3	< 1.00 U J4	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3
Chloroform	ug/l	20 HRL18	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chloromethane	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U C3
Chlorotoluene, o	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Chlorotoluene, p	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dibromomethane (methylene bromide)	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U	< 1.00 U	1.36	1.59 C5	1.11 C5	< 1.00 U	1.27 C5	< 1.00 U C5	7.27	--	12.7	6.90 C5	7.52	5.21	4.42 C5	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**	4.46 C5	3.15	6.87	8.03 C5	6.96	3.42	4.51 C5	3.92	19.1	--	**25.4**	16.7	15.9	15.9	15.1	< 1.00 U
Ethyl benzene	ug/l	40 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	23.2	21.9	25.9	24.1	24.6	14.4	14.4	14.1	20.8	--	20.5	17.9	17.6	30.0	30.3	< 1.00 U
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	--	< 10.0 U J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	--	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	1.06	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Naphthalene	ug/l	70 HRL13	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U C3	--	< 1.00 U C3	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U
Propylbenzene	ug/l		< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Styrene	ug/l		< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U

Table 4
2024 Natural Attenuation Monitoring Results
Elk River Landfill
Elk River, Minnesota

			GWCAM															
Location			P-323L	P-323L	P-325L	P-325L	P-325L	P-326L	P-326L	P-326L	P-334L	P-334L	P-334L	P-334L	P-338L	P-338L	P-338L	P-342L
Date			7/23/2024	10/17/2024	4/16/2024	7/23/2024	10/17/2024	4/16/2024	7/23/2024	10/17/2024	5/15/2024	7/22/2024	9/19/2024	10/17/2024	4/18/2024	7/22/2024	10/17/2024	4/15/2024
Sampling Event Type			N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18	12.3 B	8.63	< 5.00 U	< 5.00 U	< 5.00 U	9.62	10.7 B	9.67	7.47	--	9.04 C3 J3	7.81	8.38	16.2 B	7.52	< 5.00 U
Toluene	ug/l	70 HRL23	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	**0.927**	**0.740**	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	0.154	0.120	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	**0.222**	**0.236**	**0.533 C3**	**0.556**	**0.643**	0.156 C3	0.160	0.176	**0.584**	--	**0.690**	**0.545**	**0.442**	**1.05**	**0.984**	< 0.0500 U C3
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U
General Parameters																		
Alkalinity, total, as CaCO3	mg/l		699	683	--	620	621	--	688	633	--	308	--	300	--	449	448	145
Anions	meq/l		18.2	--	--	16.6	--	--	15.9	--	--	--	--	--	--	10.6	--	3.03
Carbon, total organic	mg/l		6.73	6.44	--	8.56	8.12	--	3.02	2.84	--	< 1.40 UB	--	1.16	--	2.63	2.21	--
Cations	meq/l		18.2	--	--	16.5	--	--	15.8	--	--	--	--	--	--	10.9	--	3.57
Chloride	mg/l		133	131	--	130	122	--	62.4	67.0	--	21.6	--	23.6	--	43.6	45.1	1.05
Dissolved oxygen, field YSI	mg/l		0.3	0.2	0.6	0.9	0.7	1.8	1.2	0.8	1	--	0.8	0.7	0.5	0.4	0.7	0.2
Dissolved oxygen, field test kit	mg/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethane	mg/l		< 0.00129 U	0.00124	--	< 0.00129 U	0.00138	--	< 0.00129 U	< 0.00120 U	--	< 0.00129 U	--	< 0.00120 U	--	0.00915	0.00178	--
Ethylene	mg/l		< 0.00127 U	< 0.00120 U	--	< 0.00127 U	< 0.00120 U	--	< 0.00127 U	< 0.00120 U	--	< 0.00127 U	--	< 0.00120 U	--	< 0.00127 U	< 0.00120 U	--
Ion Balance	%		0.107	--	--	-0.342	--	--	-0.408	--	--	--	--	--	--	1.27	--	--
Iron, ferrous, FE II, field	mg/l		2.87	--	--	1.52	--	--	2.28	--	--	1.44	--	--	--	1.87	--	--
Manganese II, field	mg/l		0.541	--	--	0.255	--	--	0.313	--	--	0.042	--	--	--	0.252	--	--
Methane	mg/l		0.106	0.0912	--	1.06	0.952	--	0.328	0.299	--	2.11	--	2.02	--	2.88	2.63	--
Nitrogen, ammonia, as N	mg/l		< 0.100 U	--	--	< 0.100 U	--	--	< 0.100 U	--	--	--	--	--	--	< 0.100 U	--	< 0.100 U
Nitrogen, nitrate + nitrite, as N	mg/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.100 U
Nitrogen, nitrate, as N	mg/l	10000 HRLMCL	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	--	< 1.00 U	< 1.00 U	--	< 1.00 U T8	--	< 1.00 U	--	< 1.00 U T8	< 1.00 U	--
pH, field	pH units		6.99	6.879	7.38	7.45	7.35	7.29	7.33	7.21	7.48	--	7.23	7.27	7.63	7.74	7.49	7.94
Redox (oxidation potential), field	mV		-97	-107	-85	20	-35	-89	-56	-85	-12	--	-86	-36	-161	-176	-166	-199
Solids, total dissolved	mg/l		924	--	--	866	--	--	725	--	--	--	--	--	--	545	--	171
Solids, total suspended	mg/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 4.00 U
Specific conductance @ 25 ºC, field	umhos/cm		995	1490	1376	1559	1503	1109	1389	1373	613	--	644	630	895	953	910	368
Sulfate, as SO4	mg/l		22.5	18.9	--	26.2	23.9	--	19.0	17.7	--	18.6	--	18.7	--	18.8	18.0	6.72
Sulfide, as S^{2-}, field	mg/l		0.11	--	--	ND	--	--	ND	--	--	0.17	--	--	--	0.19	--	--
Temperature, field	deg C		10.5	10.8	8	11.2	10.5	7.3	12.1	10.3	10.5	--	10	9.7	9.2	10.1	9.6	7.7
Turbidity, field	NTU		8.4	21	3.5	10	8	1.5	17	9.3	3.8	--	5	13	2	1	0.8	4.9
Dissolved Metals																		
Arsenic	ug/l		< 2.00 U	--	--	< 2.00 U	--	--	< 2.00 U	--	--	--	--	--	--	< 2.00 U	--	< 2.00 UF1
Boron	ug/l	**500 RAA17**	319	--	--	251	--	--	< 200 U	--	--	--	--	--	--	< 200 U	--	< 200 U F1
Cadmium	ug/l	0.5 HRL15 (1)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 2.00 U F1
Calcium	mg/l		188	--	--	181	--	--	181	--	--	--	--	--	--	128	--	44.2 F1
Chromium	ug/l	100 CR HRL93	< 4.00 U	--	--	< 4.00 U	--	--	< 4.00 U	--	--	--	--	--	--	< 4.00 U	--	< 4.00 UF1
Copper	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 10.0 U F1
Iron	ug/l		6050	--	--	2140	--	--	12600	--	--	--	--	--	--	2360	--	< 100 U F1
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 10.0 U F1
Magnesium	mg/l		78.8	--	--	71.4	--	--	70.6	--	--	--	--	--	--	50.1	--	15.3 F1
Manganese	ug/l	**100 HRL23**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**114 F1**
Mercury	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.200 U F1
Potassium	mg/l		4.02	--	--	3.14	--	--	2.53	--	--	--	--	--	--	2.14	--	1.20 F1
Sodium	mg/l		46.7	--	--	32.4	--	--	9.71	--	--	--	--	--	--	4.54	--	2.41 F1
Zinc	ug/l	2000 HRL94	< 10.0 U	--	--	< 10.0 U	--	--	< 10.0 U	--	--	--	--	--	--	< 10.0 U	--	17.1 F1

Notes
GWCAM - Groundwater Corrective Action Monitoring Well

Table 4
2024 Natural Attenuation Monitoring Results
Elk River Landfill
Elk River, Minnesota

		GWCAM	Sentinel Wells														
Location		**P-342L**	**P-327L**	**P-327L**	**P-328L**	**P-328L**	**P-329L**	**P-329L**	**P-329L**	**P-333L**	**P-333L**	**P-335L**	**P-335L**	**P-335L**	**P-340L**	**P-341L**	**P-341L**
Date		**7/24/2024**	**4/15/2024**	**7/25/2024**	**4/15/2024**	**7/25/2024**	**4/15/2024**	**7/25/2024**	**10/16/2024**	**4/15/2024**	**7/25/2024**	**4/15/2024**	**7/25/2024**	**10/16/2024**	**7/22/2024**	**4/15/2024**	**7/23/2024**
Sampling Event Type		**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Parameter	Units	MDH Human Health-Based Water Guidance Table															
Last Updated		01/16/2024															
Exceedance Key		**Bold**															
Volatile Organic Compounds																	
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U	--	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U	--	< 0.750 U	--	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	< 0.750 U	--
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,1-Dichloropropene	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2,3-Trichlorobenzene	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U J4	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.250 U	--	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 0.100 U	--	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,3-Dichlorobenzene	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,3-Dichloropropane	ug/l		< 1.00 U J4	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U	--	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
2,2-Dichloropropane	ug/l		< 1.00 U C3	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U C3	--
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U	--	< 10.0 U C3	--	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3 J3	< 10.0 U	< 10.0 U	< 10.0 U	--
Allyl chloride	ug/l	30 HRL94	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Benzene	ug/l	2 HRL09 (1)	< 0.500 U	--	< 0.500 U	--	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	< 0.500 U	--
Bromobenzene	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Bromochloromethane	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Bromoform	ug/l	40 HRL93	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--
Bromomethane	ug/l	10 HRL93	< 1.00 U C3	--	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--
Butylbenzene	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Butylbenzene, sec	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U C3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Butylbenzene, tert	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U	--	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--
Chlorobenzene	ug/l	100 HRL93	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Chloroethane	ug/l	ND RAA16	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C3	--
Chloroform	ug/l	20 HRL18	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Chloromethane	ug/l		< 1.00 U	--	< 1.00 U J3	--	< 1.00 U J3	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3	< 1.00 U C3	--
Chlorotoluene, o	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Chlorotoluene, p	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Dibromomethane (methylene bromide)	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U C5 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J4	< 1.00 U	< 1.00 U	--
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**	< 1.00 U J3	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Ethyl benzene	ug/l	40 HRL23	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Ethyl ether	ug/l	200 RAA16 (1)	< 1.00 U J3	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U	--	< 0.250 U	--	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	< 0.250 U	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U	--	< 10.0 U	--	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	< 10.0 U C3	< 10.0 U	< 10.0 U	< 10.0 U	--
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U	--	< 5.00 U	--	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U	--
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U J3 J4	< 1.00 U	< 1.00 U	< 1.00 U	--
Naphthalene	ug/l	70 HRL13	< 1.00 U J3	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U C3	< 1.00 U	< 1.00 U	< 1.00 U	--
Propylbenzene	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Styrene	ug/l		< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--

Table 4
2024 Natural Attenuation Monitoring Results
Elk River Landfill
Elk River, Minnesota

			GWCAM	Sentinel Wells														
Location			P-342L	P-327L	P-327L	P-328L	P-328L	P-329L	P-329L	P-329L	P-333L	P-333L	P-335L	P-335L	P-335L	P-340L	P-341L	P-341L
Date			7/24/2024	4/15/2024	7/25/2024	4/15/2024	7/25/2024	4/15/2024	7/25/2024	10/16/2024	4/15/2024	7/25/2024	4/15/2024	7/25/2024	10/16/2024	7/22/2024	4/15/2024	7/23/2024
Sampling Event Type			N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Tetrahydrofuran	ug/l	600 HRL18	< 5.00 U	--	< 5.00 U C3	--	< 5.00 U C3	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U C5	< 5.00 U	< 5.00 U	< 5.00 U C3	< 5.00 U	< 5.00 U	--
Toluene	ug/l	70 HRL23	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	< 0.100 U	--	< 0.100 U	--	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	< 0.100 U	--
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U	--	< 1.00 U	--	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	--
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	< 0.0500 U	--	< 0.0500 U	--	< 0.0500 U	< 0.0500 U C3	< 0.0500 U	< 0.0500 U J4	< 0.0500 U C3	< 0.0500 U	< 0.0500 U C3	< 0.0500 U	< 0.0500 U J4	< 0.0500 U	< 0.0500 U C3	--
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U	--	< 2.00 U	--	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	< 2.00 U	--
General Parameters																		
Alkalinity, total, as CaCO3	mg/l		198	208	197	215	205	210	206	--	205	198	202	197	--	179	274	272
Anions	meq/l		4.22	--	4.36	--	4.60	--	4.50	--	--	4.39	--	4.42	--	3.98	6.56	--
Carbon, total organic	mg/l		1.03	--	--	--	--	--	--	--	--	--	--	--	--	< 1.00 U	--	< 1.00 U
Cations	meq/l		4.25	--	4.51	--	4.54	--	4.38	--	--	4.33	--	4.33	--	4.56	6.23	--
Chloride	mg/l		1.38	11.2	10.6 J6	6.87	6.09	3.04	3.45	--	3.94	3.43	4.04	4.10	--	4.72	24.6	24.5
Dissolved oxygen, field YSI	mg/l		0.9	0.2	0.8	15.9	0.9	0.5	0.5	0.4	0.4	0.6	1.1	0.8	1.8	10.7	0.1	--
Dissolved oxygen, field test kit	mg/l		--													--	--	--
Ethane	mg/l		< 0.00129 U	--	--	--	--	--	--	--	--	--	--	--	--	< 0.00129 U	--	< 0.00129 U
Ethylene	mg/l		< 0.00127 U	--	--	--	--	--	--	--	--	--	--	--	--	< 0.00127 U	--	< 0.00127 U
Ion Balance	%		0.387	--	3.23	--	3.11	--	-1.26	--	--	-0.687	--	-1.01	--	6.85	--	--
Iron, ferrous, FE II, field	mg/l		0.77	--	--	--	--	--	--	--	--	--	--	--	--	1.05	--	2.49
Manganese II, field	mg/l		0.064	--	--	--	--	--	--	--	--	--	--	--	--	0.175	--	0.368
Methane	mg/l		0.0429	--	--	--	--	--	--	--	--	--	--	--	--	0.0249	--	< 0.000678 U
Nitrogen, ammonia, as N	mg/l		< 0.100 U	--	0.214	--	0.225	--	< 0.100 U	--	--	< 0.100 U	--	< 0.100 U	--	< 0.100 U	< 0.100 U	--
Nitrogen, nitrate + nitrite, as N	mg/l		--	--	--	--	--	--	--	--	--	--	--	--	--	< 1.00 U	< 0.100 U	--
Nitrogen, nitrate, as N	mg/l	10000 HRLMCL	< 1.00 U	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 1.00 U
pH, field	pH units		8.06	8.37	8.18	8.04	7.96	7.98	7.9	7.74	7.94	7.85	7.62	8.12	7.87	8.45	8.56	--
Redox (oxidation potential), field	mV		-43	-230	-201	-184	-147	-140	-125	-137	-139	-139	-138	-135	-114	72	-329	--
Solids, total dissolved	mg/l		210	--	224	--	229	--	224	--	--	228	--	229	--	207	339	--
Solids, total suspended	mg/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	37.8	--
Specific conductance @ 25 ºC, field	umhos/cm		411	409	418	424	436	395	413	392	400	403	398	407	408	404	575	--
Sulfate, as SO4	mg/l		10.3	5.85	6.28	15.5	15.9	13.4	13.8	--	16.5	16.5	15.1	17.6	--	12.5	18.9	23.7
Sulfide, as S^{2-}, field	mg/l		0.54	--	--	--	--	--	--	--	--	--	--	--	--	0.10	--	0.08
Temperature, field	deg C		12.1	8	9	8.2	9.7	9.2	9.9	9.2	7.9	9.9	11	11.1	11.4	11.5	10.2	--
Turbidity, field	NTU		19	9.1	1	0.1	13	9.5	2	9	2.3	2	8.1	28	12	8	15.5	--
Dissolved Metals																		
Arsenic	ug/l		< 2.00 U	--	3.62	--	< 2.00 U	--	< 2.00 U	--	--	< 2.00 U	--	< 2.00 U	--	< 2.00 U	< 2.00 U	--
Boron	ug/l	**500 RAA17**	< 200 U	--	< 200 U	--	< 200 U	--	< 200 U	--	--	< 200 U	--	< 200 U	--	< 200 U	< 200 U	--
Cadmium	ug/l	0.5 HRL15 (1)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 2.00 U	--
Calcium	mg/l		49.7	58.9 F1	51.5	63.9 F1	54.8	59.5 F1	51.1	--	62.6 F1	53.0	60.0 F1	52.3	--	51.6	75.8	--
Chromium	ug/l	100 CR HRL93	< 4.00 U	--	< 4.00 U	--	< 4.00 U	--	< 4.00 U	--	--	< 4.00 U	--	< 4.00 U	--	< 4.00 U	6.46	--
Copper	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 10.0 U	--
Iron	ug/l		1410	--	2320	--	810	--	1080	--	--	1310	--	879	--	400	< 100 U	--
Lead	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 10.0 U	--
Magnesium	mg/l		19.1	19.1 F1	18.5	20.6 F1	18.2	18.1 F1	18	--	19.3 F1	17.7	19.6 F1	17.8	--	21	26.9	--
Manganese	ug/l	**100 HRL23**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	84.3	--
Mercury	ug/l		--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.200 U	--
Potassium	mg/l		1.36	1.85 F1	1.61	1.48 F1	1.42	1.66 F1	1.77	--	1.29 F1	1.3	1.34 F1	1.42	--	1.39	3.02	--
Sodium	mg/l		2.58	6.64 F1	6.8	5.64 F1	5.8	5.77 F1	6.07	--	3.33 F1	3.51	4.07 F1	4.35	--	4.79	3.58	--
Zinc	ug/l	2000 HRL94	< 10.0 U	--	< 10.0 U	--	< 10.0 U	--	< 10.0 U	--	--	< 10.0 U	--	< 10.0 U	--	< 10.0 U	42.3	--

Notes
GWCAM - Groundwater Corrective Action Monitoring Well

Table 4
2024 Natural Attenuation Monitoring Results
Elk River Landfill
Elk River, Minnesota

		Location	Sentinel Wells
		Date	P-341L
		Sampling Event Type	9/19/2024
			N
Parameter	Units	MDH Human Health-Based Water Guidance Table	
Last Updated		01/16/2024	
Exceedance Key		**Bold**	
Volatile Organic Compounds			
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.00 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HRL23	< 1.00 U
1,1-Dichloropropene	ug/l		< 1.00 U
1,2,3-Trichlorobenzene	ug/l		< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HRL23	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.03 HRL23 (1)	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 0.100 U
1,2-Dichloroethylene, trans	ug/l	9 HRL23 (1)	< 1.00 U
1,2-Dichloropropane	ug/l	3 HRL23 (1)	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HRL23 (1)	< 1.00 U
1,3-Dichlorobenzene	ug/l		< 1.00 U
1,3-Dichloropropane	ug/l		< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.00 U
1,4-Dichlorobenzene	ug/l	50 HRL23	< 1.00 U
2,2-Dichloropropane	ug/l		< 1.00 U
Acetone	ug/l	3000 HRL23 (1)	< 10.0 U J3 J4
Allyl chloride	ug/l	30 HRL94	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	< 0.500 U
Bromobenzene	ug/l		< 1.00 U
Bromochloromethane	ug/l		< 1.00 U
Bromodichloromethane	ug/l	3 HRL23 (1)	< 1.00 U
Bromoform	ug/l	40 HRL93	< 1.00 U
Bromomethane	ug/l	10 HRL93	< 1.00 U
Butylbenzene	ug/l		< 1.00 U
Butylbenzene, sec	ug/l		< 1.00 U
Butylbenzene, tert	ug/l		< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	< 1.00 U
Chloroethane	ug/l	ND RAA16	< 1.00 U
Chloroform	ug/l	20 HRL18	< 1.00 U
Chloromethane	ug/l		< 1.00 U
Chlorotoluene, o	ug/l		< 1.00 U
Chlorotoluene, p	ug/l		< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l		< 1.00 U
Dibromomethane (methylene bromide)	ug/l		< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17 (1)	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**	< 1.00 U
Ethyl benzene	ug/l	40 HRL23	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	< 1.00 U
Hexachlorobutadiene	ug/l	1 HRL93	< 0.250 U
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10.0 U J3
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	< 1.00 U
Naphthalene	ug/l	70 HRL13	< 1.00 U C3
Propylbenzene	ug/l		< 1.00 U
Styrene	ug/l		< 1.00 U

Table 4
2024 Natural Attenuation Monitoring Results
Elk River Landfill
Elk River, Minnesota

			Sentinel Wells
		Location	**P-341L**
		Date	**9/19/2024**
		Sampling Event Type	**N**
Tetrachloroethylene	ug/l	4 HRL23 (1)	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18	< 5.00 U C3 J3
Toluene	ug/l	70 HRL23	< 1.00 U
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	< 0.100 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.00 U
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	< 0.0500 U
Xylene, total	ug/l	300 XYL HRL23 (1)	< 2.00 U
General Parameters			
Alkalinity, total, as CaCO3	mg/l		--
Anions	meq/l		--
Carbon, total organic	mg/l		--
Cations	meq/l		--
Chloride	mg/l		--
Dissolved oxygen, field YSI	mg/l		0.5
Dissolved oxygen, field test kit	mg/l		--
Ethane	mg/l		--
Ethylene	mg/l		--
Ion Balance	%		--
Iron, ferrous, FE II, field	mg/l		--
Manganese II, field	mg/l		--
Methane	mg/l		--
Nitrogen, ammonia, as N	mg/l		--
Nitrogen, nitrate + nitrite, as N	mg/l		--
Nitrogen, nitrate, as N	mg/l	10000 HRLMCL	--
pH, field	pH units		7.55
Redox (oxidation potential), field	mV		-172
Solids, total dissolved	mg/l		--
Solids, total suspended	mg/l		--
Specific conductance @ 25 ºC, field	umhos/cm		685
Sulfate, as SO4	mg/l		--
Sulfide, as S^{2-}, field	mg/l		--
Temperature, field	deg C		10.6
Turbidity, field	NTU		60.3
Dissolved Metals			
Arsenic	ug/l		--
Boron	ug/l	**500 RAA17**	--
Cadmium	ug/l	0.5 HRL15 (1)	--
Calcium	mg/l		--
Chromium	ug/l	100 CR HRL93	--
Copper	ug/l		--
Iron	ug/l		--
Lead	ug/l		--
Magnesium	mg/l		--
Manganese	ug/l	**100 HRL23**	--
Mercury	ug/l		--
Potassium	mg/l		--
Sodium	mg/l		--
Zinc	ug/l	2000 HRL94	--

Notes
GWCAM - Groundwater Corrective Action Monitoring Well

Data Footnotes and Qualifiers

Barr Standard Footnotes and Qualifiers

U	The analyte was analyzed for, but was not detected.
H	Recommended sample preservation, extraction or analysis holding time was exceeded.

Laboratory Qualifiers

B	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Data is likely to show a low bias concerning the result.
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
C4	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Data is likely to show a low bias concerning the result.
C5	The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
P1	P1 RPD value not applicable for sample concentrations less than 5 times the reporting limit.
Q	Sample was prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

MDH Human Health-Based Water Guidance Table

(1)	Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.
CR	Value represents the criteria for Chromium, hexavalent.
DCP	Value shown is 1,3-dichloropropene in the MDH criterion, however, the laboratory reports cis and trans isomers individually.
HRL09	Health Risk Limit 2009
HRL13	Health Risk Limit 2013
HRL15	Health Risk Limit 2015
HRL18	Health Risk Limit 2018
HRL23	Health Risk Limit 2023
HRL93	Health Risk Limit 1993
HRL94	Health Risk Limit 1994
MCL	Maximum Contaminant Level.
ND	Not derived due to insufficient information.
RAA13	Risk Assessment Advice 2013.
RAA16	Risk Assessment Advice 2016.
RAA17	Risk Assessment Advice 2017.
XYL	Value shown is for the sum of the mixed o,m and p Xylene isomers.

Table 5 - Mann-Kendall Trend Review for Vinyl Chloride
Elk River Landfill

Location	total sample count	total count NDs	count used for trend[1]	NDs used in trend	Mean (ppb)[2]	Std Deviation (ppb)[2]	CV	MK Test Value (S)[3]	p-value[4]	Trend Statement	Note
P-17C	19	9	13	3	0.194	0.106	55%	-6	0.379	No statistical evidence according to the MK test of an increasing or decreasing trend at 95% confidence level	Trend period 2016-2024, 7/21/2017 ND excluded to retain as much information as possible
P-29C	42	14	30	2	0.505	0.217	43%	-24	0.341	No statistical evidence according to the MK test of an increasing or decreasing trend at 95% confidence level	Trend period 2015-2024
P-301C	43	27	28	12	0.114	0.169	148%	16	0.377	No statistical evidence according to the MK test of an increasing or decreasing trend at 95% confidence level	Trend period 2016-2024
P-302C	43	13	31	1	0.487	0.217	45%	153	0.00488	Statistically significant evidence of an increasing trend at 95% confidence level.	Trend period 2015-2024
P-304C	43	25	28	11	0.172	0.125	73%	-95	0.02740	Statistically significant evidence of a decreasing trend at 95% confidence level level.	Trend period 2016-2024
P-308L	13	1	13	1	0.984	0.596	61%	-11	0.271	No statistical evidence according to the MK test of an increasing or decreasing trend at 95% confidence level	Trend period 2019-2024
P-309C	14	4	10	0	0.337	0.104	31%	-12	0.162	No statistical evidence according to the MK test of an increasing or decreasing trend at 95% confidence level	Trend period 2015-2024
P-313C	42	5	42	5	0.574	0.393	68%	-560	0	Statistically significant evidence of a decreasing trend at 95% confidence level level.	Trend period 2015-2024
P-314C	29	8	29	8	0.393	0.336	85%	-174	0.0005	Statistically significant evidence of a decreasing trend at 95% confidence level level.	Trend period 2015-2024
P-314C-historical	12	5	6	5	0.25	0.559	224%	-5	0.121	No statistical evidence according to the MK test of an increasing or decreasing trend at 95% confidence level	Trend period 2011-2014
P-320C	42	19	29	7	0.213	0.142	67%	-59	0.136	No statistical evidence according to the MK test of an increasing or decreasing trend at 95% confidence level	Trend period 2015-2024
P-320C2	42	18	30	6	0.142	0.107	75%	-6	0.464	No statistical evidence according to the MK test of an increasing or decreasing trend at 95% confidence level	Trend period 2015-2024
P-320L	42	12	29	1	0.352	0.225	64%	-38	0.244	No statistical evidence according to the MK test of an increasing or decreasing trend at 95% confidence level	Trend period 2015-2024
P-321L	43	4	40	2	1.016	0.646	64%	-472	0.000000	Statistically significant evidence of a decreasing trend at 95% confidence level level.	Trend period 2012-2024
P-323L	41	13	31	6	0.41	0.3	73%	-192	0.0005510	Statistically significant evidence of a decreasing trend at 95% confidence level level.	Trend period 2015-2024
P-325L	32	3	30	1	0.599	0.315	53%	31	0.296	No statistical evidence according to the MK test of an increasing or decreasing trend at 95% confidence level	Trend period 2015-2024
P-326L	30	4	30	4	0.46	0.303	66%	-196	0.00025	Statistically significant evidence of a decreasing trend at 95% confidence level level.	Trend period 2015-2024
P-334L	22	8	12	1	0.363	0.168	46%	40	0.003740	Statistically significant evidence of an increasing trend at 95% confidence level.	Trend period 2019-2024
P-338L	11	3	11	3	0.558	0.393	70%	28	0.018600	Statistically significant evidence of an increasing trend at 95% confidence level.	Trend period 2021-2024
P694477	25	12	16	3	0.253	0.202	80%	65	0.0019	Statistically significant evidence of an increasing trend at 95% confidence level.	Trend period 2019-2024
11661 225th Ave	1	1								Not enough data above reporting limits to complete trend analysis	
12163 223rd Ave New	3	3								Not enough data above reporting limits to complete trend analysis	
12265 223rd Ave New	3	3								Not enough data above reporting limits to complete trend analysis	
12269 223rd St New	3	3								Not enough data above reporting limits to complete trend analysis	
12275 239th Ave	1	1								Not enough data above reporting limits to complete trend analysis	
12901 221st Ave NW	1	1								Not enough data above reporting limits to complete trend analysis	
22130 Quinn St	3	3								Not enough data above reporting limits to complete trend analysis	
22205 Elk Lake Rd	3	3								Not enough data above reporting limits to complete trend analysis	
22272 Quinn St	4	4								Not enough data above reporting limits to complete trend analysis	
22275 ELK LAKE RD NW	2	2								Not enough data above reporting limits to complete trend analysis	
22447 Tipton St. New	3	3								Not enough data above reporting limits to complete trend analysis	
22915 Hwy 169	1	1								Not enough data above reporting limits to complete trend analysis	
22-OWA	2	2								Not enough data above reporting limits to complete trend analysis	
301-OWA	2	2								Not enough data above reporting limits to complete trend analysis	
312-OWA	2	2								Not enough data above reporting limits to complete trend analysis	

Table 5 - Mann-Kendall Trend Review for Vinyl Chloride
Elk River Landfill

Location	total sample count	total count NDs	count used for trend[1]	NDs used in trend	Mean (ppb)[2]	Std Deviation (ppb)[2]	CV	MK Test Value (S)[3]	p-value[4]	Trend Statement	Note
315-OWA	2	2								Not enough data above reporting limits to complete trend analysis	
336-OWA	2	2								Not enough data above reporting limits to complete trend analysis	
337-OWA	2	2								Not enough data above reporting limits to complete trend analysis	
401-OWA	1	1								Not enough data above reporting limits to complete trend analysis	
408-OWA	1	1								Not enough data above reporting limits to complete trend analysis	
B342	1	1								Not enough data above reporting limits to complete trend analysis	
ERL Shop Well	3	3								Not enough data above reporting limits to complete trend analysis	
LYS-11	5	5								Not enough data above reporting limits to complete trend analysis	
LYS-13	2	2								Not enough data above reporting limits to complete trend analysis	
LYS-14	1	1								Not enough data above reporting limits to complete trend analysis	
LYS-17	6	6								Not enough data above reporting limits to complete trend analysis	
LYS-6N	2	2								Not enough data above reporting limits to complete trend analysis	
P-22L	2	1								Not enough data above reporting limits to complete trend analysis	
P-29D	6	6								Not enough data above reporting limits to complete trend analysis	
P-301L	42	36								Not enough data above reporting limits to complete trend analysis	
P-303C	3	3								Not enough data above reporting limits to complete trend analysis	
P-305C	41	31								Not enough data above reporting limits to complete trend analysis	
P-308C	14	10								Not enough data above reporting limits to complete trend analysis	
P-310C	2	2								Not enough data above reporting limits to complete trend analysis	
P-311C	2	2								Not enough data above reporting limits to complete trend analysis	
P-311D	6	6								Not enough data above reporting limits to complete trend analysis	
P-311L	6	6								Not enough data above reporting limits to complete trend analysis	
P-315L	5	5								Not enough data above reporting limits to complete trend analysis	
P-322L	6	6								Not enough data above reporting limits to complete trend analysis	
P-324L	6	6								Not enough data above reporting limits to complete trend analysis	
LYS-19	5	5								Not enough data above reporting limits to complete trend analysis	
P-340L	7	7								Not enough data above reporting limits to complete trend analysis	
P-341L	4	1								Not enough data above reporting limits to complete trend analysis	
P-342L	4	4								Not enough data above reporting limits to complete trend analysis	
302-OWA	2	2								Not enough data above reporting limits to complete trend analysis	

General Notes:

(1) For purposes of this trend analysis, all samples reported as non-detections were given the value of the reporting limit or detection limit unless otherwise noted. Mann-Kendall (MK) trend analyses were only considered if datasets had at least eight data points greater than or equal to the associated reporting or detection limit. To the extent possible, all data were used for trend analyses. Prior to completing the analyses, data were screened on a case-by-case basis to identify usable data within the time series and to remove ambiguities within the dataset (primarily as it relates to datasets with multiple detection limits). The following rules were used to screen data in a consistent manner:

(a) Time series with samples that have multiple detection limits were replaced with the highest detection limit value. Detections below the highest detection limit were replaced with the detection limit value. As long as the number of detections remains above eight, a trend analysis was run.

(b) To handle cases when analytical techniques improved over time and detection limits became lower, the period with the high detection limit(s) was excluded from the trend analysis, including both detections and non-detections. This removed ambiguity in the dataset caused by the prior non-detections.

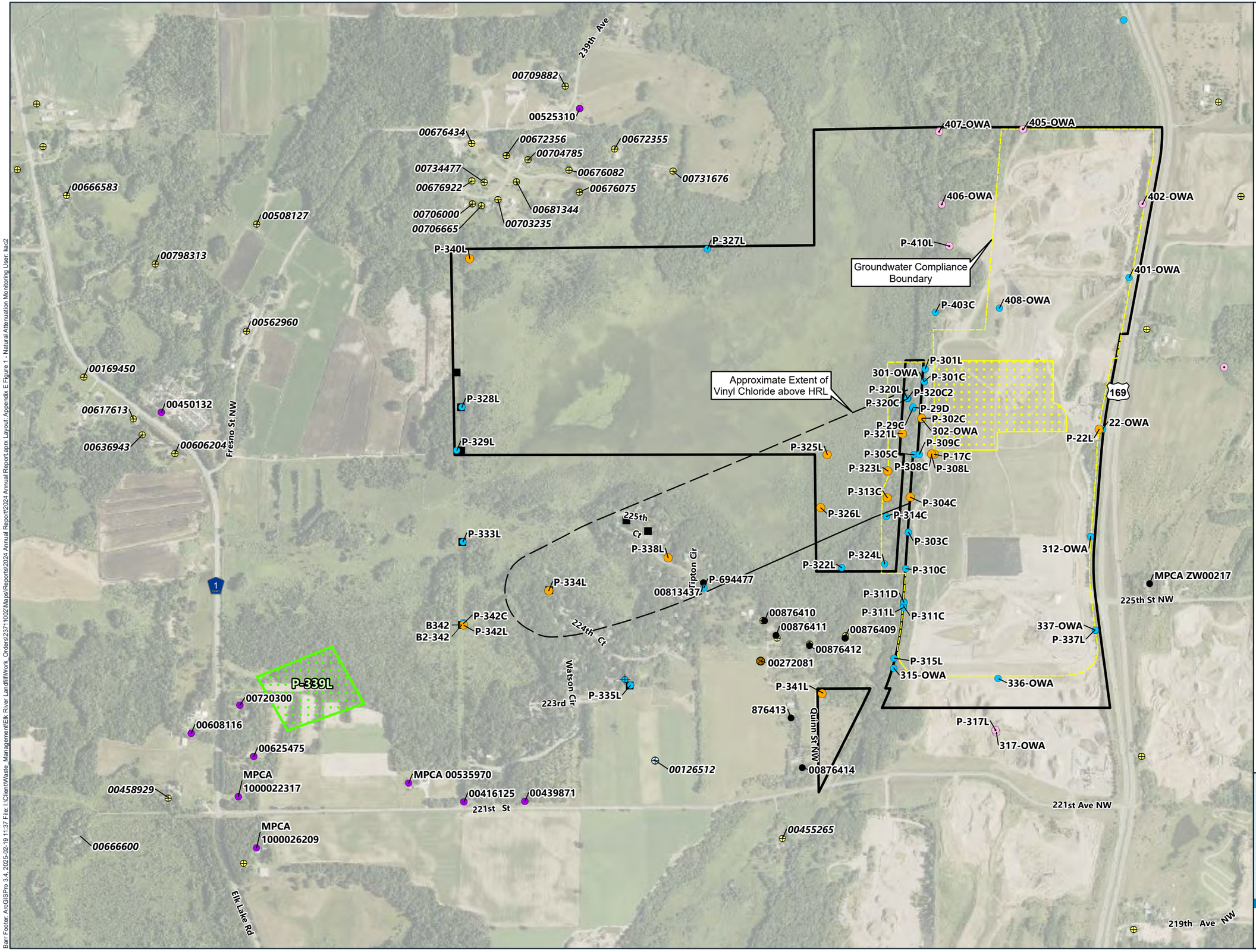
(c) Under most circumstances, non-detections were not selectively exlcuded within a data series. However, there are instances where this is an appropriate practice in order to maintain the maximum amount of information. For example, singular non-detections at relatively high limits were excluded if there were at least 5 usable data points before and after a non-detection in question. This avoided the situation where the majority of a dataset would have been replaced by the highest non-detection value.

(2) Mean and standard deviations are reported for the data included in the trend analysis, not for the complete dataset. For data sets that included non-detects mean and standard deviation calculated using the Kaplan-Meier method.

(3) The direction of the trend (increasing or decreasing) is inferred based on the value of the Mann-Kendall (MK) test value, S. An S value that is greater than zero suggests an upward trend and an S value less than zero suggests a downward trend. Values that are close to zero suggest no net upward or downward trend. Statements concerning the statistical signifance of the trend are inferred based on the associated p-value.

(4) Trends with p-values that are less than or equal to 0.05 are considered statistically significant trends at the 95% confidence level. Trends with P-values greater than 0.05 and less than or equal to 0.1 are considered possible trends, but are not statistically significant. Trends with p-values greater than 0.1 do not have enough evidence to indicate an increasing or decreasing trend.

Figures



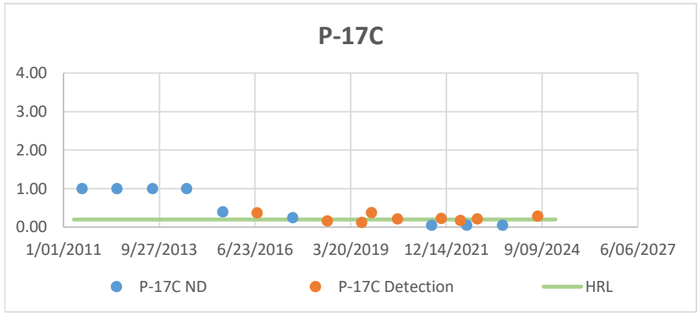
Natural Attenuation Monitoring
Elk River Landfill
Elk River, Minnesota

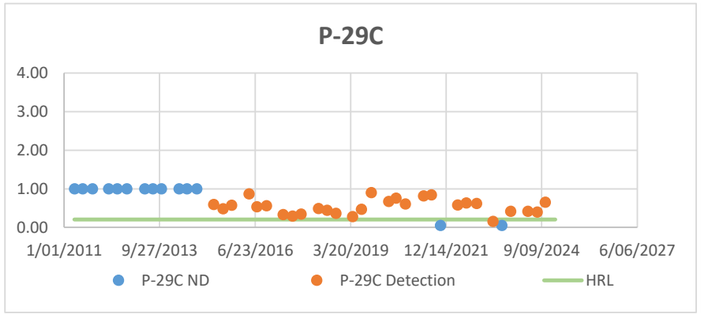
FIGURE 1

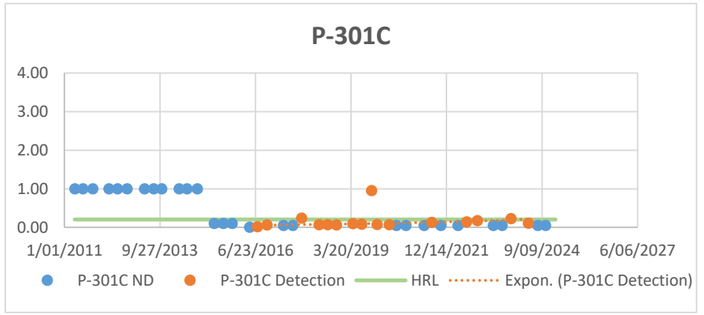
BARR

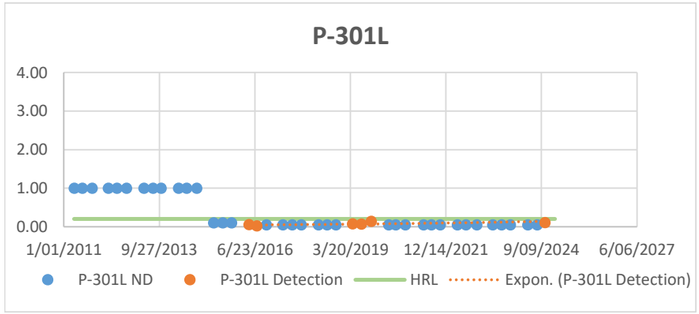
Barr Footer: ArcGISPro 3.4, 2025-02-19 11:37 File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711002\Maps\Reports\2024 Annual Report\2024 Annual Report.aprx Layout: Appendix E Figure 1 - Natural Attenuation Monitoring User: kar2

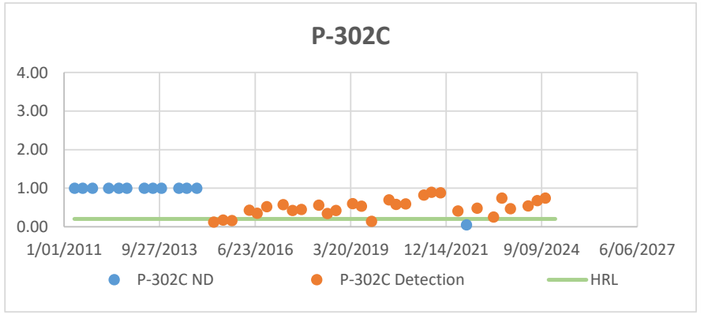
Figure 2
Vinyl Chloride Trends (2011-2024)

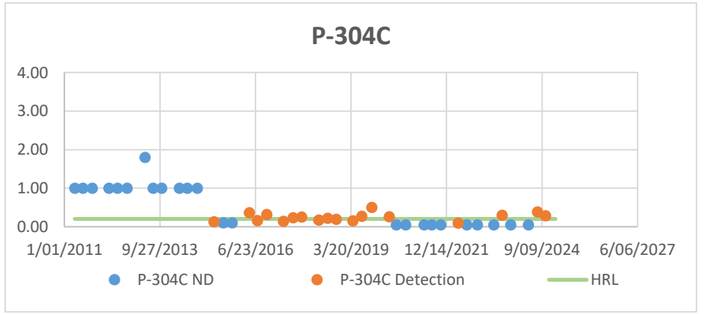


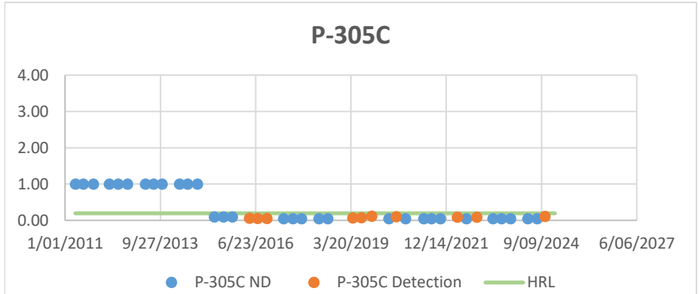


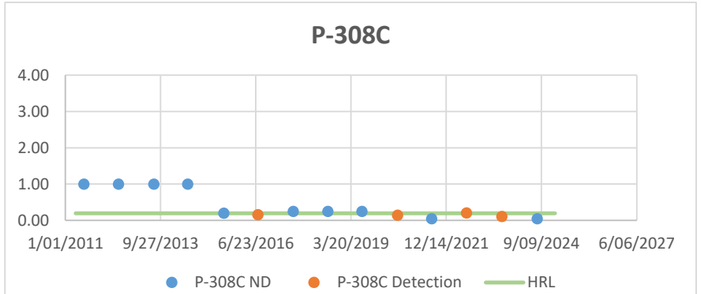


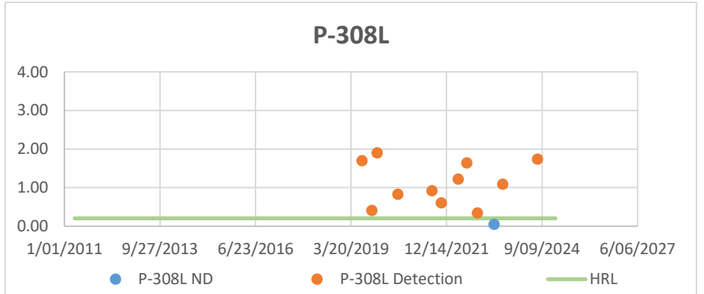


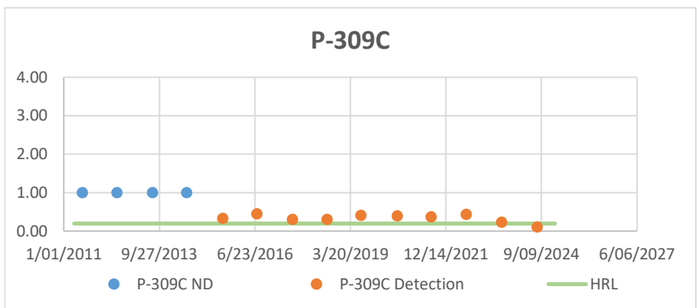


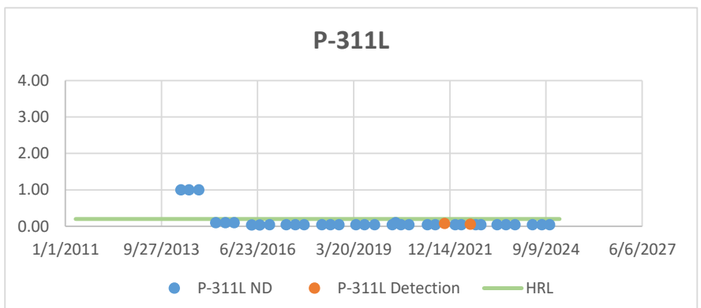












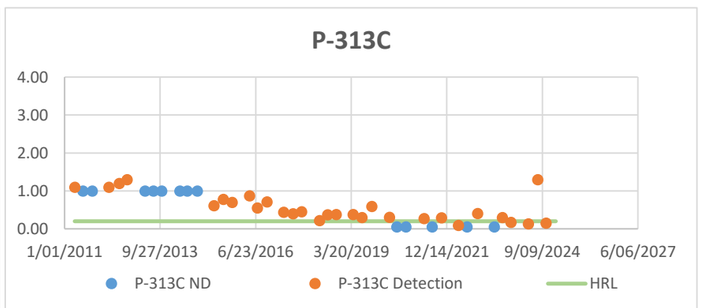
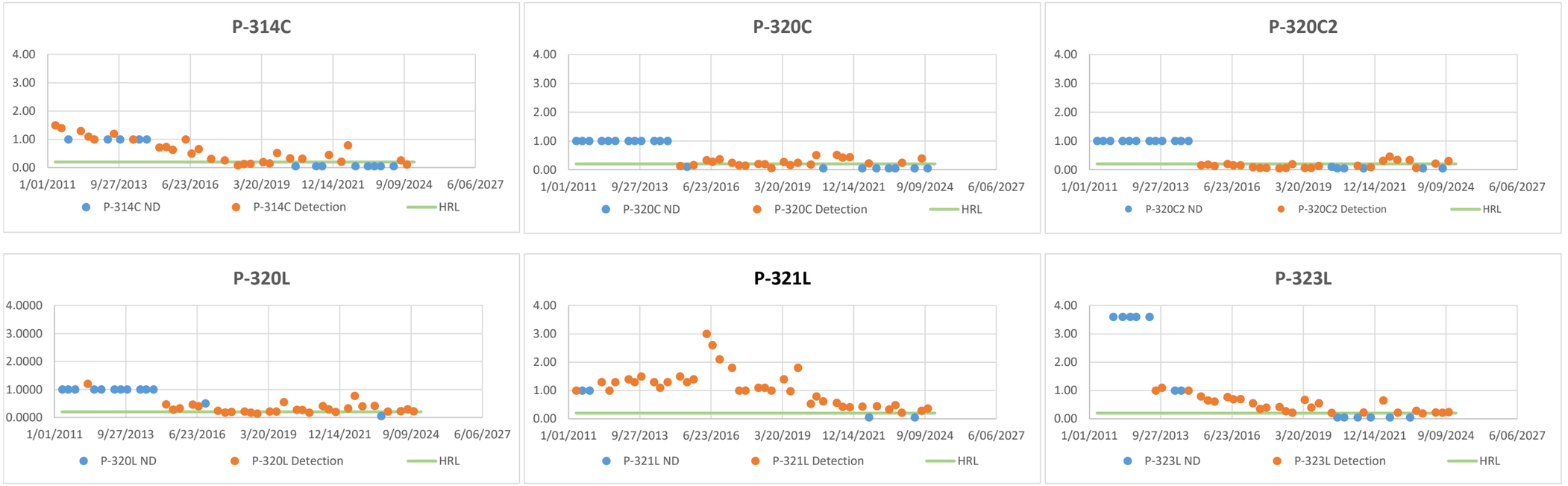
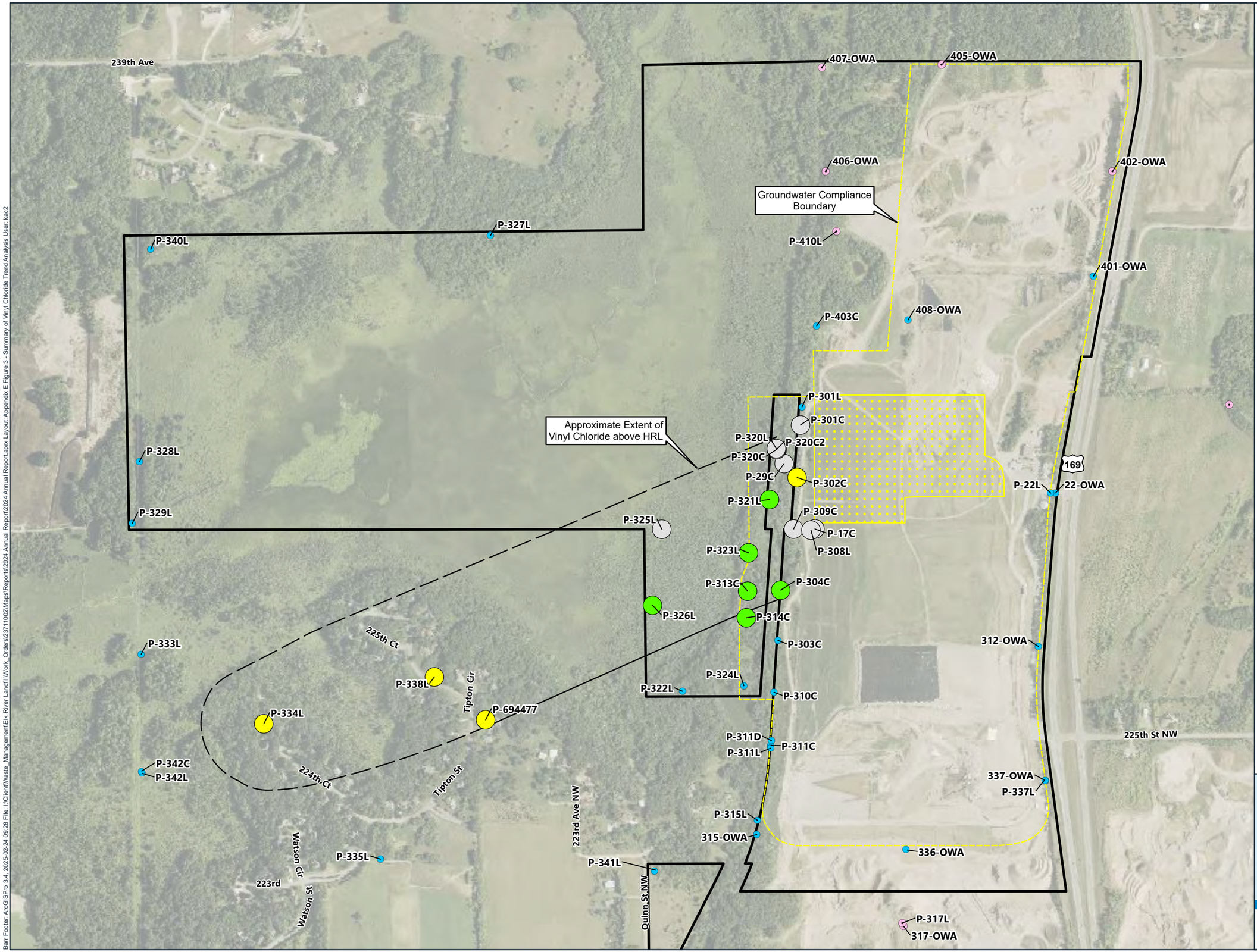


Figure 2
Vinyl Chloride Trends (2011-2024)



Note: Only locations where vinyl chloride has been detected in recent years are displayed.



Property Boundary

Pre-Subtitle D Area

Existing Monitoring Locations

Monitoring Well

Statistically Significant Vinyl Chloride Trends

Increasing

Decreasing

No Trend / Stable

Note: See Table 5

0 350 700 1,050

Feet

Imagery Source: USDA-FSA NAIP Imagery (2023)

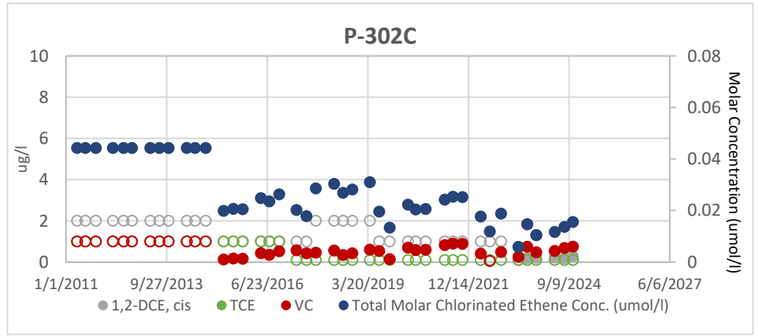
Summary of Vinyl Chloride Trend Analysis
Elk River Landfill
Elk River, Minnesota

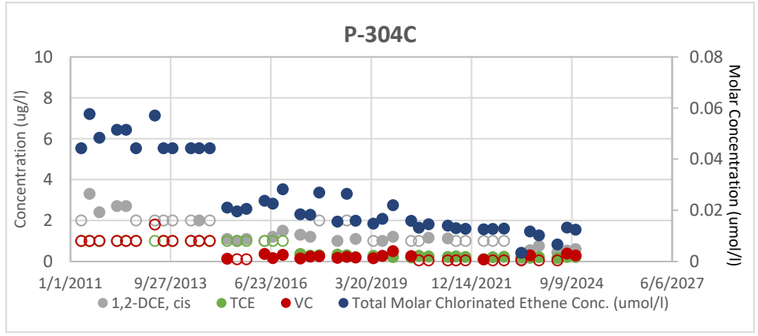
FIGURE 3

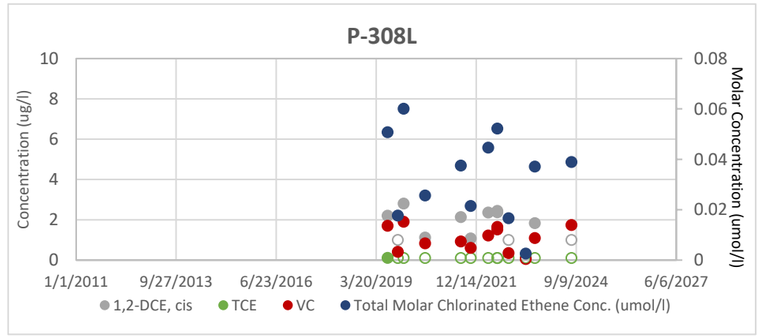
BARR

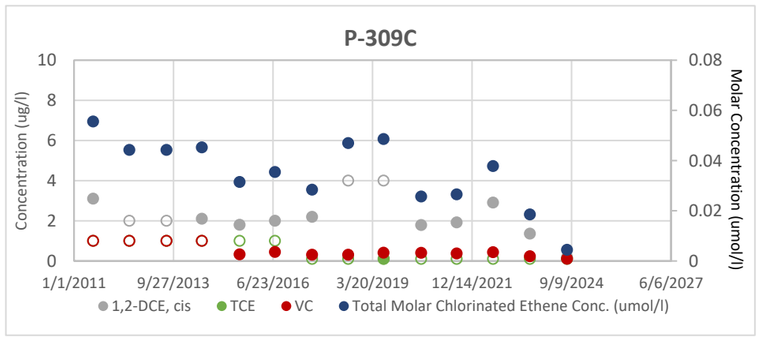
Barr Footer: ArcGISPro 3.4, 2025-02-24 09:28 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711002\Maps\Reports\2024 Annual Report\2024 Annual Report.aprx Layout: Appendix E Figure 3 - Summary of Vinyl Chloride Trend Analysis User: kac2

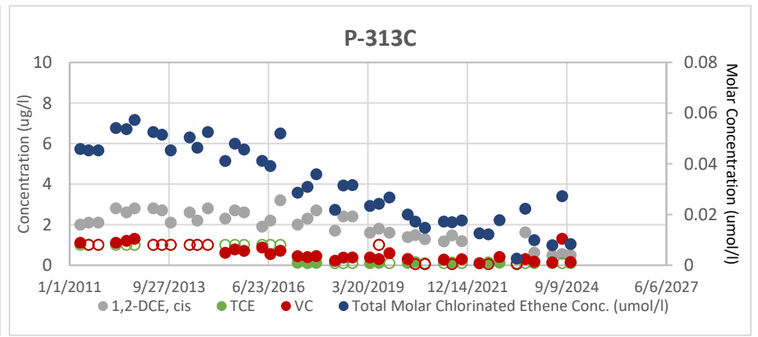
Figure 4
Vinyl Chloride, Potential Precursor Compound (TCE, DCE), and Total Molar Chlorinated Ethene Trends (2011-2024)

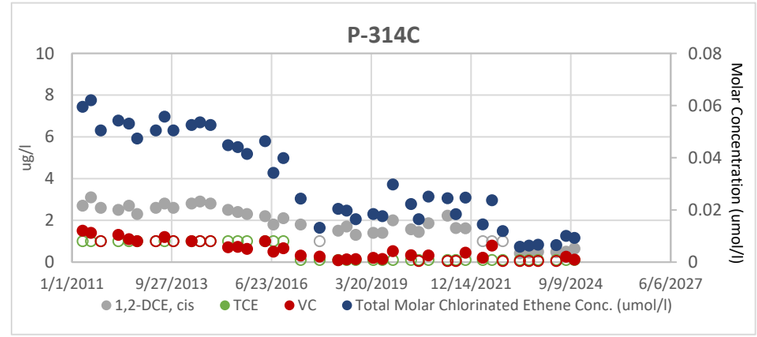


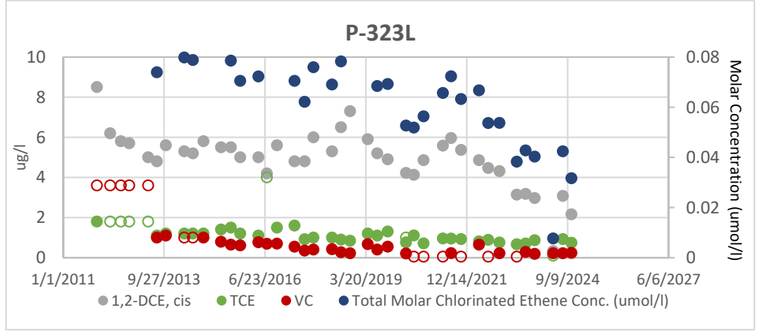


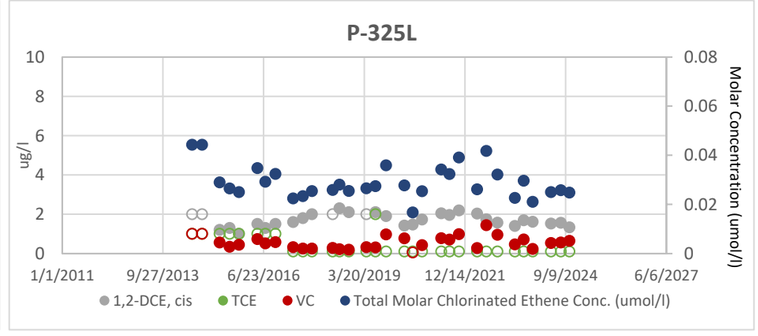


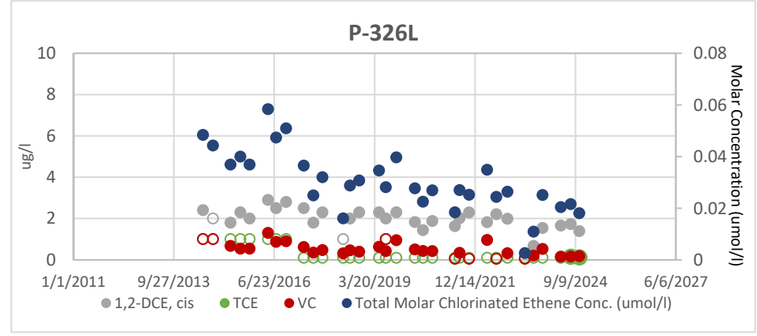


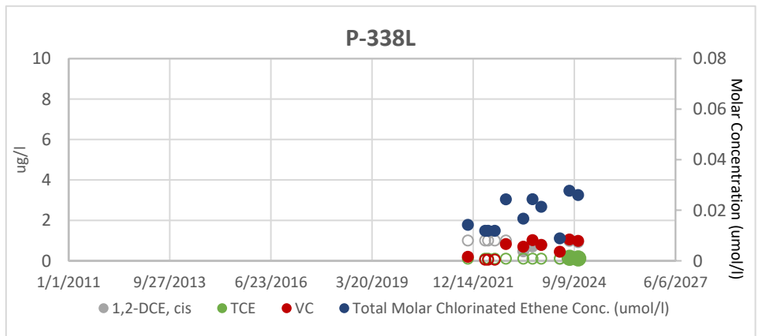








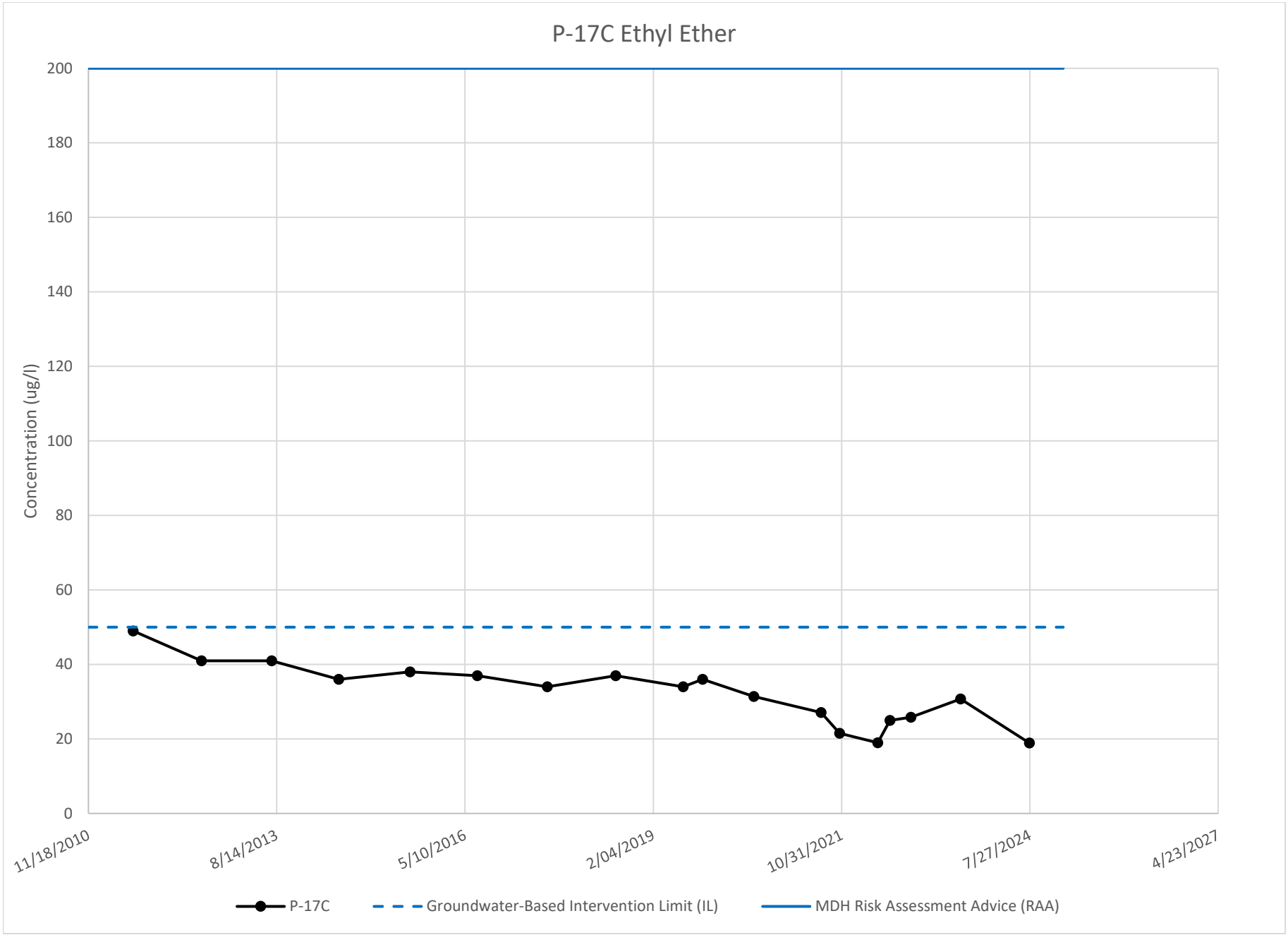


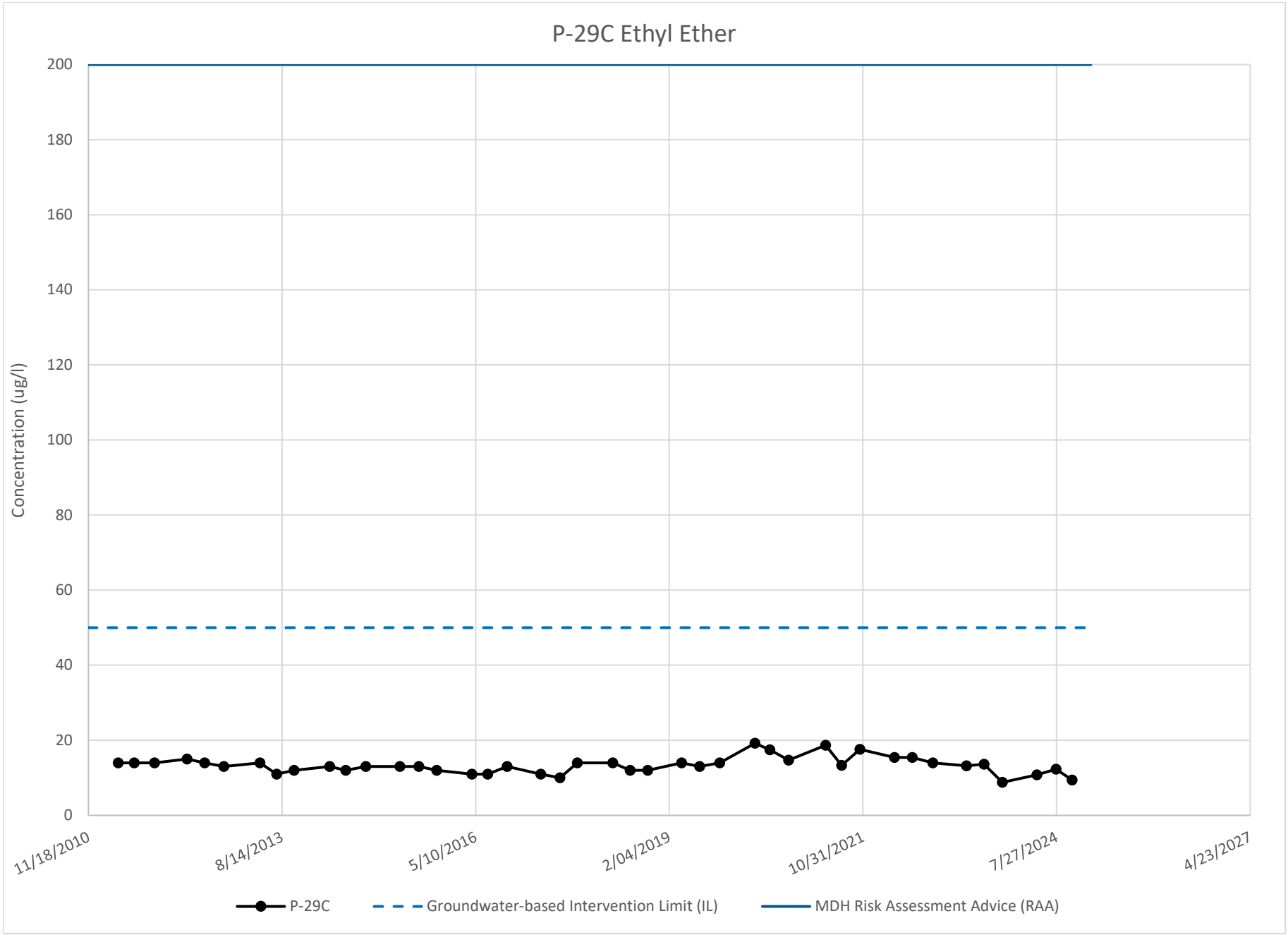


Notes: Wells where TCE or cis-DCE have historically been routinely detected are displayed (PCE not detected).
Open symbol indicates sample was non-detect.

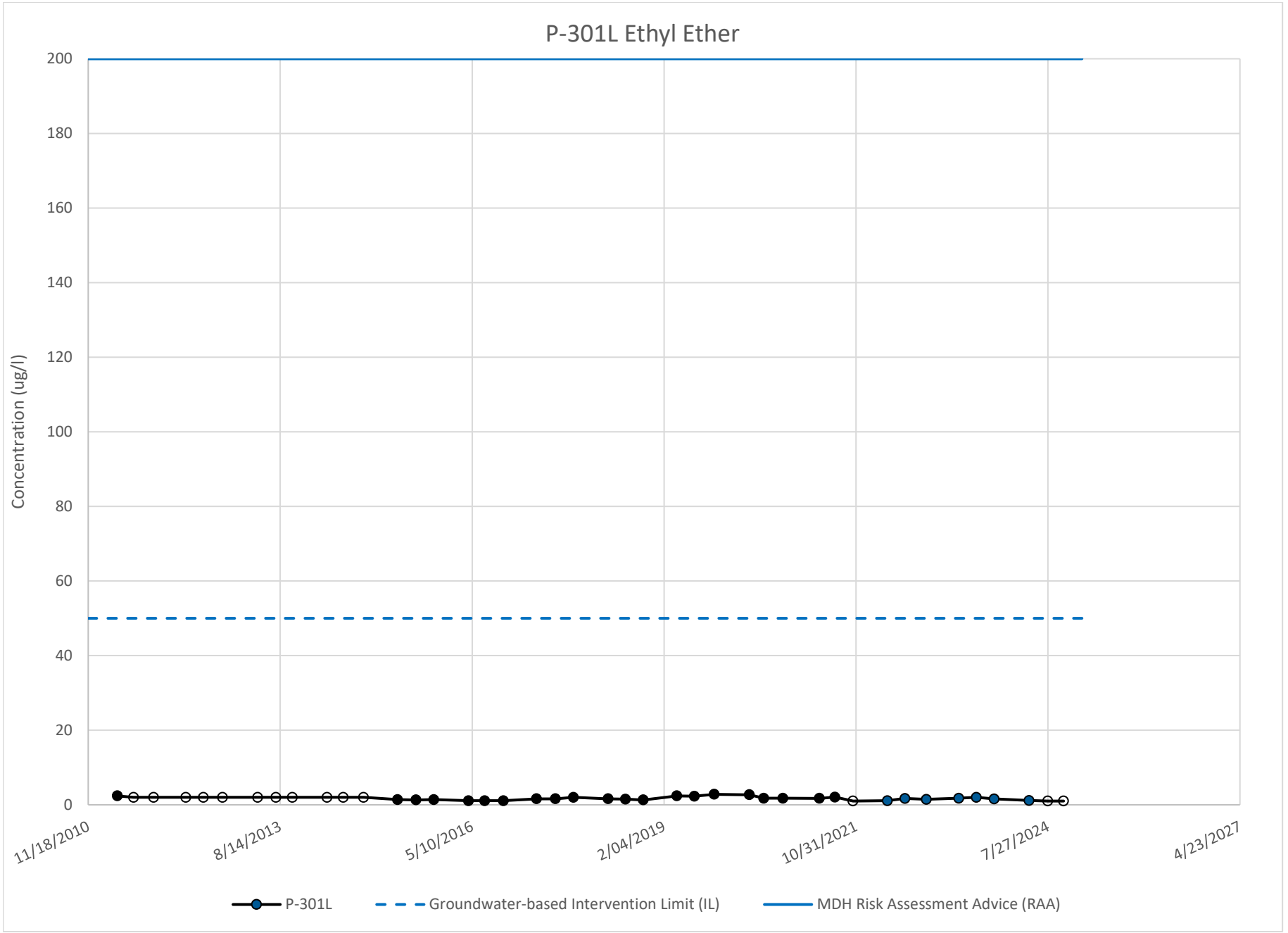
Attachment A

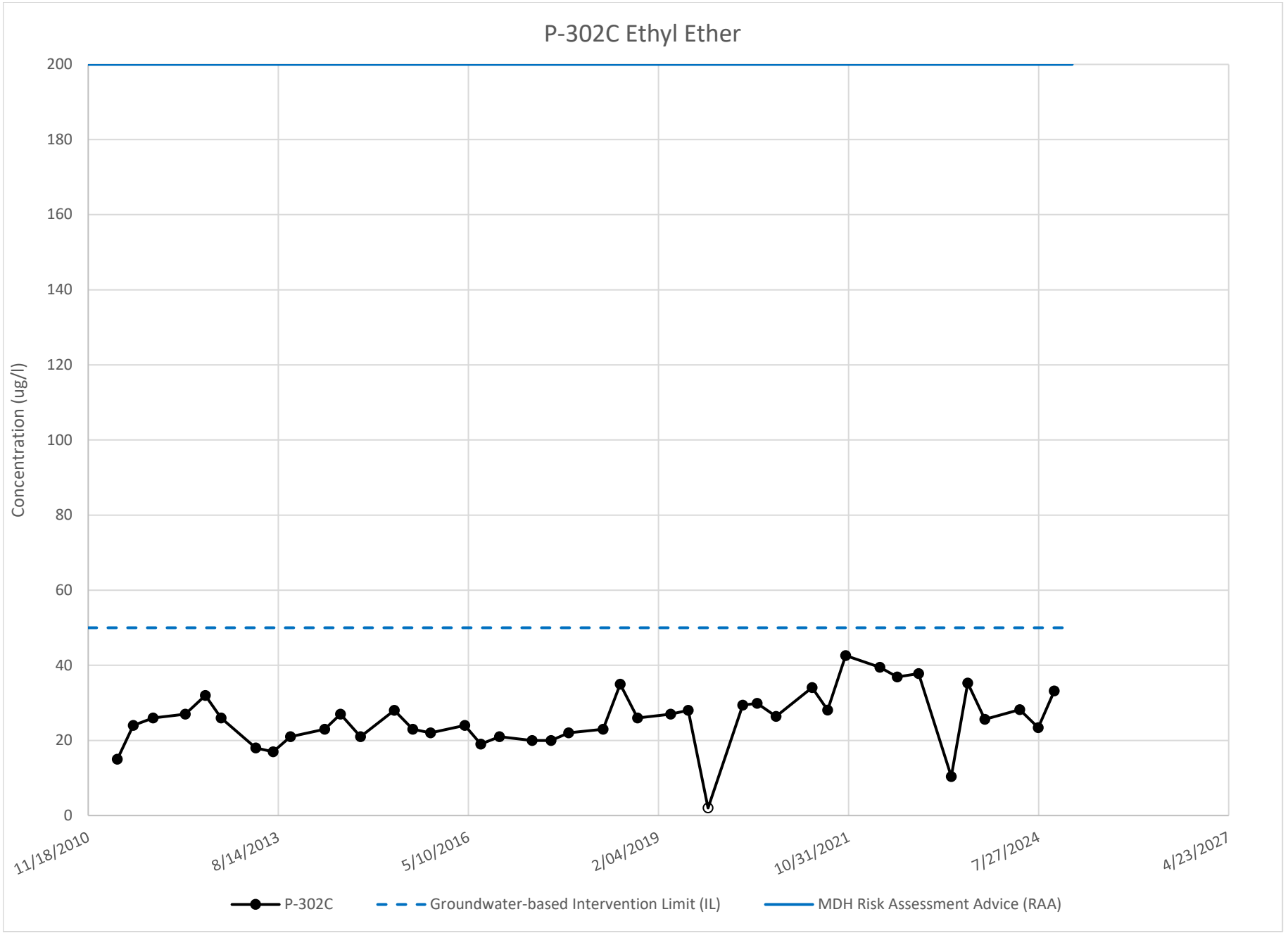
Ethyl Ether Concentration Charts

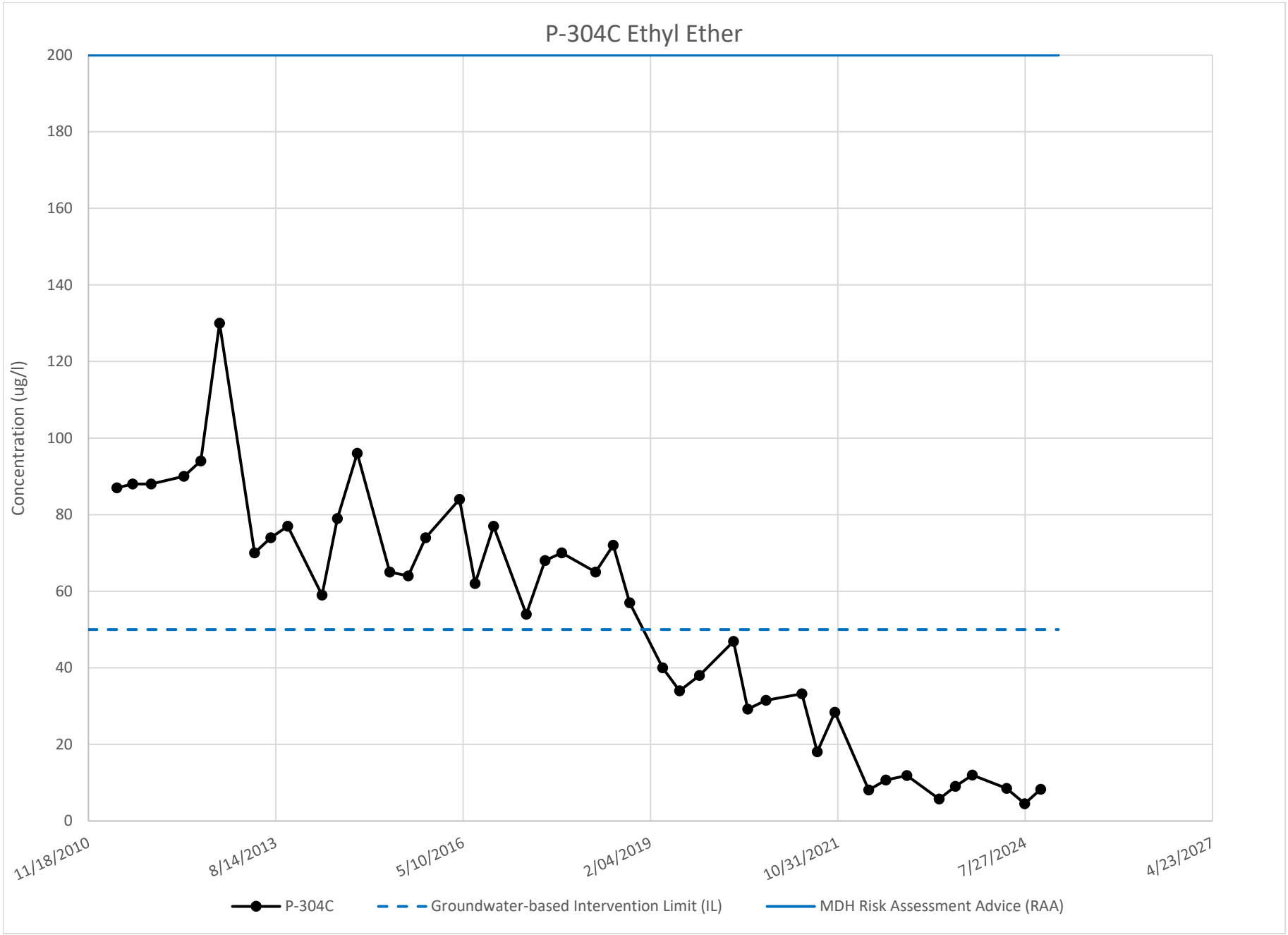

P-17C Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-17C
Groundwater-Based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

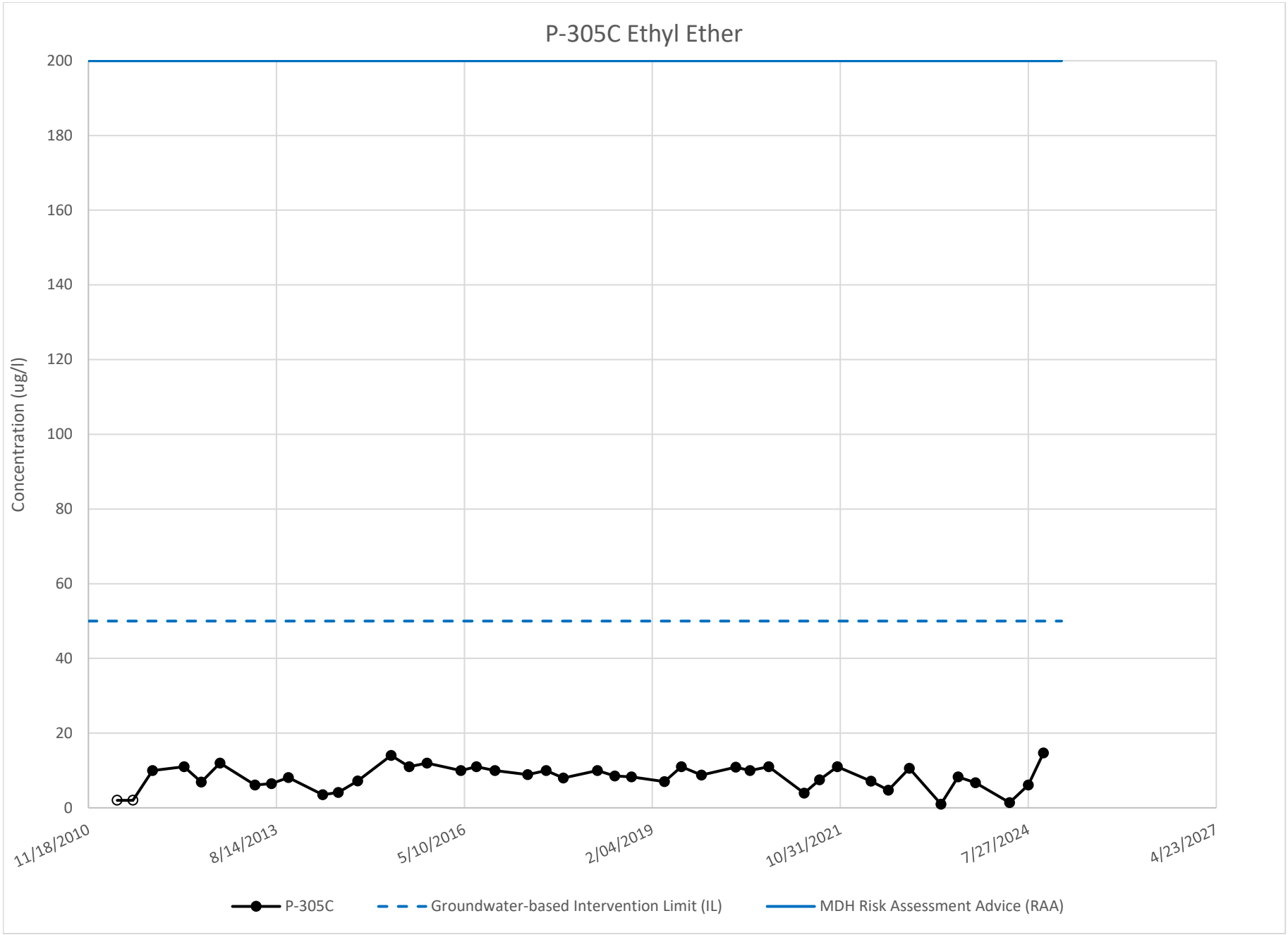


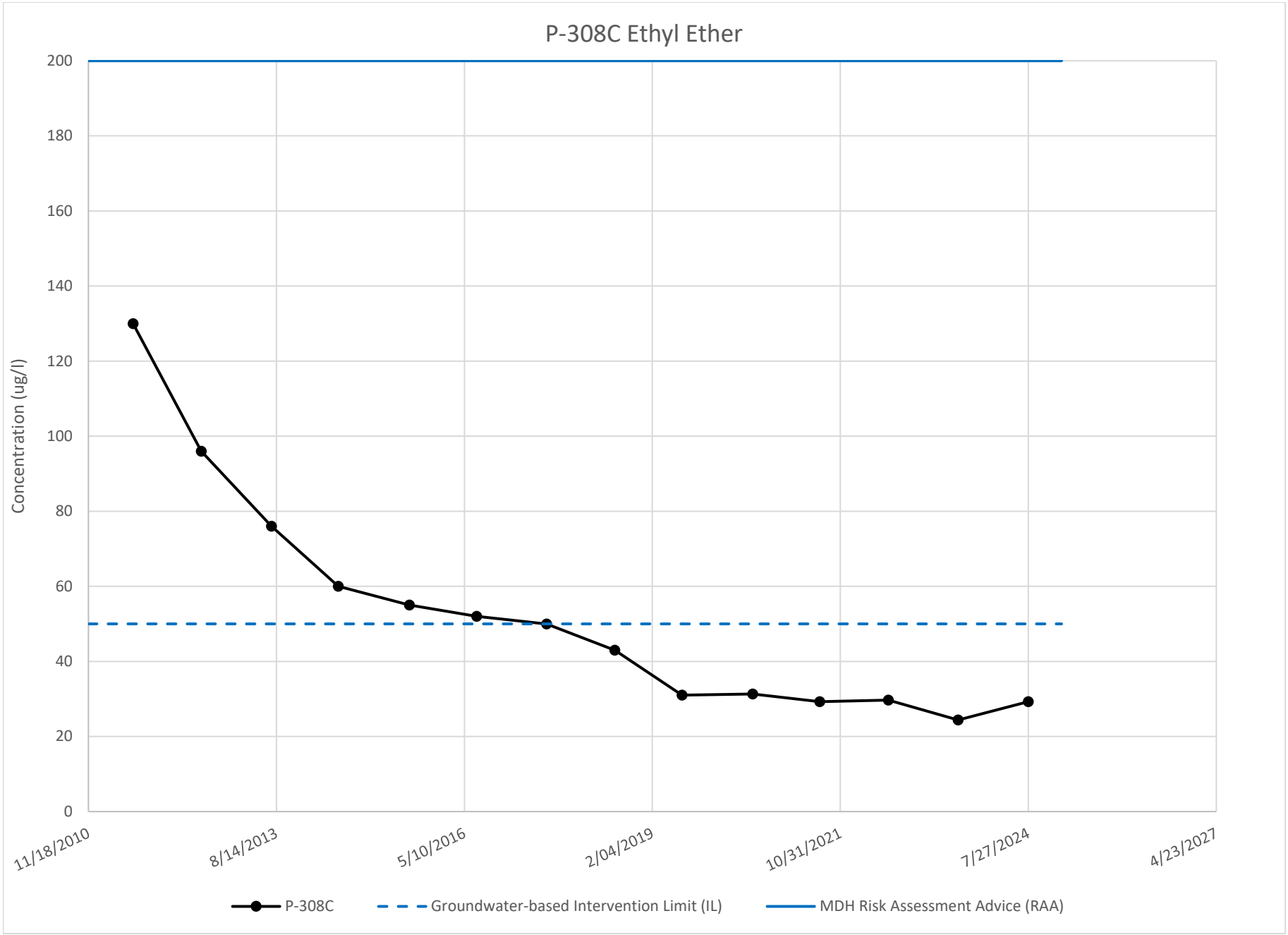
\\barr.com\projects\Mpls\23 MN\71\23711002 EMS Administration Elk River Landfill\2024\WorkFiles\MPCA GW Reports\Annual\Appendix E - MNA\Att A - EE\ERL_EthylEtherPlots_01202025.xlsx

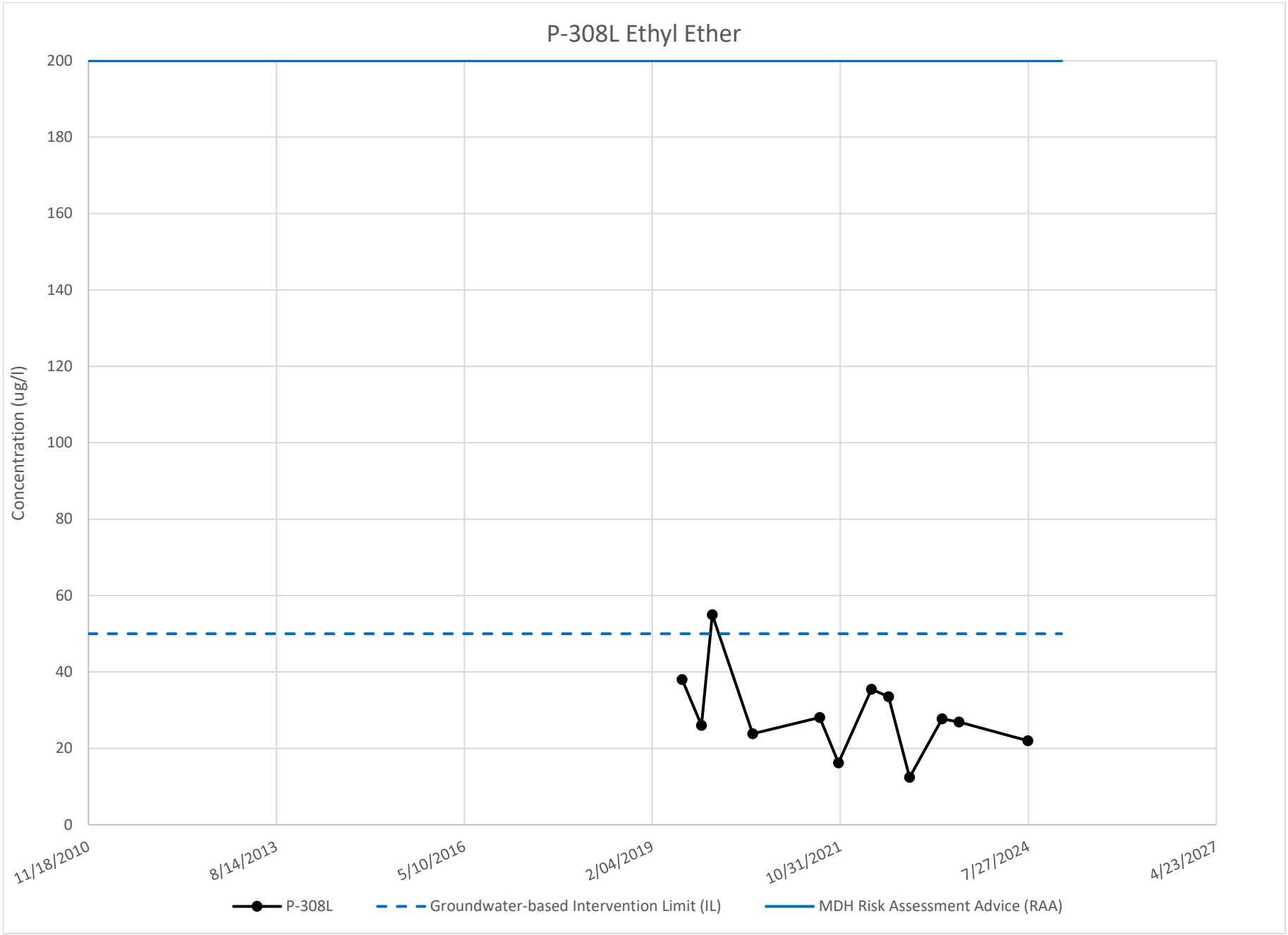

P-301L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-301L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

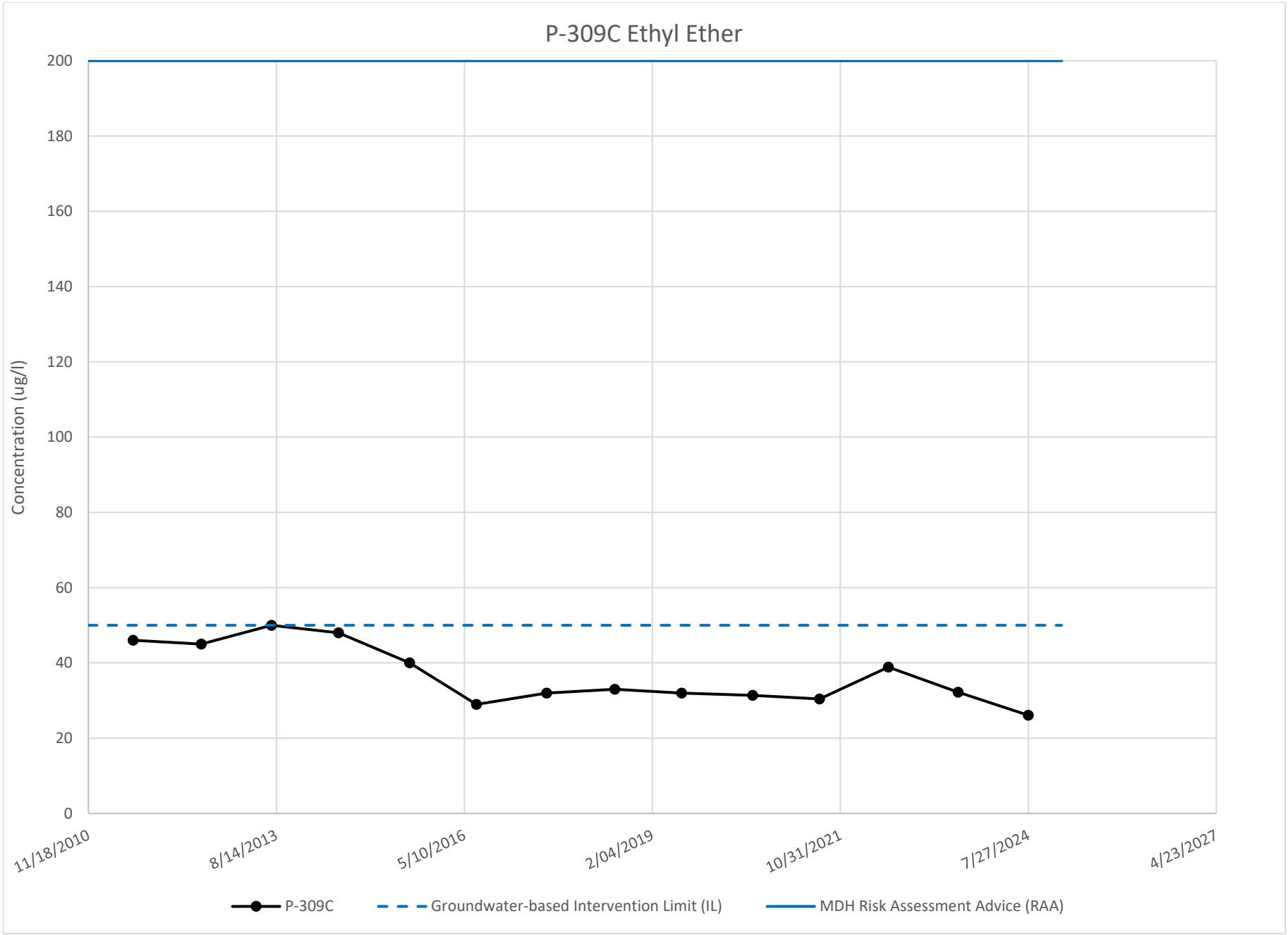

P-302C Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-302C
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

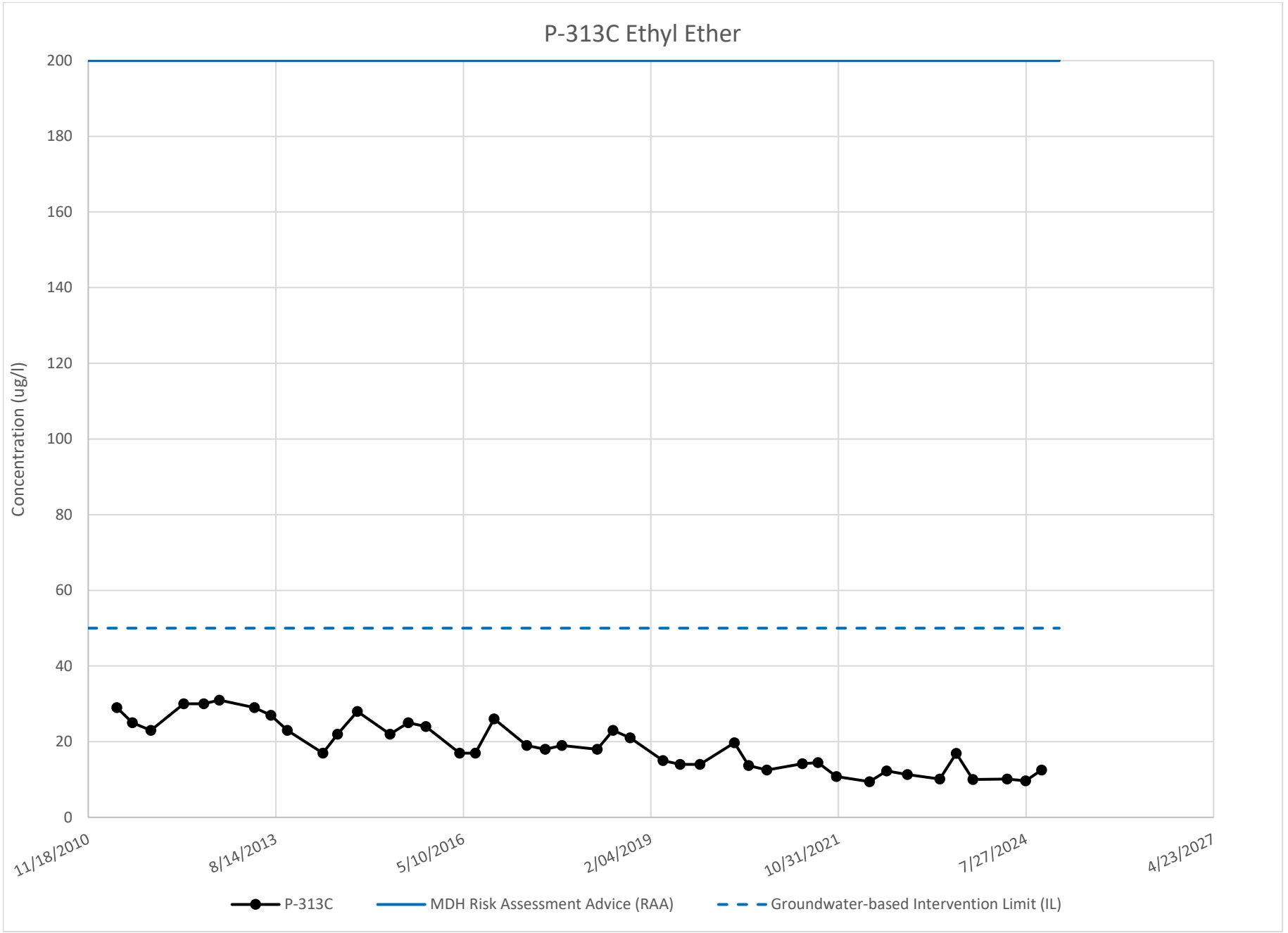

P-304C Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
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Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

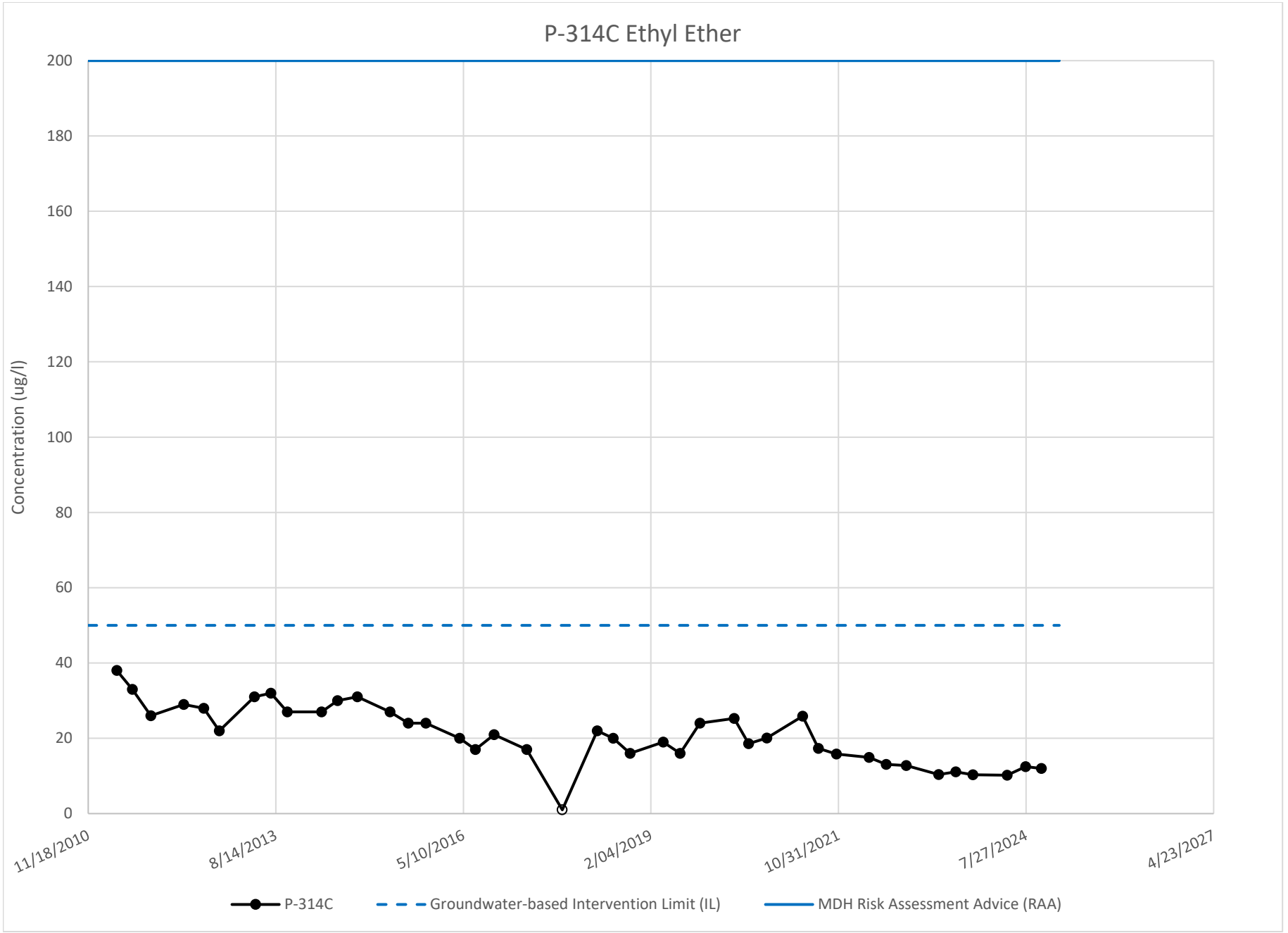

P-305C Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-305C
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

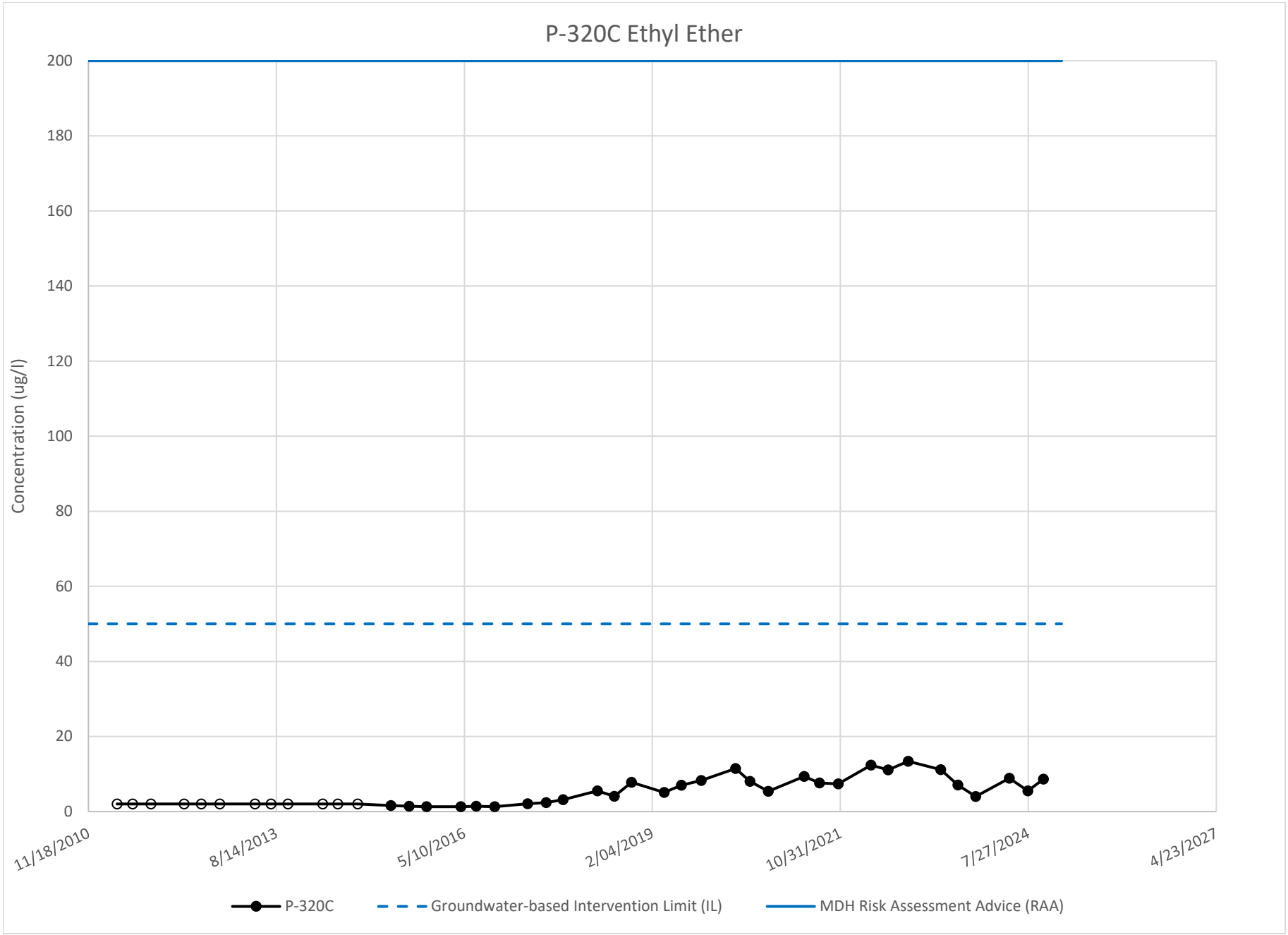

P-308C Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-308C
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

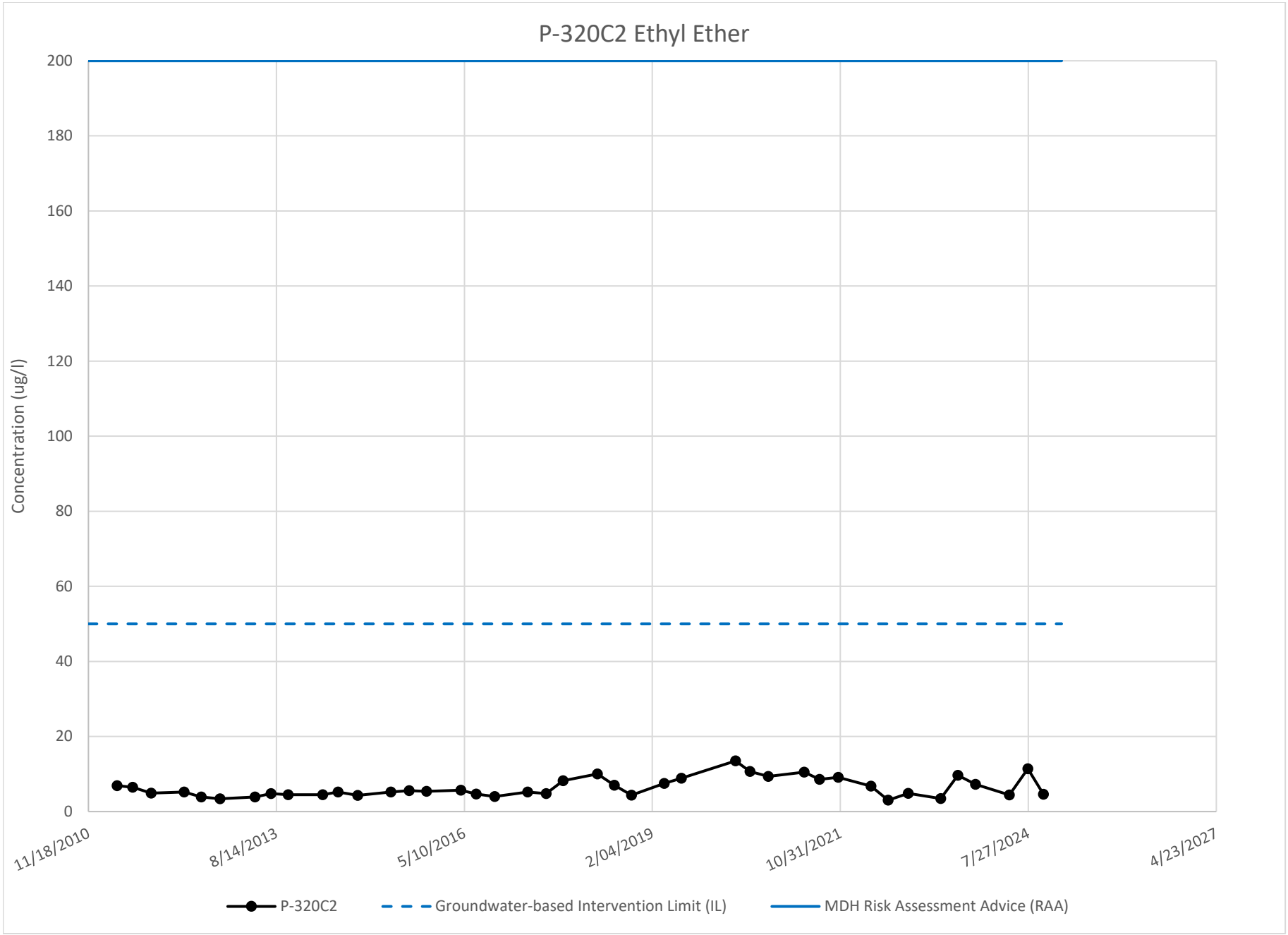

P-308L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-308L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

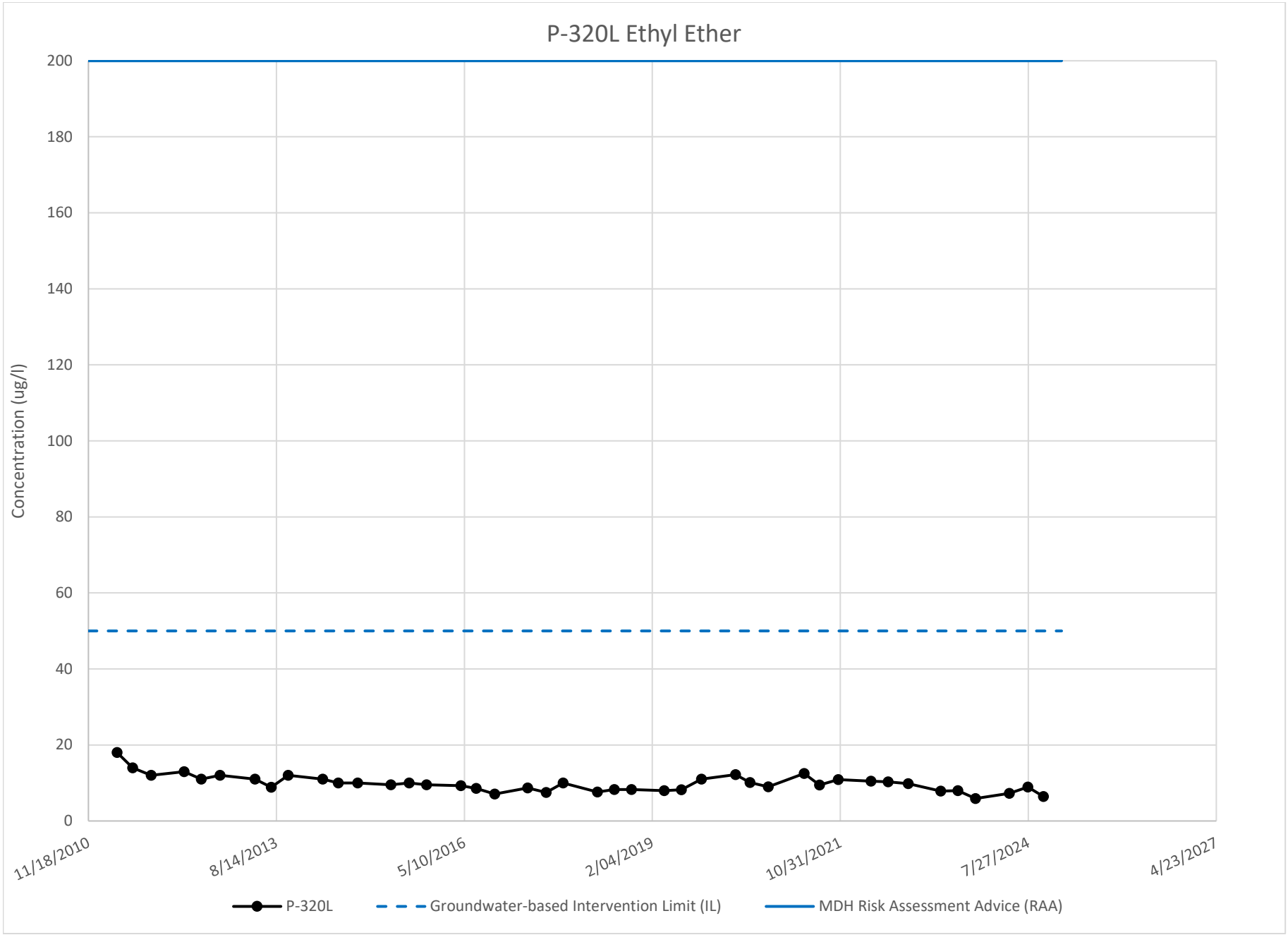

P-309C Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-309C
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

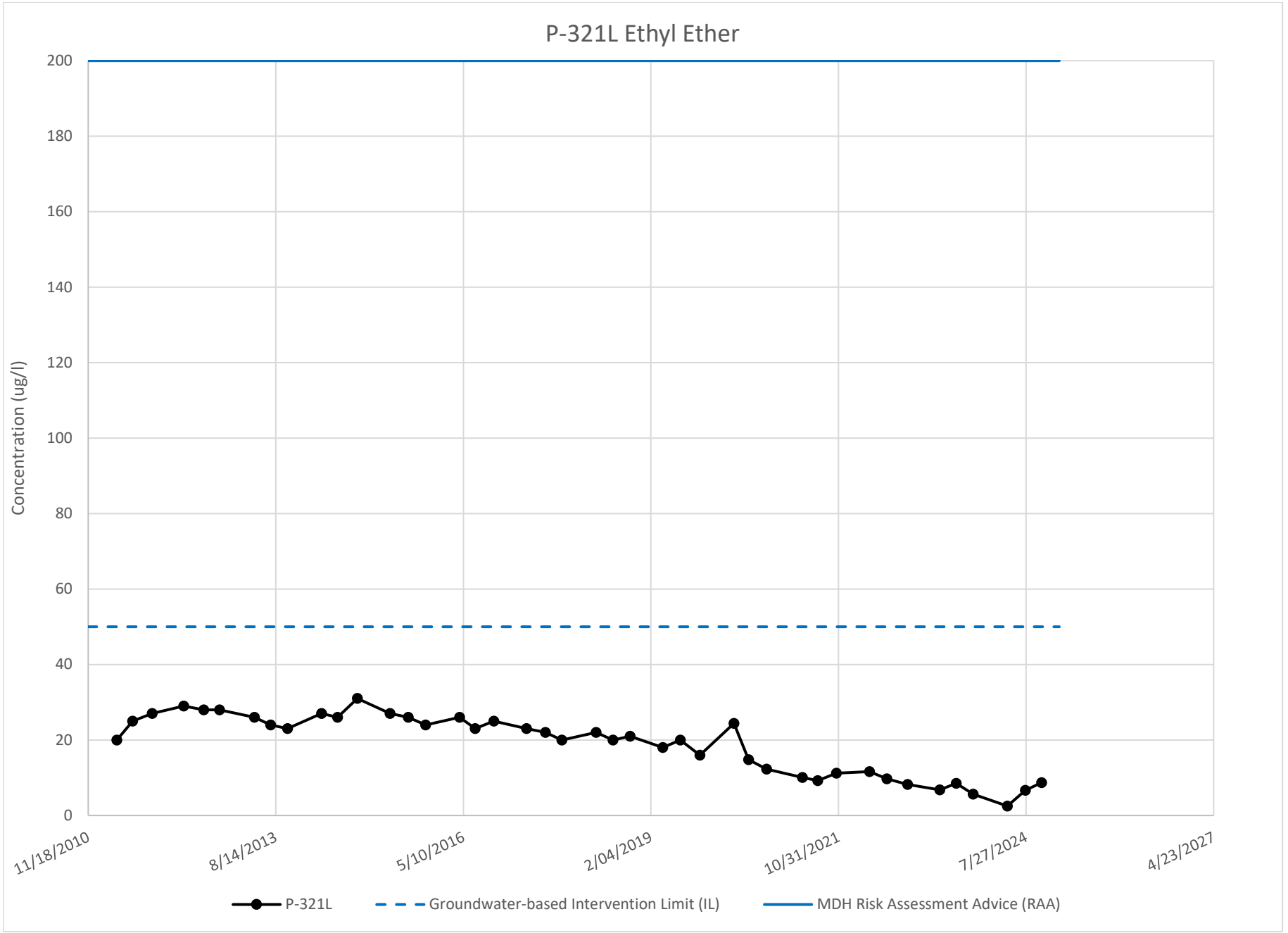

P-313C Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-313C
MDH Risk Assessment Advice (RAA)
Groundwater-based Intervention Limit (IL)

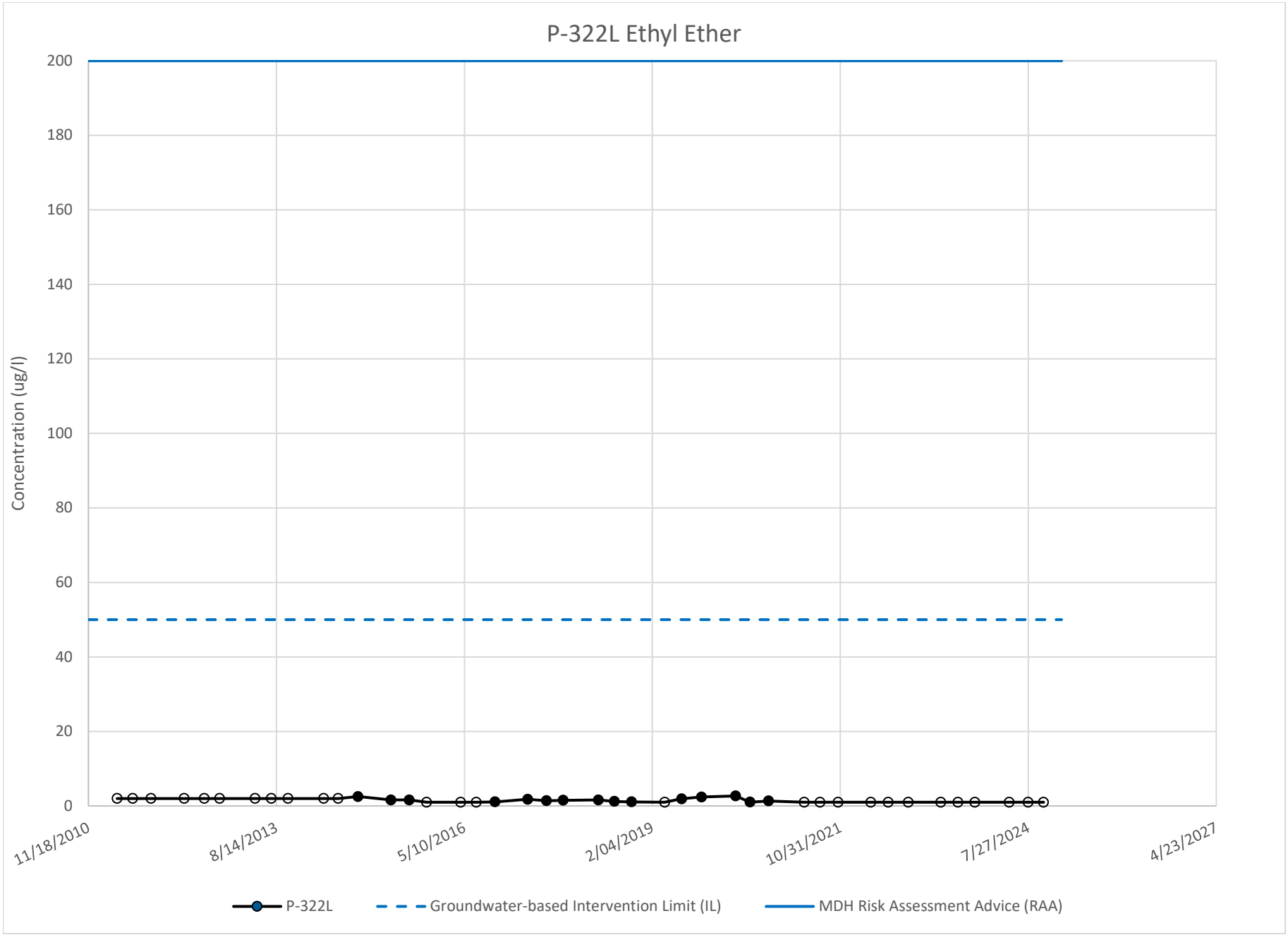

P-314C Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-314C
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

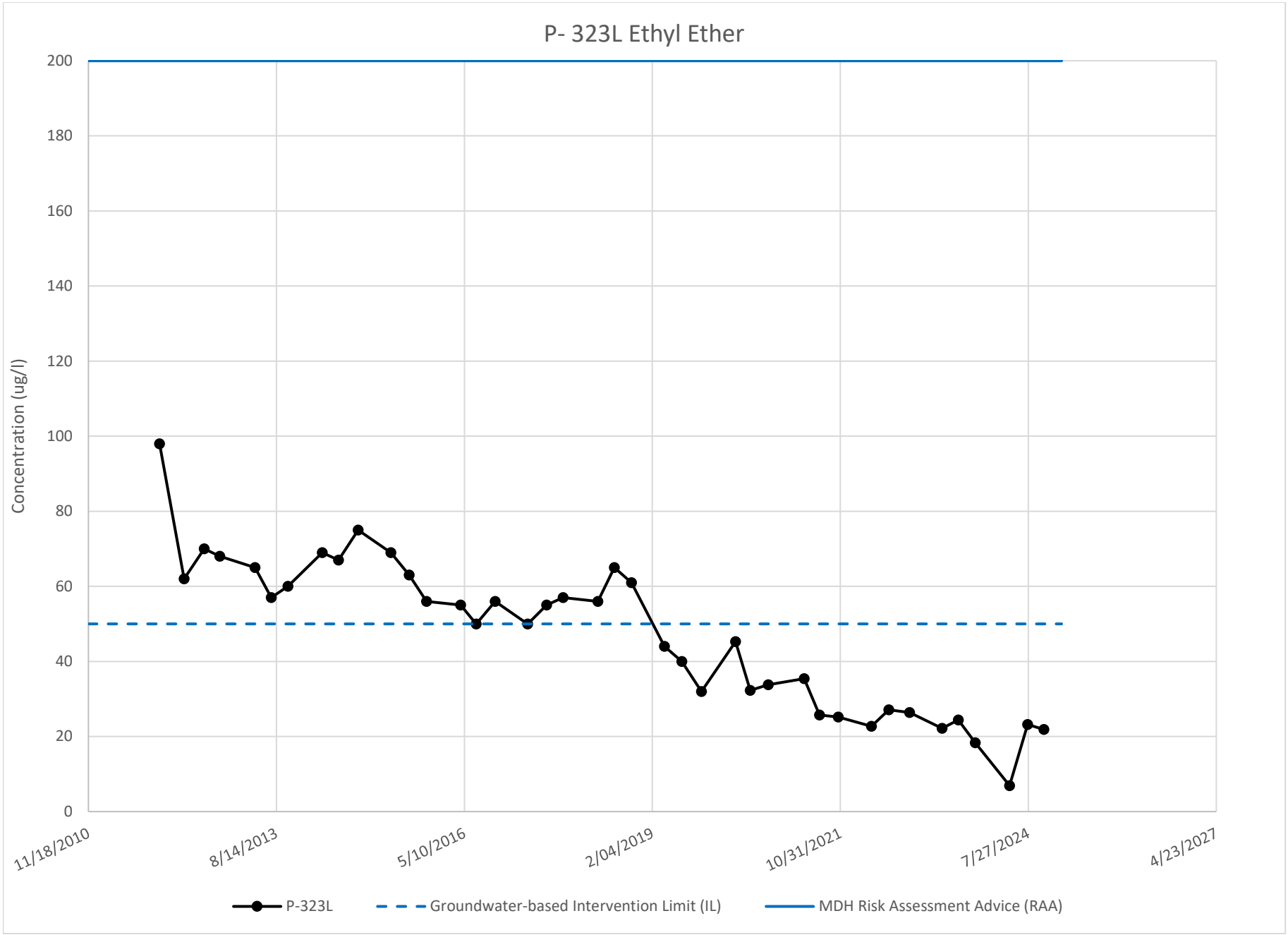

P-320C Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-320C
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

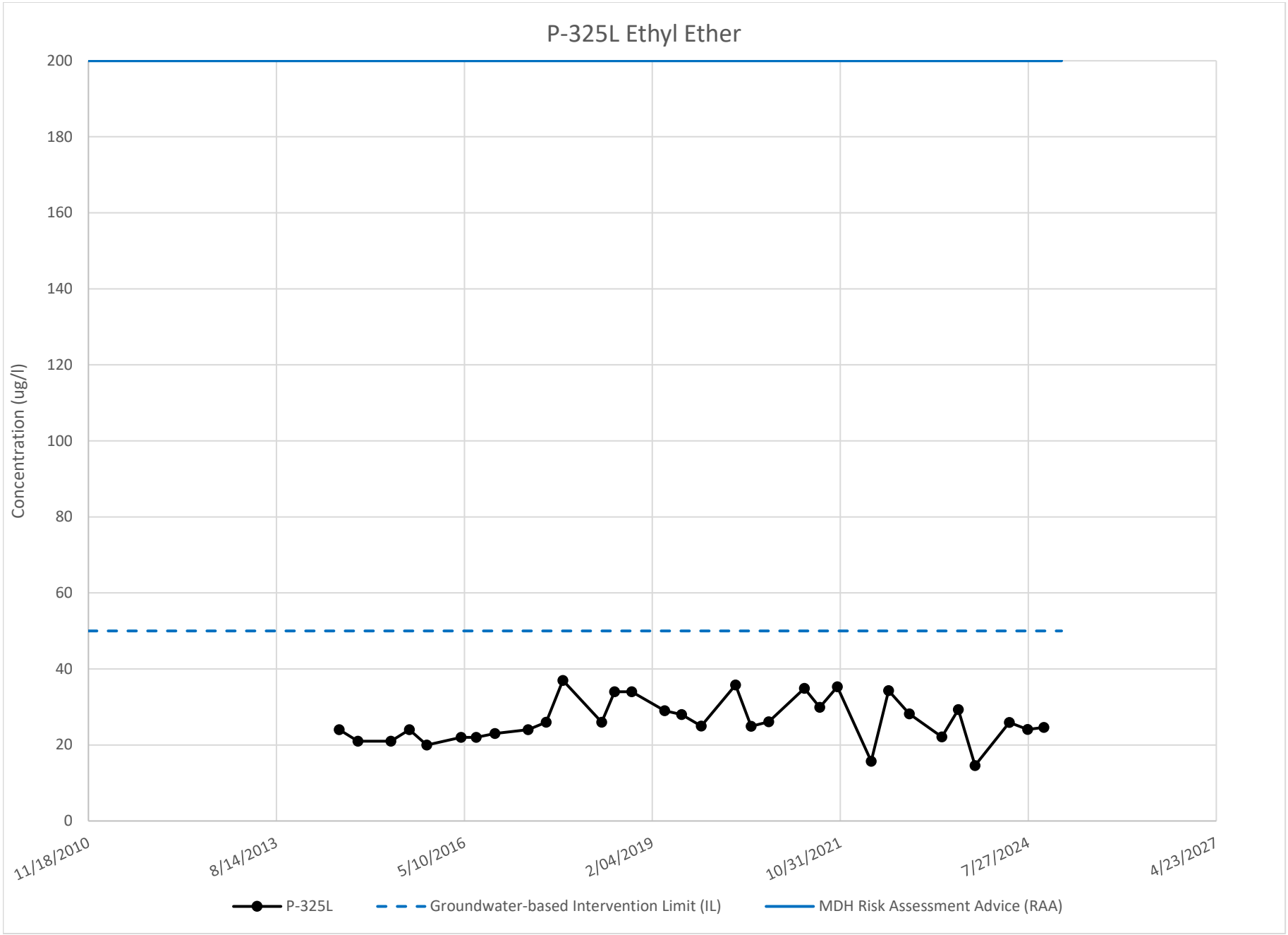

P-320C2 Ethyl Ether
Concentration (ug/l)
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140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
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7/27/2024
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P-320C2
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

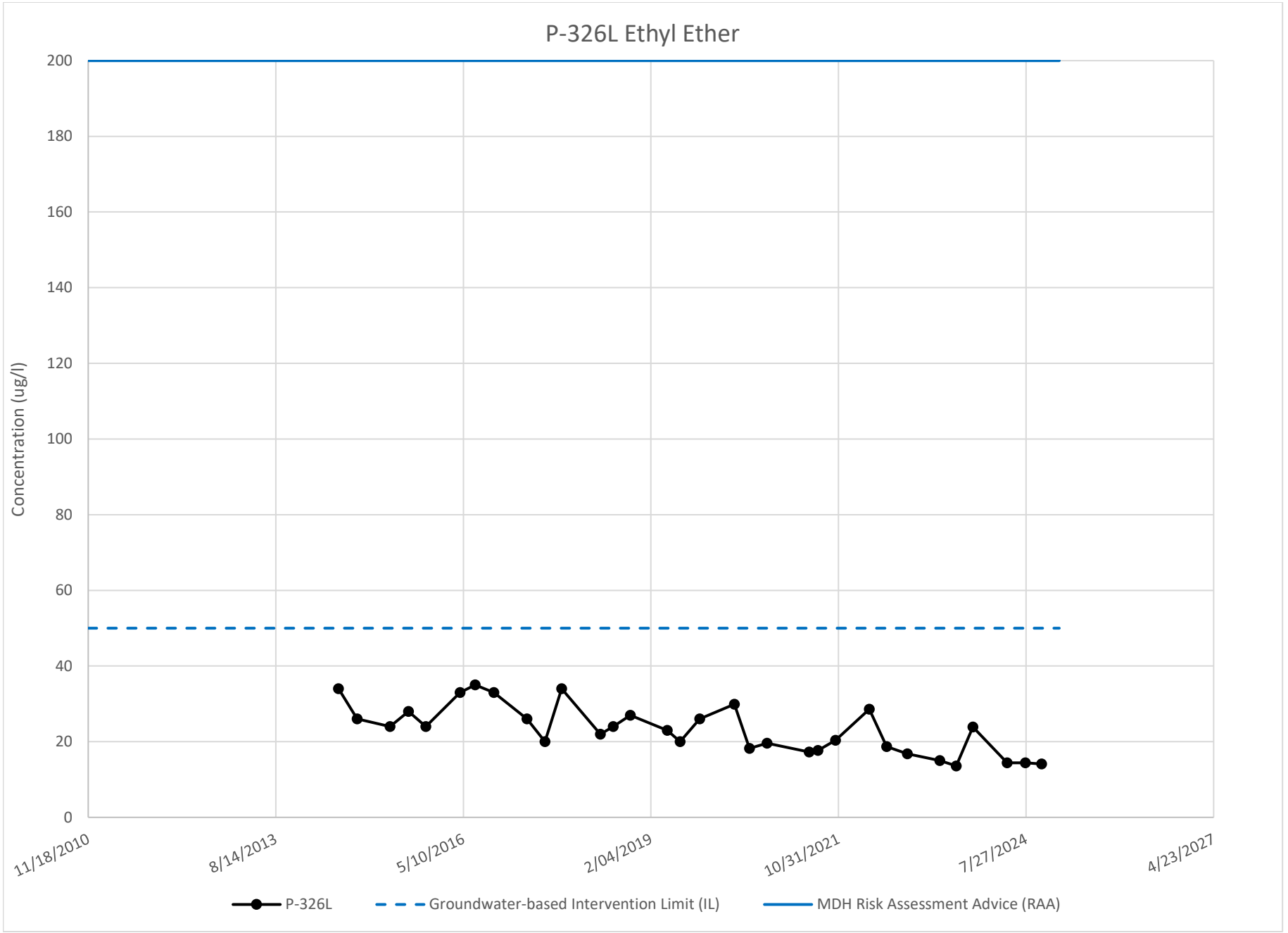

P-320L Ethyl Ether
Concentration (ug/l)
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160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-320L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

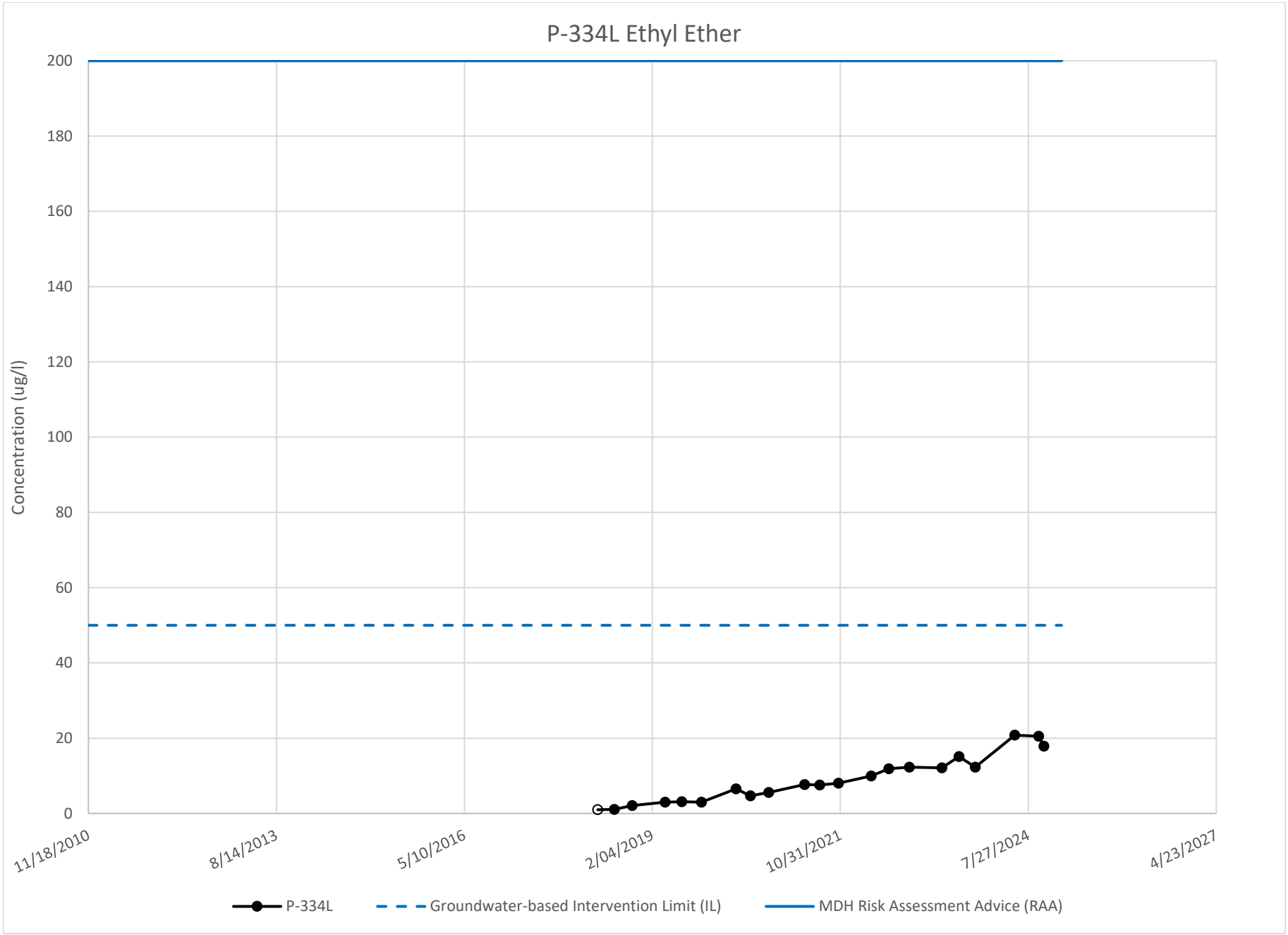

P-321L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-321L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

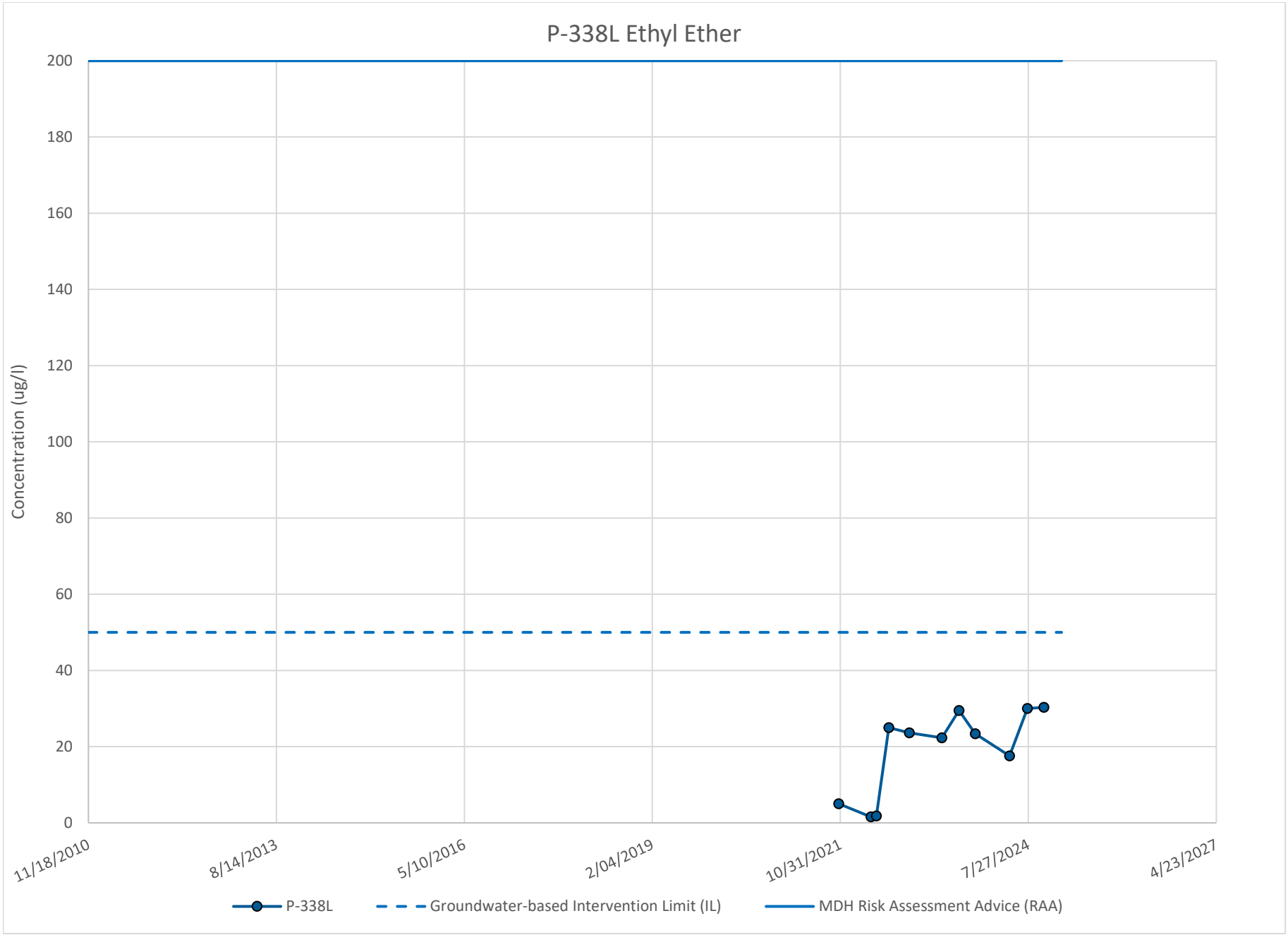

P-322L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-322L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

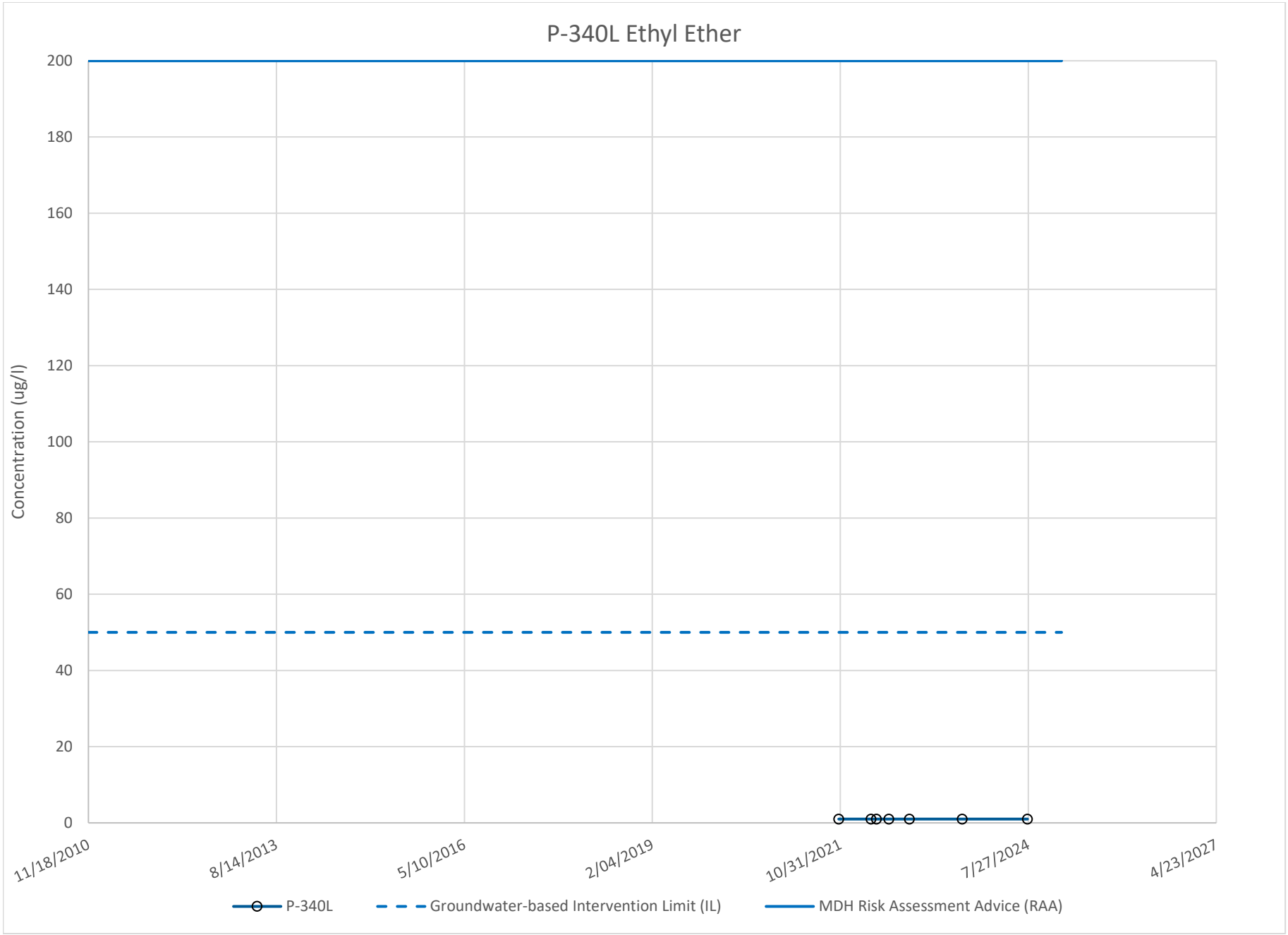

P- 323L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-323L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

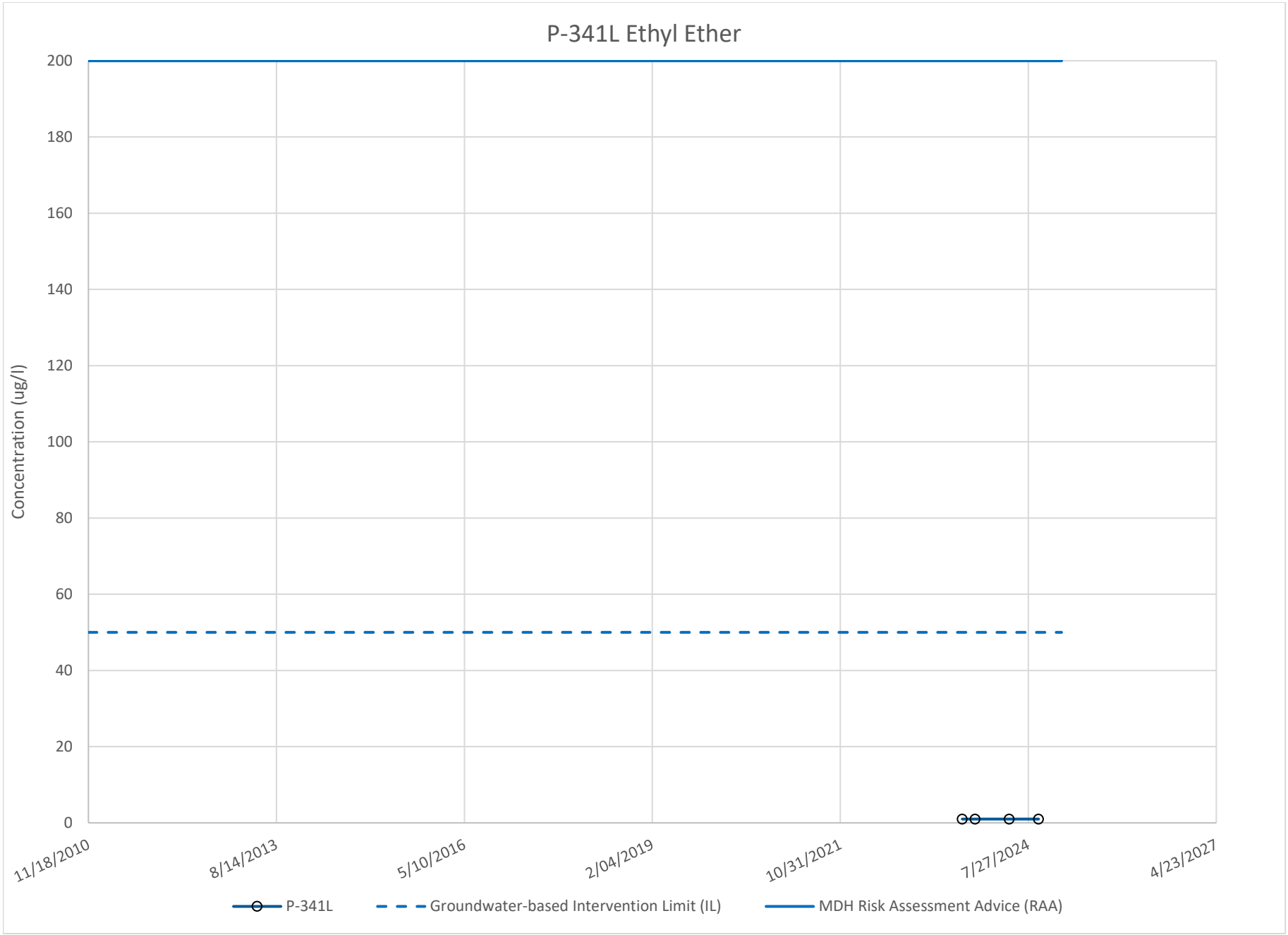

P-325L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-325L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

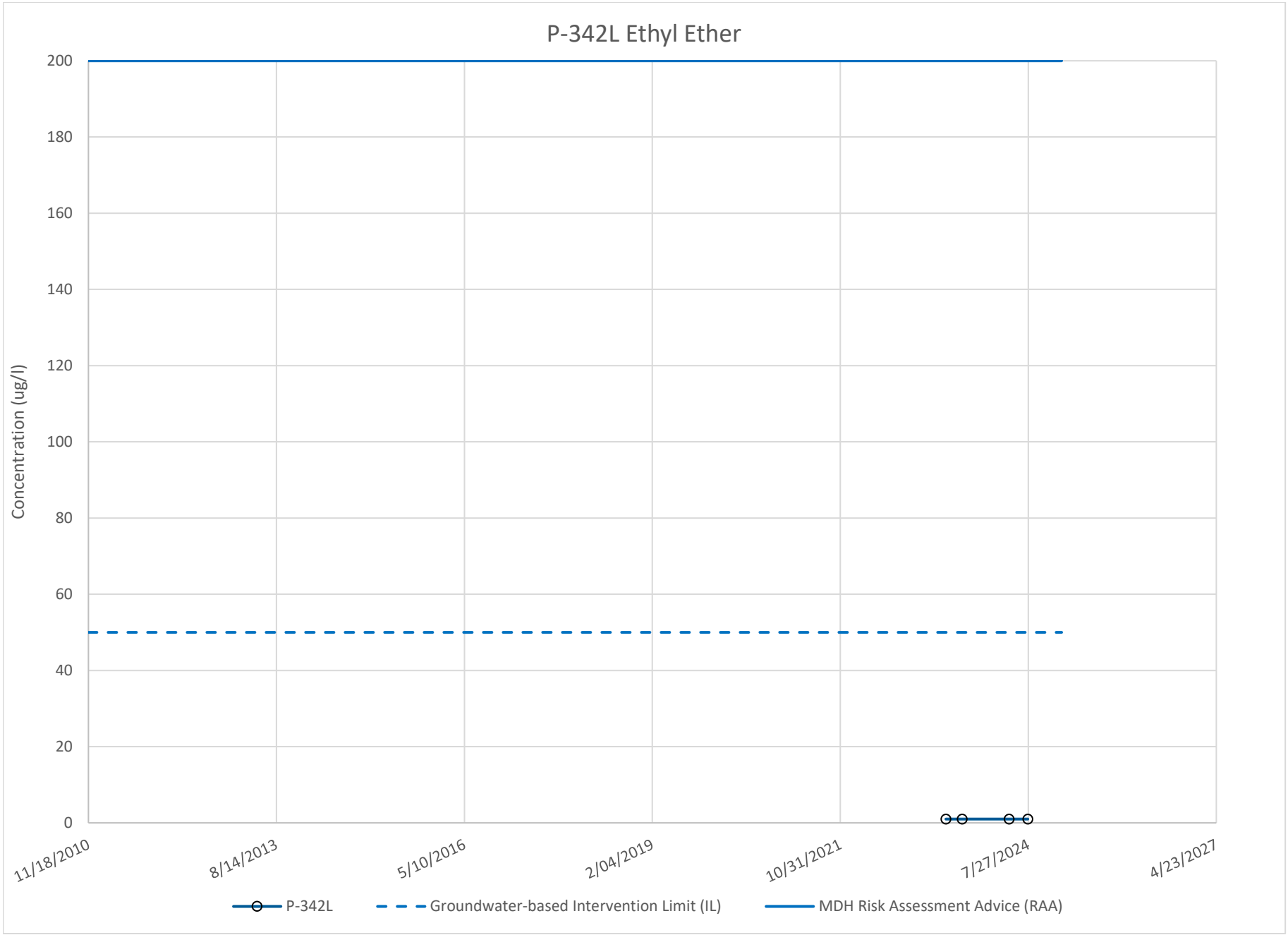

P-326L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-326L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)


P-334L Ethyl Ether
200
180
160
140
120
100
80
60
40
20
0
Concentration (ug/l)
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-334L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)


P-338L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-338L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)


P-340L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-340L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)


P-341L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-341L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)


P-342L Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P-342L
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

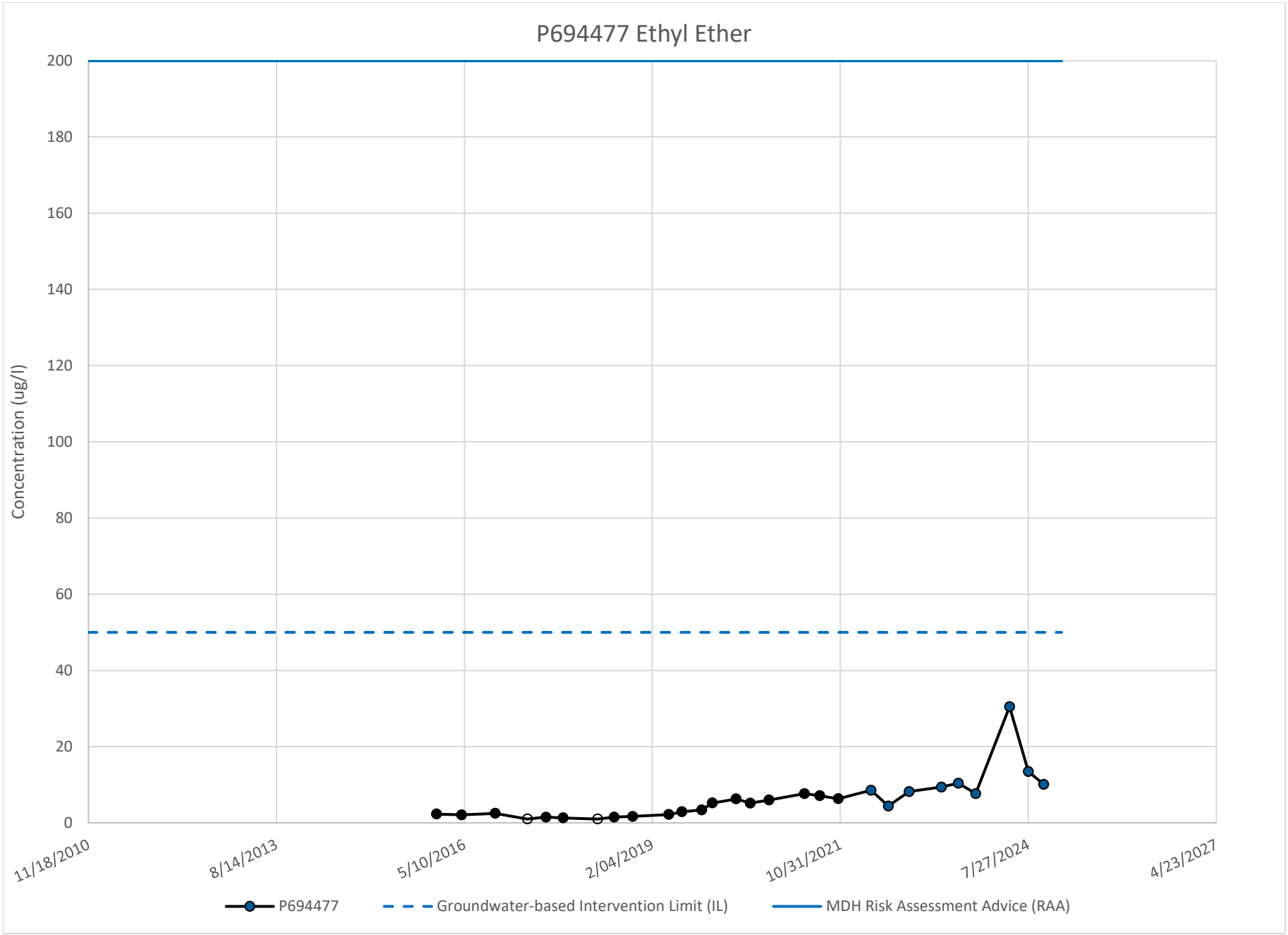

P694477 Ethyl Ether
Concentration (ug/l)
200
180
160
140
120
100
80
60
40
20
0
11/18/2010
8/14/2013
5/10/2016
2/04/2019
10/31/2021
7/27/2024
4/23/2027
P694477
Groundwater-based Intervention Limit (IL)
MDH Risk Assessment Advice (RAA)

EXHIBIT 12

#1159

resourceful. naturally.
engineering and environmental consultants

BARR

June 30, 2025

Ms. Laura Pugh
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota, 55155-4194

Re: 2025 Spring Quarterly Report, Elk River Landfill

Dear Ms. Pugh:

On behalf of Elk River Landfill, Inc., enclosed please find the 2025 spring quarterly monitoring results for Elk River Landfill (ERL). The monitoring event was conducted April 14 through April 17, 2025, with field services provided by Alliance Technical Services (Alliance) of Circle Pines, Minnesota. Laboratory analyses were conducted by Pace Analytical National Center for Testing and Innovation in Mount Juliet, Tennessee (Pace National). The compliance monitoring locations, analytical parameters, sample collection methods, and data reporting were based on the Solid Waste Facility Operating Permit SW-74 dated July 23, 2015.

Tables summarizing the monitoring network, groundwater elevations, lysimeter purge volumes, and groundwater results are attached. Copies of the sample collection report and analytical reports are included in Appendices A and B, respectively. Electronic data deliverable packages consistent with the requirements of the Solid Waste Program Electronic Laboratory Data Submittal Manual have been submitted to the Minnesota Pollution Control Agency (MPCA) by the laboratories.

SITE MONITORING SYSTEM DESCRIPTION

The ERL is located on the border of the City of Elk River and Livonia Township, Sherburne County, Minnesota and is within Sections 3 and 4 of Township 33 North and Sections 33 and 34 of Township 33 North, Range 26 West (Figure 1). The network for the 2024 spring monitoring event included 32 monitoring wells located at or beyond the compliance boundary and 11 leak detection lysimeters. Table 1 lists the monitoring points in the monitoring network for this event. Locations of the monitoring points and leak detection lysimeters are shown on Figure 2.

Data collection efforts were conducted by Alliance. Alliance's Spring 2025 EMS Report on Groundwater Sample Collection at the Elk River Landfill Facility is included in Appendix A.

DATA COLLECTION

Prior to purging and sampling the monitoring wells, water levels were recorded to the nearest hundredth of a foot (Table 2). Groundwater parameters including pH, specific conductance, temperature, Eh, and dissolved oxygen were monitored to determine stabilization during well purging. The groundwater samples were analyzed for the parameters listed in the SAP and included low-level reporting for 1,1,2,2-tetrachloroethane; 1,1,2-trichloroethane; 1,2-dichoroethane; cis-1,3-dichloropropene; benzene; carbon

tetrachloride; hexachlorobutadiene; trichloroethylene; and vinyl chloride. The low-level analyses were performed using USEPA Method 8260D.

Modifications to the routine sampling program included the following:

- Monitoring well P-342C was installed in February 2025 as part of continued groundwater corrective action investigation, and was sampled for baseline monitoring parameters. The groundwater sample from this well was inadvertently analyzed for additional MNA parameters, including total organic carbon (TOC), ethane, ethene, and methane. This was the first baseline sampling event for this well. Organics were not detected in the sample from well P-342C. The baseline data are considered in and appended to this report (and will be included in the 2025 Annual Water Quality Monitoring Report).
- Lysimeters LYS-6S and LYS-10 were not monitored due to accumulated sediment (as reported previously). The second stage of the LYS-6S and LYS-10 Lysimeter Action Plan (dated April 22, 2022) has been implemented and the results will be provided under separate cover.
- Sherburne County collected split samples for organics analysis from the following monitoring wells: P-29C, P-301C, P-304C, P-302C, P-313C, P-320C2, P-320L, P-321L, P-323L, P-325L, P-326L P-334C, P-338C, P-342L, and P-694477. The County's data was reviewed and considered consistent with ERL's analytical results.[1]
- Sherburne County sampled wells P-334L, P-338L, and P-496677 for PFAS. ERL collected split groundwater samples with the County for PFAS analysis. The PFAS data will be reported under separate cover.
- The well casing and ground surface elevations were surveyed at the new monitoring well P-342C (and the adjacent P-342L because of suspected casing movement in the wetland) on June 16, 2025. The top-of-casing elevation for the new well and the revised elevation for P-342L are used to calculate groundwater elevations in this report (and future reports).

QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance and quality control (QA/QC) procedures implemented for the monitoring event included standard field and laboratory protocol for groundwater sample collection, labeling, preservation, chain-of-custody documentation, and sample check-in at the laboratory. Summaries of QA/QC findings are detailed case narrative sections of each analytical report. Pertinent findings are discussed below:

- Reporting limits for the following compounds exceeded groundwater-based Intervention Limits (ILs) in the Permit: 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, and 1,2-dibromoethane. The ILs for these compounds are not achievable with current technology.

[1] ERL contacted Sherburne County in June 2025, to inform staff of inconsistencies with the County's sample identification number inconsistencies and a suspected switch of the County's samples from wells P-320L and P-320C2.

- One or more method blank samples had alkalinity, total, as $CaCO_3$, sulfate, as SO_4, chloride, nitrogen, nitrate + nitrite, as N, total organic carbon, toluene, chloroform, bromomethane, methylene chloride, 1,4-dichlorobenzene, 1,3-dichlorobenzene, 1,2-dichlorobenzene, chromium, and zinc detected between the method detection limit and the reporting limit. The laboratory did not qualify the associated sample results because the sample concentrations were either non-detect or were much higher than the method blank sample concentrations.
- The continuing calibration verification (CCV) was outside of the method specified limits for one or more organic compounds in eight USEPA Method 8260D batches. The associated organics results were qualified "C3 and C5" (estimated) by the laboratory.
- The laboratory control spike (LCS) and/or laboratory control spike duplicate (LCSD) sample percent recoveries and/or relative percent differences (RPDs) did not meet the established laboratory acceptance limits for one or more compounds in eight USEPA Method 8260D batches. The results were qualified "J3 or J4" (estimated) by the laboratory.
- The USEPA Method 8260D ethyl ether result associated with P-302C in report L1848860 was above the calibration range. The associated result was qualified "E" by the laboratory.
- The USEPA Method 6010D serial dilution test and/or subsequent post-spike criteria test did not pass for LYS-11 in report L1836539. The associated results were qualified "O1" (estimated due to matrix interference) by the laboratory.

EVALUATION OF ANALYTICAL RESULTS

Groundwater

The spring monitoring event included sampling and analysis of organic compounds from compliance monitoring wells completed in the lower outwash around the MSW portion of the landfill and organic and inorganic compounds from three compliance wells located around the C&D disposal cells in the North Development Area. Groundwater analytical results from compliance monitoring wells are compared to ILs included in Permit SW-74 and Health Risk Limits (HRLs) as appropriate below.

Table 3 provides a summary of results above the ILs and/or HRLs from wells with groundwater-based criteria. Vinyl chloride was detected above the HRL (0.2 micrograms per liter or µg/l) in samples from wells P-29C, P-302C, P-320C, P-320L, P-321L, P-323L, P-325L, P-338L, and P694477, and above the IL (0.05 µg/l) but below the HRL, at well P-314C, P-320C2, and P-326L. Trichloroethylene (TCE) was detected above the HRL (0.4 µg/l) in the sample from well P-323L, and above the IL (0.1 µg/l) but below the HRL at wells P-304C and P-313C. 1,2-dichloroethane was detected above the IL (0.25 µg/l) but below the HRL (1 µg/l) in samples from wells P-302C and P-323L. Dichlorofluoromethane (DCFM) was detected above the Risk Assessment Advice (RAA; 20 µg/l) in the sample from well P-334L, and above the IL but below the RAA at wells P-302C, P-323L, P-325L, P-338L, and P694477. cis-1,2-dichloroethylene was detected below the HRL but above the IL in samples from wells P-323L and P-325L. A HRL has not been established for DCFM. ERL is implementing groundwater corrective actions per the Groundwater Corrective Action Work Plan (Barr, 2021) and the Groundwater Corrective Action Report – Initial Performance Evaluation (Barr, 2024) to

address the organics in groundwater. Organics trends will be evaluated in the 2025 Annual Water Quality Monitoring Report.

Manganese was detected in the baseline groundwater sample collected from well P-342C at a concentration of 124 mg/l above the HRL (100 mg/l; Table 3). Manganese is a naturally occurring mineral that can be mobilized in groundwater under mildly reducing geochemical conditions. Manganese is not a routine monitoring parameter at the ERL because natural background manganese concentrations have been detected above the HRL upgradient and side gradient of the facility. Baseline groundwater quality data will be evaluated in the 2025 Annual Water Quality Monitoring Report.

Table 4 provides a summary of results above the ILs and/or HRLs from wells with surface-water based criteria. Chloride was detected above the IL (57.5 mg/l) in the sample from well 401-OWA. Chloride concentrations in groundwater upgradient of the landfill have been detected an order of magnitude greater than typical natural background concentrations (≤5 mg/L) and are attributed to the application and infiltration of deicing agents along Highway 169 (Barr, 2015a). A HRL has not been established for chloride.

No organics were detected in bedrock monitoring wells P-29D and P-311D or in sentinel wells P-329L, P-333L, or P-335L.

Lysimeters

Table 5 provides a summary of lysimeter purge volumes. The purge volumes from each lysimeter were below 15 gallons (and the lysimeter threshold volumes in the SAP) so no samples were collected during the spring monitoring event.

Lysimeter LYS-6N, which was constructed below the northern portion of Cell 6 prior to the MPCA's promulgation of landfill design standards and the promulgation of Subtitle D of the Resource Conservation and Recovery Act (RCRA) and Minnesota Rule, is the subject of an ongoing automated pumping program. Liquid collected in LYS-6N is discharged to the leachate collection system by an automated pump installed at the base of the lysimeter. The LYS-6N totalizer registered 266 gallons purged by the automated pump between October 2024 and May 2025.

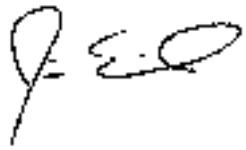
CONCLUSIONS/RECOMMENDATIONS

Monitoring was completed in accordance with the Permit with the exceptions noted in this report. Based on the data collected during the 2025 spring monitoring event, the following conclusions are drawn:

- Vinyl chloride was above the HRL in samples from nine downgradient monitoring wells, TCE was above the HRL in one downgradient monitoring well, and manganese was above the HRL in one groundwater well. ERL is implementing groundwater corrective actions (Barr, 2021 and 2024) to address the organics in groundwater.
- Lysimeter purge volumes were below the nominal threshold volumes.

Additional discussion of the spring monitoring data and recommendations for future monitoring at the ERL will be provided in the 2025 Annual Water Quality Monitoring Report.

If you have any questions, please contact me at 952-832-2763.
Sincerely,



Jim Eidem, P.G.
Barr Engineering Co.
Senior Hydrogeologist

cc: Ralph Collins, Elk River Landfill, Inc.
Erin Bulson, Elk River Landfill, Inc.
Jerome Doede, Sherburne County
Joe Hale, City of Elk River
Terry Johnson, Elk River Landfill, Inc.
Matt Ledvina, Gestalt Engineering
Dave Lucas, Sherburne County
Brad Peschong, Houston Engineering
June Volkers, Sherburne County
solidwastereports.pca@state.mn.us

Tables

Table 1
Groundwater Monitoring Network Summary
Elk River Landfill
Elk River, Minnesota

Monitoring Point	Unique Well ID Number	Intervention Limit	Relative Location to Landfill	Comment
P-29C	496289	GW	Downgradient of MSW	
P-29D	496294	GW	Downgradient of MSW	
P-301C	598562	GW	Downgradient of MSW	
P-301L	767989	GW	Downgradient of MSW	
P-302C	598563	GW	Downgradient of MSW	GWCAM
P-304C	598565	GW	Downgradient of MSW	GWCAM
P-305C	598566	GW	Downgradient of MSW	
P-311L	801471	GW	Downgradient of MSW	
P-311D	650145	GW	Downgradient of MSW	
P-313C	969668	GW	Downgradient of MSW	GWCAM
P-314C	969669	GW	Downgradient of MSW	
P-315L	722063	GW	Downgradient of SDA	
P-320C	737638	GW	Downgradient of MSW	
P-320C2	756593	GW	Downgradient of MSW	
P-320L	737637	GW	Downgradient of MSW	
P-321L	767990	GW	Downgradient of MSW	GWCAM
P-322L	767991	GW	Downgradient of MSW	
P-323L	786203	GW	Downgradient of MSW	GWCAM
P-324L	786202	GW	Downgradient of MSW	
P-325L	804281	GW	Downgradient of MSW	GWCAM
P-326L	804282	GW	Downgradient of MSW	GWCAM
P-329L	812995	GW	West of MSW	GWCAS
P-333L	828060	GW	West of MSW	GWCAS
P-334L	828061	GW	West of MSW	GWCAM
P-335L	828062	GW	West of MSW	GWCAS
P-338L	853139	GW	West of MSW	GWCAM
P-342C	890164	GW*	West of MSW	Baseline monitoring
P-342L	871179	GW	West of MSW	GWCAM
401-OWA	683321	SW	Upgradient of NDA	
P-403C	683318	SW	Downgradient of NDA	
408-OWA	717920	SW	Downgradient of NDA	
P-694477	694477	GW	Southwest of MSW	

Notes:

- MSW - Municipal Solid Waste
- NDA - North Development Area
- SDA - South Development Area
- NC - Non-compliance well
- GWCAM - monitored to evaluate natural attenuation per the Groundwater Corrective Action Work Plan (March, 2021)
- GWCAS - monitored for sentinel monitoring purposes per the Groundwater Corrective Action Work Plan (March, 2021)
- GW - Groundwater-based Intervention Limits
- SW - Surface Water-based Intervention Limits

*Anticipated

Table 2
Groundwater Elevations
Elk River Landfill
Elk River, Minnesota

Well Number	Elevation of Top of Casing	Water Elevation Oct 18, 2010	Water Elevation Oct 17, 2011	Water Elevation Oct 16, 2012	Water Elevation Oct 14, 2013	Water Elevation Oct 20, 2014[!]	Water Elevation Oct 20, 2015	Water Elevation Oct 18, 2016	Water Elevation Oct 16, 2017	Water Elevation Oct 17, 2018[!]	Water Elevation Oct 22, 2019[!]	Water Elevation Oct 11, 2020[!]
P-17C	982.62	951.73	955.19	953.34	953.05	956.04	954.96	956.15	956.38	955.19	955.84	955.30
22-OWA	1039.68	954.80	957.52	956.56	955.61	957.96	956.79	957.00	957.56	956.79	958.53	957.90
P-22L	1043.45					952.82	951.93	952.56	952.97	952.16	953.96	952.60
P-29C	957.16	949.00	950.46	949.40	948.91	951.26	950.35	950.94	951.35	950.70	952.24	950.98
P-29D	957.35	946.42	947.85	946.73	946.33	948.55	947.62	948.26	948.76	948.14	949.93	948.54
36-OWA	1021.61	955.48	958.46	957.15	956.20	958.71	957.49	957.78	958.27	957.41	959.33	958.49
301-OWA	966.54	959.72	958.31	956.70	961.07	961.77	960.10	962.27	962.38	962.72	962.34	956.50
P-301C	967.50	949.01	950.43	949.27	948.71	951.19	950.31	950.85	951.22	950.54	948.96**	950.79
P-301L	970.11	949.24	950.67	949.57	949.47	951.35	950.56	951.07	951.55	950.86	951.79	951.07
302-OWA	970.47	959.34	958.25	955.79	959.70	960.64	961.18	964.20	961.89	965.26	966.90	958.65
P-302C	970.63	948.90	950.39	949.33	948.81	951.27	950.27	950.81	951.31	950.67	955.20**	950.91
P-303C	963.77	950.44	951.94	950.66	950.28	953.24	952.75	953.70	954.14	953.18	955.48	952.61
P-304C	959.89	951.31	952.55	951.00	950.96	954.02	953.22	954.72	955.03	953.93	956.38	953.12
P-305C	963.26	948.72	950.29	949.24	948.69	951.03	950.16	950.78	951.20	950.58	952.04	950.92
P-308C	979.83	950.37	952.49	951.37	950.81	957.17	952.24	953.04	953.31	952.45	953.58	952.28
P-308L	979.94										952.58	951.26
P-309C	967.71	948.86	950.38	949.35	948.89	951.17	950.30	950.98	951.36	950.60	952.20	950.89
P-310C	975.33	954.56	954.14	951.65	953.10	954.99	955.61	956.25	956.66	955.96	957.06	953.85
P-311C	965.54	949.77	951.89	951.43	950.40	953.27	953.18	953.48	953.84	952.93	954.83	953.23
P-311L	965.76					950.32		950.21	950.76	950.04	951.60	950.64
P-311D	963.80	945.24	946.80	945.47	944.85	947.28	NM	947.38	947.82	947.09	947.39	947.32
312-OWA	1016.20	953.70	956.51	955.38	954.38	956.88	955.73	956.17	956.71	955.85	957.74	956.95
P-313C	948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15	>948.15
P-314C	952.02	948.21	949.87	948.76	948.30	950.51	950.29	950.74	951.05	950.35	951.63	950.80
315-OWA	972.41	950.72	954.38	952.53	951.46		953.27	954.07	954.54	953.36	955.64	954.21
P-315L	972.27	947.32	949.34	948.05	947.40		949.07	949.81	950.25	949.32	951.17	950.05
317-OWA	1009.73	951.66	954.21	953.61	952.05		954.31	955.00	956.42	955.37	957.38	956.17
P-317L	1008.65	947.79	949.93	948.65	947.93		949.54	950.27	950.95	949.92	951.90	950.75
P-320C	951.19	948.89	950.30	949.35	948.86	950.88	950.32	950.98	>951.19	950.60	>951.19	951.00
P320C2	951.21	948.90	950.34	949.37	948.99	950.91	950.32	951.02	951.08	950.70	>951.21	950.92
P-320L	951.37	948.87	950.38	949.36	948.82	950.87	950.30	950.90	951.33	950.62	>951.37	950.97
P-321L	972.56	948.76	950.35	949.24	948.73	950.99	950.18	950.73	951.19	950.53	951.99	950.86
P-322L	948.75	947.64	>948.75	947.69	947.12	>948.75	948.75	>948.75	>948.75	>948.75	>948.75	>948.75
P-323L	967.20		949.90	948.83	948.48	950.68	949.88	950.38	950.87	950.22	951.68	950.52
P-324L	960.40		949.70	948.68	948.05	950.33	949.59	950.11	950.64	949.99	951.57	950.21
P-325L	942.11					>942.11	~ 950.31		~ 952.5 **	~ 950.7	~ 952.8**	~ 949.3**
P-326L	942.62					>942.62	~ 950.37		~ 951.9 **	~ 950.3	~ 952.4**	~ 944.5**

Table 2
Groundwater Elevations
Elk River Landfill
Elk River, Minnesota

Well Number	Elevation of Top of Casing	Water Elevation Oct 18, 2010	Water Elevation Oct 17, 2011	Water Elevation Oct 16, 2012	Water Elevation Oct 14, 2013	Water Elevation Oct 20, 2014[!]	Water Elevation Oct 20, 2015	Water Elevation Oct 18, 2016	Water Elevation Oct 16, 2017	Water Elevation Oct 17, 2018[!]	Water Elevation Oct 22, 2019[!]	Water Elevation Oct 11, 2020[!]
P-327L	952.35							950.37 **	948.75	948.28	949.59	948.16
P-328L	948.20							946.13	946.40	945.81	947.13	945.76
P-329L	947.99							944.04 **	945.71	945.72	946.87	945.52
P-333L	943.72											
P-334L	972.22									946.44	947.79	946.27
P-335L	995.98									946.97	948.25	947.11
336-OWA	969.45											956.28
337-OWA	1031.70											956.36
P-337L	1031.68											951.58
P-338L	961.13											
P-340L	946.43											
P-341L	988.58											
P-342C	946.66											
P-342L	947.16											
401-OWA	1010.97	957.02	959.20	958.05	957.33		958.62	959.20	959.70	958.85	960.61	959.44
402-OWA	1023.56	957.93	959.61	958.51	957.81	960.13	959.02	959.53	960.06	959.27	960.96	959.94
P-403C	998.46	957.24	959.30	957.22	956.59	959.81	958.82	960.06	960.41	959.15	961.50	958.91
405-OWA	987.17	956.94	958.80	957.45	957.31	960.04	959.12	959.57	959.86	958.85	960.92	959.10
406-OWA	953.71	941.77	942.30	940.22	940.60	942.29	941.71	942.49	942.68	942.39	943.16	941.45
407-OWA	973.87	944.20	944.88	942.57	937.87	944.93	944.37	945.24	945.30	944.67	945.82	943.65
408-OWA	986.55	956.14	957.32	955.91	956.31	958.86	957.92	959.02	959.57	958.30	960.18	957.86
409-OWA	1044.39											
P-410L	994.56											
411-OWA	1007.34											
412-OWA	1028.56											
413-OWA	990.97											
P-694477	987.86							947.59	948.00	947.32	949.60	947.45

Table 2
Groundwater Elevations
Elk River Landfill
Elk River, Minnesota

Well Number	Elevation of Top of Casing	Water Elevation Oct 18, 2021	Water Elevation Oct 26, 2022[!]	Water Elevation Apr 18, 2023[!]	Water Elevation July 18, 2023[!]	Water Elevation Oct 16, 2023[!]	Water Elevation Apr 15, 2024[!]	Water Elevation Apr 16, 2025[!]
P-17C	982.62	953.17	952.74		953.57	953.52		
22-OWA	1039.68	955.97	955.14	954.53	955.93	955.68		955.80
P-22L	1043.45	949.75	950.12	951.03	950.25	950.28	951.72	951.20
P-29C	957.16	949.21	948.85	950.11	948.60	948.98	949.58	949.62
P-29D	957.35	944.65**	946.03	947.21	945.23	946.20	946.76	946.70
36-OWA	1021.61	956.51	956.03			956.31	1021.61	
301-OWA	966.54	955.94	956.23	964.25	957.53	964.43	963.89	959.70
P-301C	967.50	949.16	948.78	949.80	948.48	948.98	949.48	949.58
P-301L	970.11	949.39	949.06	950.11	948.71	949.16	949.83	968.81**
302-OWA	970.47	959.45	957.88	966.76	957.55	964.32		959.91
P-302C	970.63	949.14	948.98	949.98	948.65	948.92	948.63	949.53
P-303C	963.77	950.63	950.47	956.57	950.61	951.52		
P-304C	959.89	951.21	951.04	958.30	951.79	952.49	954.09	953.01
P-305C	963.26	949.03	948.60	949.57	948.41	948.84	949.33	949.40
P-308C	979.83	950.40	949.96	951.81	950.28	950.29		
P-308L	979.94	949.52	949.15	950.32	948.81	949.25		
P-309C	967.71	949.19	948.77		948.66	948.97		
P-310C	975.33	950.13	952.51		952.81	952.61		
P-311C	965.54	950.96	950.77		952.10	950.97		
P-311L	965.76	948.30	948.06	949.06	947.85	948.22	948.59	948.83
P-311D	963.80	946.94	944.91			945.00		
312-OWA	1016.20	954.55	953.92	953.80	954.79	954.31		
P-313C	948.15	>948.15	>948.15	>948.15	947.65	>948.15	>948.15	>948.15
P-314C	952.02	948.93	948.27	949.62	948.07	948.53	948.93	949.37
315-OWA	972.41	951.70	951.51	951.57	953.22	952.16		
P-315L	972.27	947.98	947.44	948.77	947.27	947.58	948.07	948.24
317-OWA	1009.73	953.62	953.26		953.26	954.07		
P-317L	1008.65	948.57	947.78		947.44	947.96		
P-320C	951.19	949.19	948.84	949.94	948.51	949.01	949.49	949.59
P320C2	951.21	949.12	948.87	949.91	948.51	949.02	949.49	949.62
P-320L	951.37	949.16	948.77	949.87	948.53	949.01	949.70	949.57
P-321L	972.56	949.09	948.71	949.93	948.56	948.87	949.38	949.46
P-322L	948.75	947.64	947.85	948.55	947.10	947.35	947.71	948.13
P-323L	967.20	948.59	948.37	949.63	947.94	948.53	949.06	949.13
P-324L	960.40	948.40	948.04	948.97	947.85	948.15	948.68	948.99
P-325L	942.11	~ 947.8**	~946.9	>942.11	>942.11	~ 947.0	>942.11	
P-326L	942.62	~ 947.5**	~947.0	>942.62	>942.62	~ 947.0	>942.62	

Table 2
Groundwater Elevations
Elk River Landfill
Elk River, Minnesota

Well Number	Elevation of Top of Casing	Water Elevation Oct 18, 2021	Water Elevation Oct 26, 2022[!]	Water Elevation Apr 18, 2023[!]	Water Elevation July 18, 2023[!]	Water Elevation Oct 16, 2023[!]	Water Elevation Apr 15, 2024[!]	Water Elevation Apr 16, 2025[!]
P-327L	952.35	946.86	946.83	948.35	946.05		947.59	
P-328L	948.20	944.29	944.40		943.34	944.52	945.09	
P-329L	947.99	944.11	944.27	945.59	943.14	944.29	944.90	945.07
P-333L	943.72			>943.72	943.22		>943.72	>943.72
P-334L	972.22	944.99	944.90	945.96	944.22	944.95	945.40	945.55
P-335L	995.98	944.90	945.28	946.23	944.37	945.39	945.69	946.23
336-OWA	969.45	953.71	953.27		953.56	954.45		
337-OWA	1031.70	954.37	953.18		953.89	953.66		
P-337L	1031.68	949.58	948.86			948.88		
P-338L	961.13	945.76	945.63	946.73	945.02	945.72	946.38	946.30
P-340L	946.43	944.83	944.83	>946.43	944.93	944.98		
P-341L	988.58				946.18	946.58	946.93	
P-342C	946.66							944.46
P-342L	947.16			945.42	945.27		945.27	945.01
401-OWA	1010.97	957.50	957.11	957.23	958.06	957.77	957.30	957.65
402-OWA	1023.56	958.11	957.56	957.74	958.22	958.25	958.18	958.31
P-403C	998.46	956.57	956.14	957.60	957.47	956.78	957.56	956.52
405-OWA	987.17	957.04	956.67	957.89	956.88	956.57	956.60	957.22
406-OWA	953.71	940.43	940.26	944.28	940.15	940.41	941.29	917.00
407-OWA	973.87	942.35	942.78	949.32	943.38	942.77	943.67	943.32
408-OWA	986.55	955.87	955.26	957.22	955.49	955.87	955.77	956.13
409-OWA	1044.39						965.62	965.69
P-410L	994.56						949.99	950.30
411-OWA	1007.34						959.96	960.76
412-OWA	1028.56						962.44	962.51
413-OWA	990.97						958.72	959.39
P-694477	987.86	945.93	945.65	946.67	944.80	945.75	946.42	946.36

Table 2
Groundwater Elevations
Elk River Landfill
Elk River, Minnesota

Water level elevations in feet, Mean Sea Level (MSL)

Blank indicates no water level collected

S: Well has been sealed

BP: Below top of dedicated pump

**: Unusable/rejected measurement based on hydrograph evaluation

>: groundwater elevation is greater than elevation listed; formerly reported as "Flowing"

~: approximate elevation based on pressure gauge reading

! indicates reported water levels were measured during a routine monitoring event and not necessarily on the listed day

Table 3
Groundwater Detections Exceeding Groundwater-based Intervention Limits
Elk River Landfill
Elk River, Minnesota

			Location	P-29C	P-302C	P-304C	P-313C	P-314C	P-320C	P-320C2	P-320L	P-321L	P-323L	P-325L
			Date	4/16/2025	4/16/2025	4/17/2025	4/17/2025	4/17/2025	4/15/2025	4/15/2025	4/15/2025	4/15/2025	4/15/2025	4/15/2025
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74											
Last Updated		04/24/2025	07/23/2015											
Exceedance Key		**Bold**	Underline											
Volatile Organic Compounds														
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25	--	0.615	--	--	--	--	--	--	--	0.288	--
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	1.5	--	--	--	--	--	--	--	--	--	2.13	1.59
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**	5	--	5.08	--	--	--	--	--	--	--	3.37	8.52
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1	--	--	0.106	0.106	--	--	--	--	--	**0.758**	--
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05	**0.647 C5**	**0.513 J3**	--	--	0.158 C5	**0.389 C5**	0.0836	**0.357 C5**	**0.414**	**0.244**	**0.707**
Dissolved Metals														
Manganese	ug/l	**100 HRL23**		--	--	--	--	--	--	--	--	--	--	--

(1) Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.

RAA17 Risk Assessment Advice 2017.
HRL15 Health Risk Limit 2015.
HRL18 Health Risk Limit 2018.
HRL23 Health Risk Limit 2023.

C5 The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.

J3 The associated batch QC was outside the established quality control range for precision.

Table 3
Groundwater Detections Exceeding Groundwater-based Intervention Limits
Elk River Landfill
Elk River, Minnesota

			Location	P-326L	P-334L	P-338L	P-342C	P694477
			Date	4/15/2025	4/16/2025	4/16/2025	4/18/2025	4/16/2025
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74					
Last Updated		04/24/2025	07/23/2015					
Exceedance Key		**Bold**	Underline					
Volatile Organic Compounds								
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25	--	--	--	--	--
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	1.5	--	--	--	--	--
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**	5	--	**21.9**	14.5	--	6.31 C5
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1	0.100	--	--	--	--
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05	0.0920	--	**0.683 J3**	--	**0.580 C5**
Dissolved Metals								
Manganese	ug/l	**100 HRL23**		--	--	--	**124**	--

(1) Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.

RAA17 Risk Assessment Advice 2017.
HRL15 Health Risk Limit 2015.
HRL18 Health Risk Limit 2018.
HRL23 Health Risk Limit 2023.

C5 The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.

J3 The associated batch QC was outside the established quality control range for precision.

Table 4
Groundwater Data Compared to Surface Water-Based Intervention Limits
Elk River Landfill
Elk River, Minnesota

		Location	401-OWA
		Date	4/17/2025
Parameter	Units	Elk River Surface Water Limits Table - SW-74	
Last Updated		09/28/2010	
Exceedance Key		**Bold**	
General Parameters			
Chloride	mg/l	**57.5**	**381**

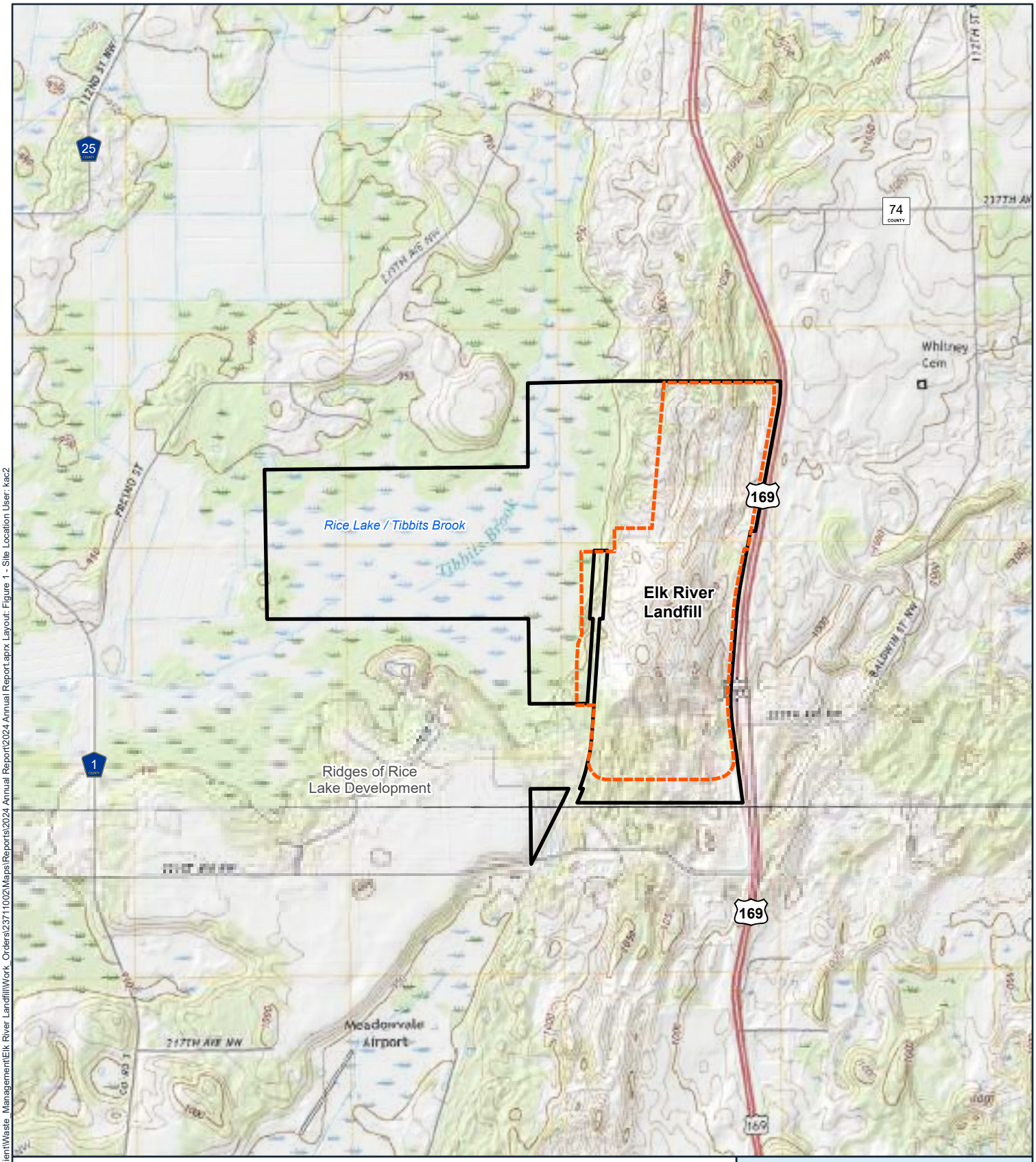
Table 5
Summary of Lysimeter Purging Information
Elk River Landfill
Elk River, Minnesota

Lysimeter Identification Number	Total Approximate Liquid Volume Removed Since Previous Monitoring Event (gallons)	Nominal Lysimeter Threshold Volume (LTV) (gallons)	Purge Volume Greater than LTV?	Sample Collected
LYS-6N*	266	--	--	No
LYS-6S	--	266	--	--
LYS-10	--	266	--	--
LYS-11	10	266	No	No
LYS-12	0	266	No	No
LYS-13	<5	266	No	No
LYS-14	<5	266	No	No
LYS-15	0	266	No	No
LYS-16	0	266	No	No
LYS-17	<5	266	No	No
LYS-18	0	266	No	No
LYS-19	<5	266	No	No
LYS-20	<5	266	No	No

LYS-6N Totalizer Reading Summary	
Date	Totalizer Reading (gallons)
10/21/2024	371299
5/19/2025	371565

Notes:
* LYS-6N is undergoing a continuous pumping program.

Figures



Property Boundary

Groundwater Compliance Boundary

Background Source: USGS 7.5 Minute Quadrangle
Data Source: Barr, Wenck, MNDOT, MNDNR

N

0 1,000 2,000 3,000

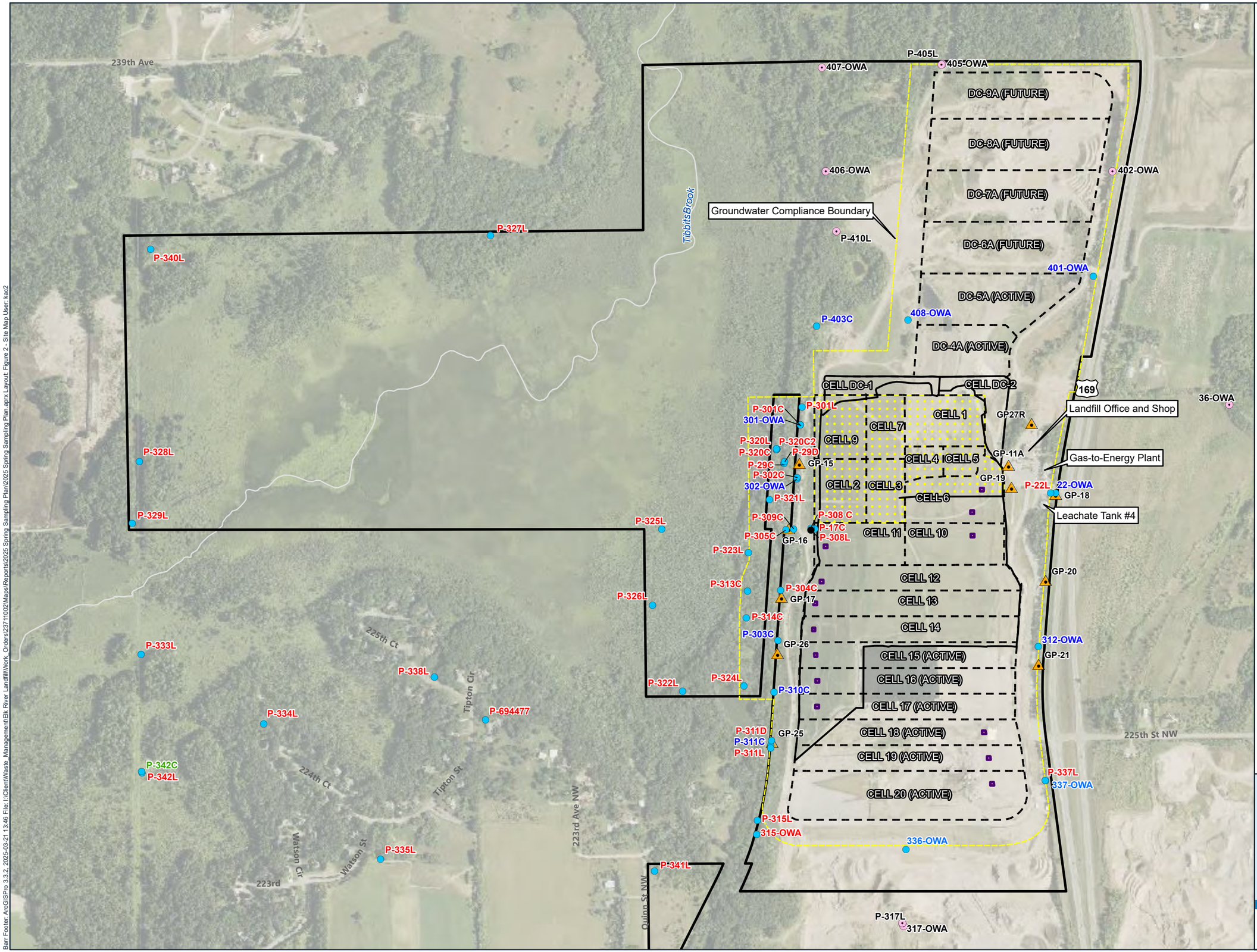
Feet

Site Location
Elk River Landfill
Elk River, MN

FIGURE 1

BARR

Barr Footer: ArcGISPro 3.4, 2025-02-18 14:12 File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711002\Maps\Reports\2024 Annual Report\2024 Annual Report.aprx Layout: Figure 1 - Site Location User: kac2



- Property Boundary
- Pre-Subtitle D Area
- Cell Boundary
- Lysimeter
- Monitoring Well
- Piezometer
- Test Well
- Gas Monitoring Probe
- P320C — Blue ID indicates well has surface water-based intervention limits
- P320L — Red ID indicates well has groundwater-based intervention limits
- P342C — Green ID indicates well is currently undergoing baseline monitoring

N

0 350 700 1,050

Feet

Imagery Source: USDA-FSA NAIP Imagery (2023)

Site Map
Elk River Landfill
Elk River, Minnesota

FIGURE 2

BARR

Barr Footer: ArcGISPro 3.3.2, 2025-03-21 13:46, File: I:\Client\Waste Management\Elk River Landfill\Work Orders\23711002\Maps\Reports\2025 Spring Sampling Plan\2025 Spring Sampling Plan.aprx Layout: Figure 2 - Site Map User: kac2

Appendices

Appendix A

Field Report

Alliance
TECHNICAL GROUP

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SPRING 2025 EMS REPORT ON GROUND WATER SAMPLE COLLECTION AT THE ELK RIVER LANDFILL FACILITY

Submitted to:

Elk River Landfill
WASTE MANAGEMENT, INC.
22460 Highway 169 Northwest
Elk River, Minnesota 55330

Prepared by:



Robin R. Worlie
Field and Lab Services Administrator

Report Number F25-7366
June 3, 2024
/rrw

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APPENDICES

A - Field Data Sheets
B - Field Notes
C - Chain of Custody

1 INTRODUCTION

ALLIANCE TECHNICAL GROUP submits this quarterly Environmental Monitoring System (EMS) report on ground and surface water sample collection at the Elk River Landfill Facility.

Thirty-two (32) ground water monitoring wells (Figure 1) were sampled during the April 15 – 18, 2025, groundwater sampling event at the Elk River Landfill Facility. These monitoring sites were identified as P-29C P-29D, P-301C, P-301L, P-302C, P-304C, P-305C, P-311D, P-311L, P-313C, P-314C, P-315L, P-320C, P-320C2, P-320L, P-321L, P-322L, P-323L, P-324L, P-325L, P-326L, P-329L, P-333L, P-334L, P-335L, P-339L, P-342C, P-342L, P-694477, 401-0WA, P-403C, and 408-0WA.

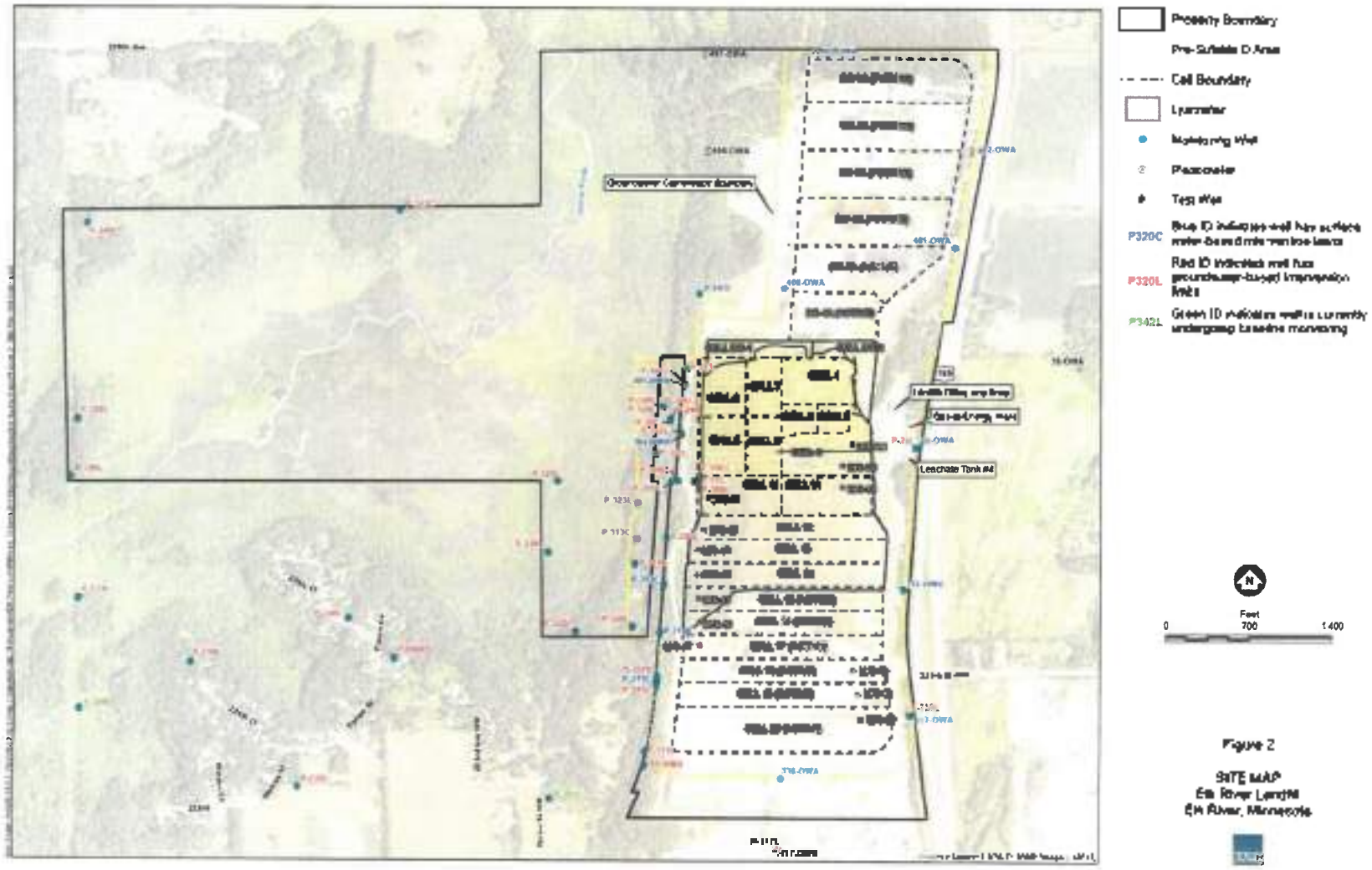
On May 19, 2025, six (6) lysimeters were purged (Lys-11, Lys-13, Lys-14, Lys, Lys-19 and Lys-20) and all yielded very little or no liquid so were therefore not sampled. The totalizer reading at lysimeter 6N was recorded and lysimeters 6S and 10 have no pumps in them.

The sampling was performed by Mike Hamer and Kenneth Smith of Alliance Technical Group in accordance in accordance with the Elk River Landfill Sampling and Analysis Plan (January 2021). This sampling guide was prepared by Jim Eidem of Barr Engineering and Waste Management, Inc.

The order of well stabilization/recovery or sample collection was as follows:

1. P-325L
2. P-326L
3. P-323L
4. P-321L
5. P-320L
6. P-320C2
7. P-320C
8. P-29D
9. P-694477
10. P-338L
11. P-334L
12. P-29C
13. P-305C
14. P-301C
15. P-311L
16. P-302C
17. P-311D
18. P-315L
19. P-313C
20. 401-OWA
21. P-304C
22. 408-OWA
23. P-342L
24. P-329L
25. P-322L
26. P-314C
27. P-324L
28. P-301L
29. P-335L
30. P-403C
31. P-342C
32. P-333L

Figure 1. Elk River Landfill Site Map.



2 SUMMARY

The groundwater monitoring wells at the Elk River Landfill were found locked and identified with a well number on the well riser. All samples were collected in a manner acknowledged to be acceptable to the MPCA.

Table 1. Results of Field Parameters

Well #	pH	Conductivity[1] (µmhos/cm)	Temperature (°C)	Turbidity (ntu)	Dissolved Oxygen (mg/L)	ORP (mv)
P-325L	6.74	1460	8.0	0.3	0.0	-122
P-326L	6.76	1275	7.6	1.0	0.2	-136
P-323L	6.76	1656	9.7	7.0	0.1	-120
P-321L	7.13	832	11.6	2.1	0.0	-106
P-320L	7.12	668	10.6	NR	0.1	-124
P-320C2	7.26	1023	10.8	5.2	0.0	-130
P-320C	7.13	1146	10.7	1.0	0.0	-154
P-29D	7.65	325	11.4	26	0.0	-199
P-694477	7.31	834	9.7	0.2	0.0	-203
P-338L	7.34	937	9.2	0.2	0.0	-174
P-334L	7.43	638	9.1	23	0.1	-132
P-29C	7.15	933	11.5	21	0.0	-118
P-305C	7.55	672	13.1	48.6	0.1	NR
P-301C	7.30	1368	11.1	6.0	0.0	-152
P-311L	7.60	638	9.4	34.4	0.1	-101.6
P-302C	7.12	1893	13.3	25.1	0.0	-186
P-311D	7.68	255	10.7	2.5	NR	NR
P-315L	7.05	236	8.7	2.0	0.1	-200.4
P-313C	6.95	1315	9.0	5.0	0.0	-117
401-OWA	7.15	1355	10.3	24.6	0.2	52.0
P-304C	6.89	1133	10.6	26.0	0.0	-124
408-OWA	7.78	384	11.3	1.7	0.2	53.6
P-342L	7.68	383	7.9	0.5	0.0	-179
P-329L	7.61	267	7.8	15.7	0.1	-166.5
P-322L	7.38	665	8.2	3.4	0.0	-104
P-314C	6.79	1337	8.7	0.5	0.0	-108
P-324L	7.32	559	9.7	39	10.0	-197
P-301I	6.65	531	10.7	17.2	0.4	-118.1

[1] Temperature compensated to 25°C.
NR = Not recorded

Table 1. Results of Field Parameters (Continued)

Well #	pH	Conductivity[1] (µmhos/cm)	Temperature (°C)	Turbidity (ntu)	Dissolved Oxygen (mg/L)	ORP (mv)
P-335L	7.19	412	12.3	10.2	0.0	-101
P-403C	7.57	543	9.3	51.0	0.3	-41.2
P-342C	7.50	300	7.5	7.3	0.0	-191
P-333L	7.45	405	8.0	1.0	0.0	-152

[1] Temperature compensated to 25°C
NR – Not Recorded.

Table 2. Visual Observations.

Well #	Odor	Color
P-325L	None	None
P-326L	None	None
P-323L	None	None
P-321L	None	None
P-320L	None	None
P-320C2	None	None
P-320C	None	None
P-29D	None	None
P-694477	None	None
P-338L	None	None
P-334L	None	None
P-29C	None	None
P-305C	None	None
P-301C	None	None
P-311L	None	None
P-302C	None	None
P-311D	None	None
P-315L	Not Recorded	Not Recorded
P-313C	None	None
401-OWA	None	None
P-304C	None	None
406-OWA	None	None
P-342L	None	None
P-329L	Not Recorded	Not Recorded
P-322L	None	None
P-314C	None	None
P-324L	None	None
P-301L	Not Recorded	Not Recorded
P-335L	None	None
P-403C	Not Recorded	Not Recorded
P-342C	None	None
P-333L	None	None

Table 3. Static Water Levels

Well Number	Date	TOC Elevation (ft)	Spring 2025 SWL's (ft)	Spring 2025 Elevation (ft)
22-OWA	4/17/2025	1039.68	83.88	955.80
P-22L	4/17/2025	1043.45	92.25	951.20
P-29C	4/16/2025	957.16	7.54	949.62
P-29D	4/14/2025	957.35	10.65	946.70
301-OWA	4/17/2025	966.54	6.84	959.70
P-301C	4/16/2025	967.50	17.92	949.58
P-301L	4/17/2025	970.11	1.30	968.81
302-OWA	4/17/2025	970.47	10.56	959.91
P-302C	4/16/2025	970.63	21.10	949.53
P-304C	4/17/2025	959.89	6.88	953.01
P-305C	4/16/2025	963.26	13.86	949.40
P-311D	4/16/2025	963.80	N/A	Final Totalizer: 2427250
P-311L	4/16/2025	966.76	16.93	949.83
P-313C	4/17/2025	948.16	Flowing	Flowing
P-314C	4/17/2025	952.02	2.65	949.37
P-315L	4/16/2025	972.27	24.03	948.07
P-320C	4/15/2025	951.19	1.60	949.59
P-320C2	4/15/2025	951.21	1.59	949.62
P-320L	4/15/2025	951.37	1.80	949.57
P-321L	4/15/2025	972.58	23.10	949.48
P-322L	4/17/2025	948.75	6.62	948.13
P-323L	4/15/2025	967.20	18.07	949.13
P-324L	4/17/2025	960.40	11.41	948.99
P-329L	4/17/2025	947.39	2.92	945.07
P-333L	4/18/2025	948.72	1.50	947.72
P-334L	4/16/2025	972.22	28.67	945.55
P-335L	4/17/2025	925.98	49.75	946.23
P-338L	4/16/2025	961.13	14.83	946.30
P-342C	4/18/2025	TBD	2.20	TBD
P-342L	4/17/2025	947.27	2.15	945.12
401-OWA	4/17/2025	1010.97	53.32	957.65
402-OWA	4/17/2025	1023.55	65.25	958.31
P-403C	4/17/2025	988.46	41.94	906.52
P-405L	4/17/2025	967.97	36.71	931.26
405-OWA	4/17/2025	987.17	29.95	957.22
406-OWA	4/17/2025	953.71	12.71	941.00
407-OWA	4/17/2025	973.87	30.35	943.52
408-OWA	4/17/2025	988.55	30.42	958.13
409-OWA	4/17/2025	1044.39	78.70	965.69
P-694477	4/16/2025	987.86	4.50	983.36
P-410I	4/17/2025	994.56	44.26	950.30
411-OWA	4/17/2025	1007.34	45.58	961.76
412-OWA	4/17/2025	1028.56	65.05	962.51
413-OWA	4/17/2025	990.87	31.58	959.29

Table 4. Lysimeter Purge Volumes.

Lysimeter	Date Recorded	Totalizer and/or Purge Volume	Sampled Yes or No
Lys-6N	5/19/2025	371565	No
Lys-11	5/19/2025	~ 10 gal	No
Lys-12	5/19/2025	0 gal	No
Lys-13	5/19/2025	< 5 gal	No
Lys-14	5/19/2025	< 5 gal	No
Lys-15	5/19/2025	0 gal	No
Lys-16	5/19/2025	0 gal	No
Lys-17	5/19/2025	< 5 gal	No
Lys-18	5/19/2025	No Pump	No
Lys-19	5/19/2025	< 5 gal	No
Lys-20	5/19/2025	< 5 gal	No

Table 5. Meteorological Data.

Weather Conditions:	4/15/2025
Precipitation:	None
Wind Speed:	10 - 25 mph
Wind Direction:	NW - NNW
Temperature, Low:	33°F
High:	52°F
Weather Conditions:	4/16/2025
Precipitation:	None
Wind Speed:	5 – 20 mph
Wind Direction:	East – East Southeast
Temperature, Low:	30°F
High:	60°F
Weather Conditions:	4/17/2025
Precipitation:	Rain
Wind Speed:	5 – 25 mph
Wind Direction:	Variable
Temperature, Low:	47°F
High.	73°F
Weather Conditions:	4/18/2025
Precipitation:	None
Wind Speed:	10 – 25 mph
Wind Direction:	North – North Northwest
Temperature. Low:	38°F
High:	57°F
Weather Conditions:	5/19/2025
Precipitation:	None
Wind Speed:	10 – 20 mph
Wind Direction:	East – East Northeast
Temperature, Low:	36°F
High:	56°F

Table 6 Natural Attenuation Parameters

Monitoring Well	Date Sampled	Sulfur (mg/L)	Ferrous Iron (mg/L)
P-325L	4/15/2025	0.03	1.76
P-326L	4/15/2025	0.03	> 3.30
P-323L	4/15/2025	> 0.80	2.17
P-321L	4/15/2025	0.28	0.79
P-338L	4/16/2025	0.11	1.38
P-334L	4/16/2025	0.16	0.98
P-302C	4/16/2025	BDL	1.54
P-313C	4/17/2025	> 0.80	0.61
P-304C	4/17/2025	0.05	0.90
P-342L	4/17/2025	0.06	0.43

APPENDIX A

Field Data Sheets

FIELD INFORMATION FORM

Site Name: cRL

Site No.:

Sample Point: P3251L

Sample ID

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is intended to along with the Chain of Custody Form that accompany the sample container(s) with the water that is returned to the laboratory.

Laboratory Use Only/Lab ID

PURGE INFO

PURGE DATE (MM/DD/YY)	PURGE TIME (2400 H Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
10/15/25	0851				

Note: For Certain Sampling Applications Where Well is Going Dry and/Or Low Flow Purging/Sampling Flow Rate and Total Purge Volume Are Critical Data Points, Additional Purge Info May Be Recorded on Field Notes Only.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated: (Y) or N

Filter Device: Y or N — 0.45 u or ____ u (circle or fill in)

Purging Device: A

A-Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper/Bottle

Sampling Device: A

Filter Type: ____ A-In-line Disposable; B-Pressure; C-Vacuum; X-Other ____

X-Other: ____

Sample Tube Type: ____ A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other ____

WELL DATA

Well Elevation (at TOC) ____ (ft msl)

Depth to Water (DTW) (from TOC) ____ (ft)

Groundwater Elevation (elev datum: from TOC) ____ (ft msl)

Total Well Depth (from TOC) ____ (ft)

Stick Up (from ground elevation) ____ (ft)

Casing ID ____ (in)

Casing Material ____

Note: Total Well Depth, Stick Up, Casing Id are optional and can be from Historical Data, unless required by Site/Permit. Well Elevation, DTW and Groundwater Elevation must be recorded.

STABILIZATION DATA (Optional)

Sample Time (2400 H Clock)	Rate/Unit	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (NTU)	DO (mg/L, ppm)	eH/ORP (mV)	DTW (ft)
1 0845	1	1 6.43	1 1453	1 13		1 02		
2 0850	2	2 6.45	2 1457	2 12.6		2 01		
3 0855	3	3 6.47	3 1457	3 12.4		3 01		
4 0915	4	4 6.48	4 1460	4 12.0	03	4 1.72		

Suggested ranges for Tetratech readings at the Penn Hill location: +/- 0.2 | +/- 3% | - | - | +/- 10% | +/- 25 mV | Stabilize

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters monitored in WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site (i.e. flow cell or other discrete system is used, fill in field readings before and after each sample is collected). If none fields above are applicable, use comments section below.

FIELD DATA

SAMPLE DATE (MM/DD/YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ Units ____

Final Field Readings are required (i.e. normal field measurement from monitoring system sampling before sampling for all field parameters required by State/Permit/Site)

Sample Appearance: ____ Odor: NO Color: CL Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed ____ Outlook ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler all should sign):

Date	Name	Signature	Company
10/15/25	[illegible]	[illegible]	

DISTRIBUTION: WHITE-ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.:

Sample Point: P12DL

Sample ID

This Waste Management Field Information Form is Required.
This form is to be completed, in addition to any State forms. The Field Form is submitted along with the Chain of Custody Form that accompany the sample containers sent with the cooler that is returned to the laboratory.

Laboratory Use Only Lab ID

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 H Clock)	ELAPSED HRS (decimal)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
2-11-22	1320				

Note: For Volatile Sampling, replace "Water Vol in Casing" and "Well Vols Purged" with Tubing Vol in Tubing, Flow Cell and Tubing, Flow Cell Vols Purged. Maintain pump rate and drawdown as low as possible.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated: (Y) or N

Purging Device: A-Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Bladder Pump, F-Dipper/Bottle, X-Other: Peri-Pump

Sampling Device: A-Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Bladder Pump, F-Dipper/Bottle, X-Other:

Filter Device: (Y) or N; 0.45 µ or ____ µ (circle one if filtering)

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other:

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other:

WELL DATA

Well Elevation (at TOC): (MSL)

Depth to Water (DTW) (from TOC): (ft)

Groundwater Elevation (elevation from TOC): (MSL)

Total Well Depth (from TOC): (ft)

Stick Up (from ground elevation): (ft)

Casing ID: (in)

Casing Material:

Note: Total Well Depth must be Casing Id for all monitoring wells provided on Well Construction Log required by Permit. Well Elevation, DTW, and Groundwater Elevation must be consistent.

STABILIZATION DATA (Optional)

Sample Time (2400 H Clock)	Rate/Time (L/hr)	pH (std)	Conductance (µmhos/cm @ 25°C)	Temp. (°C)	Turbidity (ntu)	DO (mg/L - ppm)	eh/ORP (mV)	DTW (ft)
1317	0.1	6.59	1276	7.1		0.8		
1320		6.53	1256	7.4		0.7		
1323		6.46	1265	7.5		0.5		
1326		6.46	1281	7.6	10	0.2 - 0.3		

FIELD INFORMATION FORM

Site Name: [illegible]
Site No.: [illegible] Sample Point: [illegible] Sample ID

This Waste Management Field Information Form is Required
This form is to be completed in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompanies the sample containers sent with the event that is entered in the laboratory.

Laboratory Use Only-LaSJL:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (Decimal)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 15 25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: For Passive Sampling, replace Water Vol in Casing and Well Vols Purged w/ Water Column Height in Casing and Height of Grab Sample Above Bottom

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment... Dedicated [Y] or [N]
Filter Device: [Y] or [N] [Capsule] or [illegible] (Circle or Fill In)
Purging Device: [illegible] A-Submersible Pump B-Bailer B-Peristaltic Pump C-Piston Pump
Sampling Device: [illegible] C-QED Bladder Pump D-Dipper/Bottle
X-Other:
Filter Type: [illegible] A-In-line Disposable C-Vacuum B-Pressure X-Other:
Sample Tube Type: [illegible] A-Teflon C-PVC X-Other: B-Stainless Steel D-Polypropylene

WELL DATA

Well Elevation (at TOC): [illegible] (Feet msl)
Depth to Water (DTW) (from TOC): [illegible] (ft)
Groundwater Elevation (mean datum, from TOC): [illegible] (Feet msl)
Tota. Well Depth (from TOC): [illegible] (ft)
Stick Up (from ground elevation): [illegible] (ft)
Casing ID: [illegible] (in) Casing Material: [illegible]

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and can be from historical data unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation are required.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit: [illegible] GPM	pH (std)	Conductance (SC/EC) (µmho/cm @ 25 °C)	Temp. (°C)	Turbidity (NTU)	D.O (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
[illegible]	[illegible]	1st [illegible]	1st [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2nd 6.75	2nd [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3rd 6.74	3rd [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	4th 6.76	4th [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

FIELD INFORMATION FORM

Site Name: ERL

Site No.: [ ]

Sample Point: P B 2 1 L

Sample ID

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. This Field Form is submitted along with the Chain of Custody Forms that accompany the sample container(s) with the number that is assigned to the laboratory.

Laboratory Use Only-Lab ID

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (decimal)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
0 4 1 5 2 5	1 2 2 6				

Note: For Passive Sampling replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Sampler(s) on Collected and Taking Forms. Do Not Purge, Must Assess Groundfield data Below

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment Dedicated? Y or N

Filter Device: Y or N (0.45 µ) or _____ (Circle or fill in)

Purging Device: C

Sampling Device: C

A-Submersible Pump D-Bailer
B-Peristaltic Pump E-Piston Pump
C-QED Bladder Pump F-Dipper/Bucket

Filter Type: _____

A-In-Line Disposable C-Vacuum
B-Pressure X-Other _____

X-Other _____

Sample Tube Type: _____

A-Teflon C-PVC X-Other: _____
B-Stainless Steel D-Polypropylene

WELL DATA

Well Elevation (at TOC): 9 7 2.5 6 (ft msl)

Depth to Water (DTW) (from TOC): 2 2.1 0 (ft)

Groundwater Elevation (abs datum, from TOC): 9 7 0 4.4 6 (ft msl)

Total Well Depth (from TOC): _____ (ft)

Stick Up (from ground elevation): _____ (ft)

Casing ID: _____ (in)

Casing Material: _____

Note: Total Well Depth, Stick Up, Casing ID are generally not to be from historical data, unless required by Site Permit. Well Elevation (TOC) and Groundwater Elevation are required.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate (mL/min - LPM)	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1 2 1 6	0.4	7.1 8	1 P 4 C	1 1.1		0 7		
1 2 1 9		7.1 6	1 P 3 C	1 1.3		0 6		
1 2 2 2		7.1 4	1 P 2 H	1 1.4		0 5		
1 2 2 5		7.1 3	1 P 3 2	1 1.5	E A	0 5 - 1 0 %		
Required range for 3 most readings per Permit, State requirement:		± 0.2	± 3%	±	±	+/- 10%	+/- 25 mV	± 0.01 ft

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM, Site or State. These fields can be used whether (if) field measurements are required by Local/Protective (i.e. Data Logger or other Electronic) means and (if) actual readings below and other environmental parameters for Site. If none are needed, see remarks below.)

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L - ppm)	eH/ORP (mV)	Other: _____ Units _____

Final Field Readings are required (i.e. record field measurements (final stabilized readings, passive sample readings) before sampling for all field parameters required by State/Permit/Site)

FIELD COMMENTS

Sample Appearance: _____ Odor: N _____ Color: N _____ Other _____

Weather Conditions (record daily, or as conditions change). Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if none then use Samples, all should sign)

Date	Name	Signature	Company
4 15 25	[illegible]	[illegible]	[illegible]

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.:

Sample Point: P-3 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompanies the sample containers (i.e. with the cooler when returned to the laboratory)

Laboratory Use Only/Lab ID

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (minutes)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
10 12 25	1315				

Note: For Ferrous Sampling replace "Water Level Casing" and "Well Depth" w/ "Water Level Tubing/Riser" and "Total Depth of Tubing/Riser". Call out Purged Above changes record/observations below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated? Y or N

Purging Device: A-Submersible Pump, B-Bailer, C-Peristaltic Pump, D-Piston Pump, E-QED Bladder Pump, F-Dipper/Bottle, X-Other

Sampling Device: 1

Filter Device: Y or N — 0.45 µ or ____ µ (circle or fill in)

Filter Type:

Sample Tube Type: A-Tefton, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other

A-In line Disposable, B-Pressure, C-Vacuum, X-Other

WELL DATA

Well Elevation (at TOC): 611.77 (feet)

Depth to Water (DTW) (from TOC): 10.60 (ft)

Groundwater Elevation (elev. datum, from TOC): 601.17 (ft msl)

Total Well Depth (from TOC): ____ (ft)

Stick Up (ft +/- ground elevation): ____ (ft)

Casing ID: ____ (in)

Casing Material: ____

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and can be from historical data unless required by Site Permit. Well elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 hr Clock)	Rate (mL/min)	pH (unit)	Conductance (SCOND) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	oHYORP (mV)	DTW (ft)
1120	200	7.22	1774	10.6		0.12		
1125		7.17	1810	10.7		0.11		
1130		7.16	1815	10.6		0.09		
1135		7.17	1815	10.6		0.09	-12	
Required ranges for 3 consec. readings or per Permit/Site requirements		+/- 0.1	+/- 3%	-	-	+/- 10%	+/- 25 mV	Minimum

Stabilization Data Fields are Optional for completion/collection readings for parameters required by WM, Site or State. These fields may be used when four (4) field measurements are required by Permit/Site. If a Data Logger or other Electronic Format is used for final readings below and retained on file; then reference to Site. If more fields/Note are needed, use Comment Sheet or Form

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L - ppm)	oHYORP (mV)	Other: Units

Final Field Readings are required for each parameter, final stabilized readings must be recorded before sampling for all field measurements required by Permit/Site.

FIELD COMMENTS

Sample Appearance: ____ Odor: ____ Color: ____ Other: ____

Weather Conditions (required daily, or as conditions change): ____ Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign).

Date	Name	Signature	Company
10/12/25	[illegible]	[illegible]	

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: ERL

Date: / / Sample No.: P3256-2

Sample ID

This Waste Management Field Information Form is Required
This form is to be completed in addition to any State Forms. The field form is submitted along with the Chain of Custody forms that accompany the sample containers to the cooler for transport to the laboratory.

Laboratory Use Only/Lab ID

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gal) (x)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
1 0 1 5 2 5	1 3 1 5	1 1			1

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" in Water Info or Tubing Flow Cal and Tubing/Formula Vol Purged. Add Change, record Specifics below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated: Y (X) or N ( )

Filter Device: Y (X) or N ( ) 0.45 µ or ____ µ (circle one)

Purging Device: ( )
A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/bottle

Sampling Device: ( )

X-Other: ____

Filter Type: ( )
A-In-line Disposable, B-Pressure, C-Vacuum, X-Other: ____

Sample Tube Type: ( )
A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: ____

WELL DATA

Well Elevation (MTOC): 4 5 1 2 5 (0.01ft)

Depth to Water (DTW) (from TOC): 1 5 2 1 (ft)

Groundwater Elevation (site datum, from TOC): 4 5 1 2 3 (0.01ft)

Total Well Depth (from TOC): ____ (ft)

Stick Up (from ground elevation): ____ (ft)

Casing ID: ____ (in)

Casing Material: ____

Note: Total Well Depth, Stick Up, Casing ID, Casing Material can be from historical data, only required for Site Permit. Well Elevation, DTW and Groundwater Elevation must be recorded.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Gal (L/gal)	pH (std)	Conductance (SC/TC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	DO (mg/L ppm)	eH/ORP (mV)	DTW (ft)
1 3 5 6	0.4	7.30	1024	16.7		0.2		
1 3 5 5	1	7.29 (2nd)	1.025	16.8		0.1		
1 4 0 6	1	7.27 (3rd)	1.024	16.9		0.0		
1 4 0 5	1	7.26 (4th)	1.023	16.8	5.2	0.0	-130	
Suggested Stabilization Criteria per Field Sheet Notes		± 0.2	± 3%			± 10%	± 22 mV	Stabilize

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by Well, Site, or State). These fields are to provide documentation of Field measurements required by State/Permit. Note: If no Field Readings are taken (Grab), leave fields blank and explain why in Field Comments below. If more Field Readings are needed, use separate sheet or form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP (°C)	TURBIDITY (ntu)	DO (mg/L ppm)	eH/ORP (mV)	Other: / Units

Final Field Readings are required (i.e. record field measurements from stabilization readings, passive sample readings before sampling for all field parameters are required by State/Permit/Site)

FIELD COMMENTS

Sample Appearance: ____ Odor: N/A Color: N/A Other: ____

Weather Conditions (typical daily, or as conditions change): ____ Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
10/25/25	[illegible]	[illegible]	[illegible]

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Released to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: GPL

Site No.:

Sample Point: P2206 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Form. The Field Form is submitted along with the Chain of Custody Form that accompanies the sample containers (i.e., with the cooler that is shipped to the lab, etc.)

Laboratory Use Only/Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 hr Clock)	ELAPSED HRS (hr:mn)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOL PURGED
121325	1145				

Note: For Passive Sampling, replace "Water Column Change" and "Well Vols Purged" w/ Water Flow Through Time, Flow Cell and Deployment, Grab Vols Purged. Mark changes, record field data here.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated (Y) or (N) | Filter Device: (Y) or (N) | 0.45µ | or _____ µ (Circle One)

Purging Device: C — A=Submersible Pump, B=Peristaltic Pump, C=QED Bladder Pump, D=Bailer, E=Piston Pump, F=Dipper/Bucket

Sampling Device: C

X=Other

Filter Type: A=In-line Disposable, B=Pressure, C=Vacuum, X=Other

Sample Tube Type: A=Teflon, B=Stainless Steel, C=PVC, D=Polypropylene, X=Other

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)	Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
9519 (ft msl)	160 (ft)	9359 (ft msl)		(ft)	(in)	

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 hr Clock)	Rate (L/min)	pH (std)	Conductance (µS/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	DO (mg/L - ppm)	eFROPP (mV)	D.W. (ft)
1217	0.4	7.17	1.140	10.6		6.1		
1222		7.13	1.190	10.6		4.1		
1230		7.12	1.195	10.6		2.6		
1235		7.13	1.196	10.7	LC	1.9	-71.6	

Suggested range for 3 consecutive readings per Permit/Std. requirements: (+/- 0.1) | (+/- 3%) | (-) | (+/- 10%) | (+/- 10 mV) | Stabilize

Stabilization Data Fields are Optional for complete stabilization reading for all parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Std. If a Water Logger or other Electronic Sensor is used, all or final readings below and indicate parameters in use. Electronic device printout attached, w/ appropriate sheet or form

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µS/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L - ppm)	eHAORP (mV)	Others: _____ Units _____

Final Field Readings are required for record/field documentation. For stabilized readings, provide sample readings before sampling for all field parameters required by State/Permit/Std.

Sample Appearance: _____ Odor: None Color: Clear Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation Y or N

Specific Comments (including purge/well volume calculations if required):

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
12/13/25	[illegible]	[illegible]	

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.: ____ Sample Point: P2MP (Sample ID)

This Waste Management Field Information Form is Required.
This form is to be completed and submitted to any State Forms. The Field Form is submitted along with the Chain of Custody. Forms that accompany the sample containers (i.e. with the sample label or container) are optional.

Laboratory Use Only/Lot ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL. PURGED (Gallons)	WELL VOLs PURGED
0 6 1 5 2 5	1 4 5 6				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" with "Water Vol in Tubing" (Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged). Mark changes on next Solid Waste form.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated [Y] or [N]

Filter Device: [Y] or [N] [.45µ] or [ ] µ (circle one)

Purging Device: [C]
A- Submersible Pump, B-Bailer, D-Peristaltic Pump, C-Piston Pump, E-QED Bladder Pump, F-Dipper/Bailer

Sampling Device: [C]

Filter Type: [ ]
A-In-line Disposable, C-Vacuum, B-Pressure, X-Other

Sample Tube Type: [ ]
A-Teflon, C-PVC, D-Stainless Steel, B-Polypropylene, X-Other

X-Other:

WELL DATA

Well Elevation (at TOC): 9 5 7 3 5 (ft msl)

Depth to Water (DTW) (from TOC): 1 0 0 5 (ft)

Groundwater Elevation (elev datum. from TOC): 9 4 6 7 0 (ft msl)

Total Well Depth (from TOC): ____ (ft)

Stick Up (from ground elevation): ____ (ft)

Casing ID: [ ] [ ] (in)

Casing Material: ____

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and can be free-form/edited unless required by State/Permit. Well Elevation, DTW, and Groundwater Elevation are required.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Vol	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	DO (mg/L - ppm)	oRDRP (mV)	DTW (ft)
1 3 1 5		7 1 5	1 3 4 3	1 1		6 6		
1 3 2 0		7 0 6	1 3 2 0	1 1 5		6 5		
1 3 2 5		7 0 2	1 3 4 2	1 1 4		6 5		
1 3 3 0		7 0 5	1 3 2 6	1 1 4		6 5		
Suggested range for Stabilization (see Permit/State requirements)		+/- 0.2	+/- 3%	+/- 3		+/- 10%	+/- 25 mV	Stable

Stabilization Data Fields are Optional. Use multiple stabilization readings for parameters required by WM, Site or State). These fields can be used when four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic Device is used, fill in final readings below. Instrument documentation is required by Site. If water fields change, are not in range, then so note.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L - ppm)	oRDRP (mV)	Other: ____ Units: ____

Final Field Readings are required (i.e. record of field measurements, final stabilized readings, pertinent sample readings before sampling for all field parameters required by State/Permit/Site.

FIELD COMMENTS

Sample Appearance: ____ Odor: N [illegible] Color: N [illegible] Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: ____ Outfall: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign).

Date	Name	Signature	Company
6/25/25	[illegible]	[illegible]	[illegible]

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: [illegible]
Site No.:
Sample Point: [illegible] (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompanies the sample containers (i.e. with the cooler that is shipped to the laboratory)

Lab (Only Use Only/Lot ID:

PURGE (NPU)

PURGE DATE (MM/DD/YY)	PURGE TIME (2400 hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
[illegible]	[illegible]				

Note: For Passive Sampling replace "Water Col in Casing" and "Well Vols Purged" w/ "Water Col on Sampler" in Col 4 and "Sampler Vols Purged" in Col 6. Well Vols Purged: Most changes remove information below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: Y | or [illegible]
Filter Device: Y or [illegible] | 0.45 µ | or _____ | Field or Lab Filtered

Purging Device: [illegible]
A- Submersible Pump; B-Bailer; D-Peristaltic Pump; E-Piston Pump; G-QED Bladder Pump; F-Dipper/Bailer; X-Other: _____

Sampling Device: A
Filter Type: _____
A-In-line Disposable; B-Pressure; C-Vacuum; X-Other _____

Sample Tube Type: _____
A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other _____

WELL DATA

Well Elevation (at TOC): [illegible] (Feet)
Depth to Water (DTW) (from TOC): [illegible] (ft)
Groundwater Elevation (use Datum, from TOC): [illegible] (Feet)
Total Well Depth (from TOC): _____ (ft)
Stick Up (from ground elevation): _____ (ft)
Casing ID: _____ (in)
Casing Material: _____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and may be from historical data, unless required by client/permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr. Clock)	Rate/Vol	pH (std)	Conductance (SC/TC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (NTU)	D.O (mg/L - ppm)	+/-ORP (mV)	DTW (ft)
[illegible]		[illegible]	[illegible]	[illegible]		[illegible]		
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Suggested range for Stabilization readings or most Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 10 mV	Stabilize

Stabilization Data Fields are Optional. For complete Stabilization readings for parameters required by WM, site or State. These fields can be used where low-flow purging techniques are required by State Permit/Site. Via Data Logger or other Electronic means is used for these readings, delete and attach electronic data separately to file. If more fields than are needed, use appropriate sheet or form.

FIELD DATA

SAMPLE DATE (MM/DD/YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (NTU)	DO (mg/L-ppm)	eH/ORP (mV)	Other: _____ Units _____

Final Field Readings are required for record (field measurements, final stabilized readings, person/sample readings) before sampling for all field parameters required by State Permit/Site.

Sample Appearance: _____ Odor: N Color: N Other: _____

Weather Conditions (required daily, or as conditions change): _____ Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

4-19-23 [illegible] [illegible] [illegible]
Date Name Signature Company

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: LRL
Site No.:
Sample Point: P3S6
Sample ID

This Waste Management Field Information Form is Required
This form is to be considered a section of any Sales Invoice. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the coolers that are returned to the laboratory)

Laboratory Use Only/Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 hr Clock)	ELAPSED HRS (Decimal)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOL. PURGED
041625	1015	.41			

Note: For Monitor Events Where Water Is Only Used To Rinse Pump Or Water Is Temporarily Collected Temporarily Stored Prior To Disposal, Mark Changes, record and state Actual

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: [Y] or [N]
Filter Devices: [Y] or [N] Qty: [ ] @ [ ] (Gallons)

Purging Device: [ ]
A- Submersible Pump B-Bailer
B-Peristaltic Pump E-Piston Pump
C-QED Bladder Pump F-Dipper-Bottle

Sampling Device: [C]

X-Other:

Filter Type: [ ]
A-In-line Disposable C-Vacuum
B-Pressure X-Other:

Sample Tube Type: [ ]
A-Teflon C-PVC X-Other:
B-Stainless Steel D-Polypropylene

WELL DATA

Well Elevation (at TOC): 5616.78 (ft msl)
Depth to Water (DTW) (from TOC): 18.53 (ft)
Groundwater Elevation (elevation, from TOC): (ft msl)
Total Well Depth (from TOC): (ft)
Stick Up (from ground elevation): (ft)
Casing ID: (in)
Casing Material:

Note: Total Well Depth used for Casing Id, etc. are optional and not to be confused with Boring Depth, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be entered

STABILIZATION DATA (Optional)

Sample Date (2400 Hr Clock)	Rate/Unit: GPM	pH (std)	Conductance (SC/EC) (umhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1017	1	7.35	1 9359	9.5		0.02		
1021	2nd	7.34	2nd 9360	9.4		0.02		
1025	3rd	7.34	3rd 9360	9.4		0.01		
1036	4th	7.34	4th 9367	9.3	0.2	0.00	-177.5	
Stabilized range for 3 consec. readings or note Permit/State requirements		+/- 0.2	+/- 3%	+/-	+/-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional for complete stabilization readings for parameters required by WM, Site, or Permit. These fields can be used where four (4) field measurements are required by State/Permit. Use Data Logger or other Electronic Device to store field readings. Indicate where stabilization readings are recorded (i.e. Data Logger, Laptop, Other)

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are to be recorded. Final stabilized readings from the Sample Reading. Refer to Stabilization for all field parameters required by State/Permit.

FIELD COMMENTS

Sample Appearance: Odor: None Color: None Other:

Weather Conditions (required daily, or as conditions change): Direction/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State and WM protocols (if more than one sampler all should sign):

Date	Name	Signature	Company
4-16-25	M. Hall		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.: | Sample Point: 2354 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed in addition to any State forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (Optional)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
09 16 25	1045				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Vol Purged" w/ Water Vol in Tubing Prior to and Following Flow Through Sampler. Make changes on all applicable forms.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated: Y or N

Purging Device: 1

Sampling Device: 1

Other:

A- Submersible Pump
B-Peristaltic Pump
C-QED Bladder Pump
D-Bailer
E-Piston Pump
F-Dipper (Bailer)

Filter Device: Y or N | Brand: | # | Size (pore) of Filter:

Filter Type:

A-In-line Disposable
B-Pressure
C-Vacuum
X-Other:

Sample Tube Type:

A-Teflon
B-Stainless Steel
C-PVC
D-Polypropylene
X-Other:

WELL DATA

Well Elevation (at TOC): 4132.13 (ft msl)

Depth to Water (DTW) (from TOC): 7667 (ft)

Groundwater Elevation (site datum, from TOC): 4465.13 (ft msl)

Tot. Well Depth (from TOC): (ft)

Stick Up (from ground elevation): (ft)

Casing ID: (in)

Casing Material:

Note: Total Well Depth, Stick Up, Casing Id are not required values by State Regulations, only required by SiteProtect. Well Elevation, DTW and Groundwater Elevation must be given.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp. (°C)	Turbidity (NTU)	D.O. (mg/L ppm)	eH/ORP (mV)	DTW (ft)
1116	0.5 1"	7.54 1"	4.51 1"	6.1 1"		10.6 1"		
1120	2"	7.56 2"	1.37 2"	6.1 2"		10.3 2"		
1124	1"	7.45 3"	2.40 3"	6.1 3"		10.2 3"		
1126	4"	7.45 4"	0.30 4"	6.1	2.5	10.1	-152	
Suggested range for 3 consec. readings or +/- Equip. Specs (see above)		+/- 0.1	+/- 3%			+/- 10%	+/- 25 mV	0.01 ft

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by NJ, just as Optional). These fields can be used where four (4) field measurements are required by local Procedures. If a Data Logger is also being used, please record final stabilized reading below and submit electronic data separately as well. If more fields other than those included here are needed, use separate sheet or form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (NTU)	DO (mg/L-ppm)	eH/ORP (mV)	Other: / Time:

Field Field Readings are required (i.e. record field measurements from stabilized readings just before sampling for all field parameters required by State Protocols).

Sample Appearance:

Odor: None

Color: Clear

Other:

Weather Conditions (required daily, or as conditions change):

Direction/Speed:

Outlook:

Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
9/16/25	[illegible]	[signature]	[illegible]

INSTRUCTION: White-ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.: | | | | |

Sample Point: D A C

Sample ID

This Waste Management Field Information Form is Required
This form is to be completed in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompany the sample containers (i.e. with the cooler that is received at the laboratory)

Laboratory Use Only/Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (24HR Clock)	ELAPSED HRS (Purge)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
04 12 15	1235				

Note: For Passive Sampling Apps, Water Vol in Casing, Time Well Was Purged, or Water Level Before Purging Are Not Applicable. Well Vols Purged = Actual Vol Purged / Water Vol in Casing. Mark changes, record deviations, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment Dedicated: Y or N

Filter Device: Y or N Pore Size (if applicable)

Purging Device: A-Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle, X-Other

Sampling Device: C

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (elevation, below TOC)	Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
971.6 (ft/msl)	7.54 (ft)	974.62 (ft/msl)	(ft)	(ft)	(in)	

Note: Total Well Depth, Stick Up, Casing ID, and Casing Material are optional and can be filled in as needed, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be entered.

STABILIZATION DATA (Optional)

Sample Time (24HR Clock)	Rate/Unit (LPM)	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	DO (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1230	0.4	1st 7.37	917	11.2		0.4		
1235		2nd 7.34	913	11.4		0.1		
1240		3rd 7.19	893	11.3		0.0		
1245		4th 7.15	893	11.5	21	0.0	5	
Suggested range for 3 consec. readings at min. Purge/Stab. (optional)		+/- 0.2	+/- 3%	+/-	+/-	+/- 10%	+/- 25 mV	Stable

Stabilization Data Fields are Optional for complete stabilization reading, for parameters required by Well Std. or State. These fields can be completed if field measurements are required by State Permit/Law. If not required, leave blank. Use Comments field below and other electronic data deliverables for any additional parameters.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L - ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required. Use multi-field measurements from stabilized readings prior to sample readings before sampling for all field parameters required by State/Permit/Etc.

Sample Appearance: Odor: None Color: Clear Other:

Weather Conditions (expand daily, or as conditions change): Direction/Speed: Outlook: Precipitation: Y or N

Specific Calculations (including purge/well volume calculations if required):

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and Wid protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
04 12 15	[illegible]	[illegible]	[illegible]

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: [illegible]
Site No.:
Sample Point:
Sample ID:

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State forms. This Field Form is submitted along with the Chain of Custody forms that accompany the sample containers (or with the cooler that is returned to the laboratory)

Laboratory Use Only Task ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
11 12 15	1310				

Note: The Purge Sampling options 'Water Vol in Casing' and 'Well Vols Purged' or Water Vol to Sample Flow Cell and tubing from Cell Inlet Purged (Multi-Analyte, mini) Solutions Only

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated (Y) or N
Filter Device: Y or (N) [ ] µ or [ ] µ (circle one)
Purging Device: E
A- Submersible Pump B-Peristaltic Pump C-QED Bladder Pump D-Bailer E-Piston Pump F-Dipper/Bottle
Filter Type:
A-Inline Disposable D Pressure C-Vacuum X-Other
Sampling Device: E
X-Other
Sample Tube Type:
A-Teflon B Stainless Steel C-PVC D-Polypropylene X-Other

WELL DATA

Well Elevation (at TOC): [illegible] (0.01ft)
Depth to Water (DTW) (from TOC): [illegible] (ft)
Groundwater Elevation (site datum, from TOC): (0.01ft)
Total Well Depth (from TOC): (ft)
Stick Up (from ground elevation): (ft)
Casing ID: (in)
Casing Material:

Note: Total Well Depth, Stick Up, Casing ID are optional and not required for Hydrostatic Data, unless required by State/Permit. Well Elevation, DTW, and Groundwater Elevation must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Vol	pH (std)	Conductance (SCEC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (NTU)	DO (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1315	0.4	7.10						
1320	0.4	7.11						
1325	0.4	7.11						
1330	0.4	7.11						

FIELD INFORMATION FORM

Site Name: [illegible]

Site No.:

Sample Point: [illegible] (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompany the sample containers (i.e. with the cooler that is returned to the laboratory)

Laboratory Use Only/Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (minutes)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: For Passive Sampling, enter = "Water Level Change" and "Well Bail Length" of Water Column Above Ground Straight for Cell Gas Program. Blank otherwise, record field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated [Y] or [N]

Purging Device: [ ]
A-Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device: [ ]
X-Other

Filter Device: [Y] or [N] | 0.45µ | or [ ] µ (Other than 0.45)

Filter Type: [ ]
A-In-line Disposable, B-Pressure, C-Vacuum, X-Other

Sample Tube Type: [ ]
A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other

WELL DATA

Well Elevation (at TOC): [illegible] (feet)

Depth to Water (DTW) (from TOC): [illegible] (ft)

Groundwater Elevation (site datum, from TOC): [illegible] (feet)

Total Well Depth (from TOC): [illegible] (ft)

Stick Up (From ground elevation): [illegible] (ft)

Casing ID: [ ] (in)

Casing Material: [ ]

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and can be form customization; unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit (+/- 0.2)	pH (SU)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (NTU)	DO (mg/L - ppm)	eh/ORP (mV)	DTW (ft)
[illegible]	1st	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2nd	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	3rd	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4th	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Suggested Sig Fig (1 Decimal Unless Otherwise Required by Site/State requirements)		+/- 0.2	+/- 5%			+/- 10%	+/- 20 mV	Stabilized

Stabilization Data Fields are Optional (i.e. temperature, conductance readings per parameter) required by WM, Site, or State. These fields can be used where four (4) field measurements are required to demonstrate stabilization (Purging Logs or other Elections); for other cases, fill in final readings below and where electronic data measurements are less. If more field space is needed, use separate sheet or form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (SU)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (NTU)	DO (mg/L - ppm)	eh/ORP (mV)	Other: _____ Units: _____
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

Final Field Readings are required (i.e. record field measurements, final stabilized readings, prior to sample readings before sampling for all field parameters required by Site/Permit/State)

Sample Appearance: _____ Odor: [illegible] Color: [illegible] Other: _____

Weather Conditions (required daily, or as conditions change): Days since/Special: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one samples, all should sign):

Date	Name	Signature	Company
[illegible]	[illegible]	[illegible]	[illegible]

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: E.F.L

Site No.:

Sample Point: [illegible] (Sample ID)

This Waste Management Field Information Form is Required
This Form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form(s) that accompany the sample container(s) (i.e. - to the cooler that is returned to the laboratory)

Laboratory Use Only Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hrs min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOL PURGED
[illegible]	[illegible]				

Note: For Passive Sampling, replace "Water Vol in Casing" with "Well Vol Purged" and "Water Vol in Tubing/Filter Cell and Tubing" with "Vol Well Purged". Mark changes in red for Validation Review.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment Dedicated: [Y] or [N] Filter Device: [Y] or [N] [0.45 µ] or [ ] µ (circle one if other)

Purging Device: [ ] A- Submersible Pump B- Peristaltic Pump C-QED Bladder Pump D-Bailer E-Piston Pump F-Dipper/Bucket

Filter Type: [ ] A-In-line Disposable B-Pressure C-Vacuum X-Other:

Sampling Device: [ ]

Y-Other:

Sample Tube Type: [ ] A-Teflon B-Stainless Steel C-PVC D-Polypropylene X-Other:

WELL DATA

Well Elevation (at TOC): [illegible] (msl)

Depth to Water (DTW) (from TOC): [illegible] (ft)

Groundwater Elevation (calculated from DTW): [ ] (msl)

Total Well Depth (from TOC): [ ] (ft)

Stick Up (from ground elevation): [ ] (ft)

Casing ID: [ ] (in)

Casing Material: [ ]

Note: Total Well Depth, Stick Up, Casing ID, and Casing Material are optional and to be filled in only when requested by Site Personnel. Well Elevation, DTW and Groundwater Elevation must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Vol	pH (SU)	Conductance (SCMEC) (µmhos/cm @ 25°C)	Temp. (°C)	Turbidity (NTU)	DO (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
[illegible]	[illegible]	1st 7.65	1st 6.21	9.16		0.1		
[illegible]		2nd 7.66	2nd 6.33	9.14		0.2		
[illegible]		3rd 7.62	3rd 6.35	9.14		0.1		
[illegible]		4th 7.60	4th 6.38	9.12	34.1	0.1	116	

Suggested range for certain, mid-point and Permit/Specific criteria: +/- 0.2 | +/- 3% | - | - | +/- 10% | +/- 20 mV | Stabilize

Stabilization Data Fields are Optional (i.e. complete whichever readings for parameters required by QAPP, Site or Permit). Some fields may be deleted from four (4) field measurements are required by Permit/Permit Type. If a field is not to be filled in, leave blank, do not enter dashes, N/A, etc.) Enter field values and numbers only as appropriate, do not enter text.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (SU)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (NTU)	DO (mg/L - ppm)	eH/ORP (mV)	Other: Units:

Final Field Readings are required (i.e. record field measurements from last stabilized readings prior to sample readings before removing for all field parameters required in Permit/QAPP).

Sample Appearance: Odor: None Color: Amber Other:

Weather Conditions (required daily, or as conditions change): Direction/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State and WM protocols (if more than one sampler, all should sign).

Date	Name	Signature	Company
1/16/25	Kenneth Smith	[signature]	Arcadis

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: FRL

Site No.:

Sample Point: P3024

Sample ID

This Waste Management Field Information Form is Required
This form must be completed in addition to any State Forms. This Field Form is submitted along with the Chain of Custody forms that accompany the sample containers (i.e. with the cooler that is received by the laboratory)

Laboratory Use Only/Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 hr Clock)	ELAPSED HRS (decimal)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
04 06 25	1355	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Level Before Taking Flow Out and Water Level After Collecting Sample. Also, Remove "Actual Vol Purged" Below:

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: ... Dedicated: (Y) or N

Filter Device: Y or (N) Type: ____ or ____ (Pore Size in Microns)

Purging Device: C

A- Submersible Pump
B- Peristaltic Pump
C-QED Bladder Pump
D-Bailer
E-Fisher Pump
F-Dipper/Scoop

Sampling Device: C

X-Other: ____

Filter Type:

A-In-line Disposable
B-Pressure
C-Vacuum
X-Other: ____

Sample Tube Type:

A-Teflon
B-Stainless Steel
C-PVC
D-Polypropylene
X-Other: ____

WELL DATA

Well Elevation (at TOC): 5705.5 (0.01ft)

Depth to Water (DTW) (from TOC): 21.10 (ft)

Groundwater Elevation (use datum, from TOC): 5684.40 (0.01ft)

Total Well Depth (from TOC): ____ (ft)

Stick Up (from ground elevation): ____ (ft)

Casing ID: ____ (in)

Casing Material: ____

Note: Total Well Depth, Stick Up, Casing ID, and Casing Material only to be filled out when historical data varies - required at first event. Well elevation, DTW and Groundwater Elevation must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate(L/min) 0.1 LPM	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (NTU)	DO (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1316	0.1	7.30	1911	13.7		0.6		
1326		7.15	1980	13.9		0.61		
1340		7.19	1827	13.8		0.6		
1355		7.12	1895	13.5	25	0.6	120	
Suggested range for 3 consec. readings at most Permit/State requirement		+/- 0.2	+/- 3%	-	-	+/- 0%	+/- 25 mV	Stabilize

Small Diameter Thin Wells are Optional (i.e. a single set of readings for parameters required by WM, Site, or State). These fields can be used when four (4) sets of measurements are required by State/Permit. (In Data Logger to enter. Use these boxes to write down readings before and when electronic data requested to Site. If more sets of readings are needed use remarks sheet or form

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (NTU)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ Units: ____

Final Field Readings are required - i.e. second set of measurement (final stabilized readings, previous sample readings) before sampling for all field parameters required by State/Permit/etc.

Sample Appearance: ____ Odor: None Color: None Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign)

Date	Name	Signature	Company
4/6/25	[illegible]	[signature]	[illegible]

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: [illegible]

Site No.: [ ]

Sample Point: [illegible] (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed in addition to any sites Forms. The Field Form is submitted along with the Chain of Custody forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only (LAB ID.)

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 H Clock)	ELAPSED HRS (Decimal)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
[illegible]	[illegible]				

Note: For Casing Sampling, replace "Water Col in Casing" and "Well Vols Purged" w/ Enter below Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark Targets, record and data below.

PURGE & SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated: [Y] or [N] Filter Device: [Y] or [N] [0.45µ] or [ ] Other/Grab

Purging Device [ ] A- Submersible Pump D-Bailer
B-Peristaltic Pump E-Piston Pump
C-QED Bladder Pump F-Dipper/Bomb

Filter Type: [ ] A-Inline Disposable C-Vacuum
B-Pressure X-Other

Sampling Device [ ] A-Teflon C-PVC X-Other
B-Stainless Steel D-Polypropylene

A-Other [ ] Sample Tube Type [ ]

WELL DATA

Well Elevation (at TOC) [ ] (ft msl) Depth to Water (DTW) (from TOC) [ ] (ft) Groundwater Elevation (mls datum, from TOC) [ ] (ft msl)

Total Well Depth (from TOC) [ ] (ft) Stick Up (from ground elevation) [ ] (ft) Casing ID [ ] [ ] (in) Casing Material [ ]

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and are to be filled out as desired, unless required by Site Forms. Well Elevation, DTW, and Groundwater Elevation must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 H Clock)	Rate/Unit	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
[illegible]	1st		1st					
	2nd		2nd					
	3rd		3rd					
	4th		4th					

FIELD INFORMATION FORM

Site Name: 4 RL

Site No.:

Sample Point: P3 | 5 | 4

Sample ID

This Waste Management Field Information Form is Required
This form will be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that documents the sample containers (i.e. with the containers supplied by the laboratory).

Laboratory Use Only (Lab ID)

WASTE MANAGEMENT

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (minutes)	WATER VOL IN CASING (Gallons)	ACTUAL VOL. PURGED (Gallons)	WELL VOLs PURGED
4/16/25					

Note: For Passive Sampling, replace "Purge Info" w/ Deployment and Well Int. Purged w/ Water Vol for Pkrs (if Used) Elapsed Time Well Vol. Purged. Make changes as needed, and below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment Dedicated? [Y] or [N] Filter Device? [Y] or [N] [0.45] µ or [ ] µ (circle or fill in)

Purging Device: A-Submersible Pump, B-Bladder, D-Peristaltic Pump, E-Piston Pump, G-QED Bladder Pump, F-Dipper/Bottle

Sampling Device:

X-Other:

Filter Type:

A-In-line Disposable, C-Vacuum, B-Pressure, X-Other

Sample Tube Type:

A-Teflon, C-PVC, B-Stainless Steel, D-Polypropylene, X-Other:

WELL DATA

Well Elevation (ft TOC): 1973.27 (Feet)

Depth to Water (DTW) (from TOC): 1 [illegible] (ft)

Groundwater Elevation (ft relative to Mean Sea Level from TOC): 1952.4 (Feet)

Total Well Depth (from TOC): (ft)

Stick Up (+/-) from ground elevation: (ft)

Casing ID: (in)

Casing Material:

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and can be from historical data unless required as Staff Gauge. Well Elevation, DTW, and Groundwater Elevation must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Time	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	DO (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1110		7.16	231			0.1		
1116		7.07	2					
1126		7.07	235					
1134		7.05	236	8.7		0.1	-120.9	
Suggested range for 3 consec. readings or per Permit/State requirements		+/- 0.2	+/- 10%			+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM, Inc. or State. These fields can be used above for all field measurements, as required by State/Permit, i.e. Data Logger or other Electronic format, or may be omitted altogether, depending on Site requirements. If no stabilization data are needed, use remaining space for Comments, below.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L ppm)	eH/ORP (mV)	Other: Units

Field Blank Readings are Required. Use above fields for all field measurements. Insert individual readings per site sample readings before sampling for all field parameters as required by State/Permit/Site.

FIELD COMMENTS

Sample Appearance: Odor: Color: Other:

Weather Conditions (required daily, or as conditions change): Direction/Speed: Outlook: Precipitation Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/16/25	[illegible] Smith		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: ARL

Site No.: | | | | | Sample Point: P 2 L 3 C (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Data is summarized along with the Chain of Custody forms that accompany the sample containers sent with the order that is received in the laboratory.

Laboratory Use Only/Lab ID

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (Decimal)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
0 5 1 7 2 5	0 8 2 0				

Note: For Passive Sampling, replace "Water Column Cased With Well Properties" Above with Data Pertaining to Passive Sampler Deployment. Mark changes made on field sheets. Note.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: D Dedicated [ ] or N [ ] Filter Device: Y [ ] or [N] 0.45 µ or [ ] µ (circle or fill in)

Purging Device: C
Sampling Device: C
X-Other:

A- Submersible Pump D-Bailer
B-Peristaltic Pump E-Piston Pump
C-QED Bladder Pump F-Dipper/Bottle

Filter Type: [ ]
A-In-line Disposable C-Vacuum
B-Pressure X-Other

Sample Tube Type: [ ]
A-Teflon C-PVC X-Other
B-Stainless Steel D-Polypropylene

WELL DATA

Well Elevation (M HOC) [ ] (Datum)
Depth to Water (DTW) (from TOC) [ ] (ft)
Groundwater Elevation (ude depth, from TOC) [ ] (Datum)
Total Well Depth (from TOC) [ ] (ft)
Slotz Up (from ground elevation) [ ] (ft)
Casing ID [ ] (in)
Casing Material [ ]

Note: Prior Well Depth, Well Up Casing Mat'l are optional and can be from historical data unless required by State Permit. Prior elevation DTW and Groundwater Elevation must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Cnt L/Min	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (NTU)	DO (mg/L - ppm)	+/-ORP (mV)	DTW (ft)
0 8 1 2 C	0 4	7 3 3	1 3 2 6	9 0		0 6		
0 8 3 0		7 6 5	1 3 2 5	9 1 0		0 1		
0 8 3 5		6 9 7	1 3 1 6	9 0		0 0		
0 8 4 0		6 9 5	1 3 1 5	9 0	5 0	0 0	- 1 1 7	
Suggested (e.g., for Water Column or per Permit/State requirements)		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 20 mV	Stabilize

Stabilization Data Fields are Optional for complete stabilization reading per parameters required by WM, Site, or State. These fields can be used where prior (1) field measurements are required by State/Permit/Site. If other Loggers or other Electronic Probes used, fill in field readings below and above as needed and required by Site. If more field sheets are needed, use separate sheet(s) for

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	+/-ORP (mV)	Other: Cells

Final Field Readings are required - i.e. record field measurements (field stabilized readings, parameter specific readings before sampling for all fields/parameters required by State/Permit/Site

FIELD COMMENTS

Sample Appearance: Odor: None Color Normal Other:

Weather Conditions (required daily or as conditions change): Temp/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): Well empty

Identify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
5 / 1 7 2 5	M. Hughes		

DISTRIBUTION: WHITE/ORIGINAL - Stay with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: GMZ

Site No.:

Sample Point: ___ sample ID

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompany the sample containers (all with the same ID) that is received by the laboratory.

Laboratory Use Only Label(s)

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED

Note: For Passive Sampling, replace "Water Vol in Casing" and "Water Vol Purged" w/ Water Lvl to Bottom of Well and Water Lvl to Top of Well Screened. Start changes in conductivity, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment Dedicated: Y | N | Filter Device: Y | or | N | Pump ___ or ___ psi (or other unit)

Purging Device: ___ A-Submersible Pump B-Bailer U-Peristaltic Pump E-Piston Pump C-QED Bladder Pump F-Dipper/Bottle

Filter Type: ___ A-In-line Disposable C-Vacuum B-Pressure X-Other

Sampling Device: ___

X-Other:

Sample Tube Type: A-Teflon C-PVC X-Other: B-Stainless Steel D-Polypropylene

WELL DATA

Well Elevation (at TOC): (ft/msl) Depth to Water (DTW) (from TOC): (ft) Groundwater Elevation (the datum is from TOC): (ft/msl)

Total Well Depth (from TOC): (ft) Stick Up (from ground elevation): (ft) Casing ID: ___ (in) Casing Material:

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from an external doc. Leave blank for Stabilization. Well Elevation, DTW, and Groundwater Elevation are necessary for calculations.

STABILIZATION DATA (Optional)

Sample Time (2400 hr Clock)	Rate/Vol	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	D.O (mg/L - ppm)	eh/ORP (mV)	DTW (ft)
	1"	1"	1"					
	2"	2"	2"					
	3"	3"	3"					
	4"	4"	4"					
Suggested range for 3 passes: readings or rate between/within 3 passes		+/- 0.2	+/- 3%			+/- 10%	+/- 20 mV	Stabilize

Stabilization Data Fields are Optional if a complete stabilization reading for parameters required by RMI, Site or State. These fields can be used where paper (ie, field map/drawing) are required by State/Permit. If a Data Logger or other electronic format is used, fill in final readings below and refer to electronic data recorded in file. If more than three passes are required, use the comments section of this form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eh/ORP (mV)	Other: Units:

Final Field Readings are required. *Use recent field measurements, final stabilized readings, prior to sample readings, before sampling for all field parameters required by State/Permit/Site.*

FIELD COMMENTS

Sample Appearance: Odor: NONE Color: Other:

Weather Conditions (record daily, or as conditions change). Direction/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required).

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all must sign):

Date Name Signature Company

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

WASTE MANAGEMENT

Site Name: ERL

Site No.:

Sample Point: B304C

Sample ID

This Waste Management Field Information Form is Required.
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompany the sample container(s) (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only-Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
11 12 12	0940				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" with "Vol in Tubing/Flow Cell" and "Tubing/Flow Cell Vols Purged". Mark changes, record field notes below.

PURGE/SAMPLE EQUIPMENT

Pumping and Sampling Equipment Dedicated: Y | N

Filter Device: Y or N | Qty: | Size: | or | µ (circle or list one)

Purging Device: | A-Submersible Pump | B-Bailer | E-Piston Pump | C-QED Bladder Pump | F-Dipper/Bottle

Sampling Device: | A-Submersible Pump | B-Bailer | E-Piston Pump | C-QED Bladder Pump | F-Dipper/Bottle

Filter Type: | A-In-line Disposable | B-Pressure | C-Vacuum | X-Other

Sample Tube Type: | A-Teflon | B-Stainless Steel | C-PVC | D-Polypropylene | X-Other

X-Other

WELL DATA

Well Elevation (at TOC): 9934 (ft msl)

Depth to Water (DTW) (from TOC): 6.53 (ft)

Groundwater Elevation (site datum, from TOC): 9534 (ft msl)

Total Well Depth (from TOC): (ft)

Stick Up (ft+/-, ground elevation): (ft)

Casing ID: (in)

Casing Material:

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data unless required by StorPerm. Well Elevation, DTW and Groundwater Elevation must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Volume Purged (Gal.)	pH (unit)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
0918	0.5	6.66	1628	14.4		1.1		
0922	1	6.57	1110	14.7		10.3		
0927	1.5	6.53	1064	14.6		9.7		
0932	2	6.59	1113	14.6	20	9.6	24	
Suggested range for Purged Volume or use Permit/State requirements.		+/- 0.2	+/- 3%	+/-		+/- 10%	+/- 20 mV	Survey

Stabilization Data Fields are Optional (i.e. consistent stabilization readings for parameters required by WM, Site, or State). Water field shall be used when low-flow (Bladder) sampling is required by State/Permit. (i.e. Data Logger, or other Electronic format is used, pH to 2 decimals, temperature to 1 decimal). Ensure field meters are properly calibrated per manufacturer's instructions.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: / Units

Final Field Readings are required. (i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/WM)

FIELD COMMENTS

Sample Appearance: Odor: None Color: Clear Other:

Weather Conditions (required daily, or as conditions change): Direction/Speed: Rainfall: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should signs)

Date	Name	Signature	Company
12/12/12	[illegible]	[illegible]	AII

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: GW-1

Site No.:

Sample Point.

Sample ID

This Waste Management Field Information Form is Required
This form is to be completed in addition to any State Forms. The Field Person is responsible along with the Chain of Custody Form that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 hr Clock)	ELAPSED HRS (hours)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED

Note: For Passive Sampling, replace Water Vol in Casing/Total Well Vol. Purged w/ Time Collected/Retrieved and Temp/Time Cal Unit Purged. Add changes to comments section, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment Dedicated: [Y] or [N]

Filter Device: [Y] or [N] [0.45 µ] or [ ] µ (circle one)

Purging Device: [ ]
A- Submersible Pump
B Peristaltic Pump
C-QED Bladder Pump
D-Bailer
E Peleton Pump
F-Dipper/Bottle

Sampling Device: [ ]

X-Other

Filter Type: [ ]
A-In-line Disposable
B-Pressure
C-Vacuum
X-Other

Sample Tube Type: [ ]
A-Teflon
B-Stainless Steel
C-PVC
D Polypropylene
X-Other

WELL DATA

Well Elevation (at TOC) (ft msl)

Depth to Water (DTW) (from TOC) (ft)

Groundwater Elevation (calculated from TOC) (ft msl)

Total Well Depth (from TOC) (ft)

Stick Up (from ground elevation) (ft)

Casing ID [ ] (in)

Casing Material

Note: Total Well Depth, Stick Up, Casing ID, etc are optional, use as appropriate or more useful; required for Elevated Well Elevation, DTW and Groundwater Elevation must be complete.

STABILIZATION DATA (Optional)

Sample Time (2400 hr Clock)	Rate/Unit	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L ppm)	eH/ORP (mV)	DTW (ft)
		1st	1st	1st	1st	1st	1st	1st
		2nd	2nd	2nd	2nd	2nd	2nd	2nd
		3rd	3rd	3rd	3rd	3rd	3rd	3rd
		4th	4th	4th	4th	4th	4th	4th
Suggested range for 3 consecutive readings (see Parameter requirements)		+/- 0.2	+/- 5%	+/- 1	+/- 10%	+/- 10%	+/- 25 mV	stable

Stabilization Data Fields are Optional for complete stabilization readings for parameters required by WM, State or Site. Data fields can be used when four (4) field measurements are required in State Procedures. If a Data Logger or other Electronic format is used, fill in four readings below and submit the report along with COC to Site. If more fields above are supplied, use attached sheet or form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L ppm)	eH/ORP (mV)	Other: _____ Units _____

Final Field Results are required. Use stabilized field measurements, final stabilized readings, passive sampler readings before sampling for all field parameters required by State/Site/WM.

FIELD COMMENTS

Sample Appearance: _____ Odor _____ Color _____ Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
___/___/___			
___/___/___			

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: LRL

Site No.:

Sample Point: 13421L (Sample ID)

This Waste Management Field Information Form is Required. This form is to be completed, in addition to any State Forms. The Field Form is to be retained along with the Chain of Custody. Forms must accompany the sample containers (or with the cooler that is provided by the laboratory).

Lab Entry Use Only Lab ID:

PURGE INFO

PURGE DATE (Mo. DD YY)	PURGE TIME (2400 hr Clock)	ELAPSED HRS (to nearest)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
10 17 25	1135				

Note: For Low-Flow Sampling replace "Water Vol in Casing" and "Well Vol Purged" w/ "Water Lvl & Pump/Tube Vol Ml. Well Purged" Most changes recommended since below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated: [Y] or [N]

Filter Device: Y [or] [N] | 0.45µ | or _____ µ (circle or fill in)

Purging Device: C

Sampling Device: C

A- Submersible Pump; B- Peristaltic Pump; C- QED Bladder Pump; D- Bailer; E- Piston Pump; F- Dipper/Bottle

X-Other: _____

Filter Type: _____

A- In-line Disposable; B- Pressure; C- Vacuum; X- Other: _____

Sample Tube Type: _____

A- Teflon; B- Stainless Steel; C- PVC; D- Polypropylene; X- Other: _____

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (elevation, from TOC)
9472 (feet)	215 (ft)	9257 (ft msl)

Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
(ft)	(ft)	(in)	

Note: Total Well Depth, Stick Up, Casing ID and Material are optional and are to be filled out once, unless repaired or Staff Gauge, Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (if/optional)

Sample Time (2400 hr Clock)	Rate (mL/min)	pH (std)	Conductance (SC/EC) (umhos/cm @ 25°C)	Temp. (°C)	Turbidity (ntu)	D.O (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1035	250	7.73	3516	7.5		0.0		
1040		7.71	3597	7.5		0.0		
1045		7.68	3534	7.5		0.0		
1050		7.66	3533	7.5	10.6	0.0	-170.2	
Suggested range for 3 source readings or 3 to 5 Well Volumes (if used)		+/- 0.2	+/- 10%	+/-	+/-	+/- 10%	+/- 20 mV	Subtract

Stabilization Data Field Use Optional (For example: stabilization readings for parameters required by WM, Inc. or State. These field data sheets and/or Low-Flow Forms (if used) must be retained for 5 years. If a Low-Flow Cell or water sheet is used, fill in final reading here and retain sheet/data separately. If more field sheets are needed, use separate sheet or form.)

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L - ppm)	eH/ORP (mV)	Other: Units:

Final Field Readings at the end of Well Purging (i.e. Well Field measurements). Final stabilized readings prior to sample readings before sampling for all field parameters required by State/Permit/Title.

FIELD COMMENTS

Sample Appearance: _____ Odor: None Color: Clear Other _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
10/17/25			

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: GL

Site No.: [ ]

Sample Point: [ ] (Sample ID)

This Waste Management Field Information Form is Required
(This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers sent with the cooler that is returned to the laboratory)

Laboratory Lot/Login ID

PURGE INFO

PURGE DATE (MM DD YY)	PURGE Time (2400 Hr Clock)	ELAPSED HRS (hours)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOL PURGED
04 17 95	1110				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vol Purged" = Water vol in Tubing from Calculations Tab. Vol Purged: Note changes made in field below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated [Y] or [N]

Purging Device: [ ] A-Submersible Pump B-Peristaltic Pump C-QED Bladder Pump D Bailer E Piston Pump F-Other/Bottle

Sampling Device: [ ] (same codes)

X-Other: [ ]

Filter Device: [Y] or [N] [0.45µ] or [ ] µ (circle or fill in)

Filter Type: [ ] A-In-line Disposable B-Pressure C-Vacuum X-Other [ ]

Sample Tube Type: [ ] A-Teflon B-Stainless Steel C-PVC D-Polypropylene X-Other [ ]

WELL DATA

Well Elevation (at TOC): 1014.94 (ft msl)

Depth to Water (DTW) (from TOC): [ ] (ft)

Groundwater Elevation (calculated, from TOC): 945.01 (ft msl)

Total Well Depth (from TOC): [ ] (ft)

Stick Up (from ground elevation): [ ] (ft)

Casing ID: [ ] (in)

Casing Material: [ ]

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and can be left on historical data unless required by State Forms. Well Elevation (TOC) and Groundwater Elevation are required.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit gpm	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	DO (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1115	.04 1st	7.34 1st				0.11		
1120	2nd	7.52 2nd				0.04		
1125	3rd	7.6 3rd				0.12		
1130	4th	7.7 4th			15.7	0.11	-1	
Stabilization Criteria: (Optional)		± 0.2	+/- 3%	—	—	+/- 10%	+/- 20 mV	Stable Level

Stabilization Data Fields are Optional for completion and calculations. Only for parameters required by WM Site or Client. These fields can be used to record four (4) final measurements required by State Permit, i.e. If a Data Logger or other Electronic Device is used. Write down readings before and after each sample is taken. If more fields than are provided, use Remarks Section or Form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required. (i.e. record of final measurements, final stabilized readings prior to sample readings before sampling for all field parameters required by State Permit(s).)

Sample Appearance: [ ] Odor [ ] Color: [ ] Other: [ ]

Weather Conditions (required daily, or as conditions change): Direction/Speed [ ] Outlook: [ ] Precipitation [Y] or [N]

Specific Comments (including purge/well volume calculations if required): [ ]

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sample, all should sign):

04 17 95 Kenneth Smith Alliance

Date | Name | Signature | Company

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: EZL

Site No.:

Sample Point: MW-22L

Sample ID

This Waste Management Field Information Form is Required
This form is to be completed in addition to any State forms. The Field Form is taken (to) along with the Chain of Custody Form that accompany the sample containers to the lab and that is returned to the laboratory.

Laboratory Use Only Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 H Clock)	ELAPSED HRS (Minutes)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 17 25	1235				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Filter Cell and "Tubing Vols Cell Vol Purged" after Sample record field data below

PURGE/SAMPLER EQUIPMENT

Purging and Sampling Equipment Dedicated: Y or N — Filter Device: Y or N — Prep ? or N — If yes, circle all that apply

Purging Device: A-Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bailer

Sampling Device: C

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other

X Other:

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Develop (pre-datum, from TOC)
1054.75 (ft-msl)	15.62 (ft)	9.83 (Date)

Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
(ft)	(ft)	1 (in)	

Note: Total Well Depth, Stick Up, Casing ID and Material are not required unless you're doing Aquifer Testing, unless required by Site Permit. Well Elevation, DTW, and Groundwater Develop must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Reading Num	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	DO (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1215	1st	7.54	1754	5.4		6.0		
1316	2nd	7.43	1825	5.2		10.0		
1326	3rd	7.40	1853	5.2		5.0	-104	
1330	4th	7.38	1812	5.2	4.5	4.6	-4	

Suggested range for Stabilization readings per Permit/State requirements: +/- 0.2 | +/- 3% | +/- 10% | +/- 10 mV | Stabilized

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM, Site, or State). Note: fields with red asterisks (*) field requirements are required by State/Permit. If a Discharge to other Outfalls, Sewer(s), and/or Surface Water(s) before and during discharge) is true, then more frequent and accurate readings are required.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ (units)

Final Field Readings are required (i.e. record field measurements from stabilized readings, purge sample readings before sampling, for all field parameters required by State/Permit/Site)

FIELD COMMENTS

Sample Appearance: Odor: None Color: Clear Other:

Weather Conditions (required daily, or as conditions change): Direction/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): Pump would not take water to sample

Certify that sampling procedures were in accordance with applicable EPA, State and WM protocols (if more than one sampler, all should sign).

Date	Name	Signature	Company
4/17/25	[illegible]	[illegible]	[illegible]

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.:

Sample Point: 1 3 4 C

Sample ID

This Waste Management Field Information Form is Required. This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form(s) that accompany the sample containers (i.e. with the cooler that is shipped to the laboratory).

Laboratory Use Only/Lab ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (minutes)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
10 17 25	1315				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ "Water Vol in Tubing/Screen Filter" and "Tubing/Screen Filter Vols Purged". Mark changes, non-applicable data "NA".

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment - Dedicated: Y or N

Filter Device: Y or N | 0.45 µ | Other (size)

Purging Device: C

A- Submersible Pump, B-Bailer, D-Peristaltic Pump, E- Piston Pump, C-QED Bladder Pump, F-Dipper/Bottle

Sampling Device: C

Filter Type:

A-In-line Disposable, B-Pressure, C-Vacuum, X-Other

X-Other:

Sample Tube Type:

A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other

WELL DATA

Well Elevation (at TOC): 9528 (feet)

Depth to Water (DTW) (from TOC): 26.5 (ft)

Groundwater Elevation (site datum, from TOC): 9473.7 (feet)

Total Well Depth (From TOC): (ft)

Stick Up (from ground elevation): (ft)

Casing ID: (in)

Casing Material:

Note: Total Well Depth, Stick Up, Casing ID, etc. are entered once per location unless otherwise requested by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Vol (LPM)	pH (std)	Conductance (SC @ 25°C) (umhos/cm @ 25°C)	Temp. (°C)	Turbidity (ntu)	DO (mg/l - ppm)	eH-ORP (mV)	DTW (ft)
1310	0.3 1"	6.92 1"	1215 1"	8.0 1"	1"	0.12 1"	1"	1"
1315	2"	6.85 2"	1343 2"	8.10 2"	2"	0.10 2"	2"	2"
1320	3"	6.91 3"	1359 3"	7.96 3"	3"	0.10 3"	3"	3"
1325	4"	6.79 4"	1337 4"	8.7 4"	0.15 4"	0.09 4"	-0.7 4"	4"
Suggested range for 3 readings or site/Permit specific:		+/- 0.1	+/- 3%	-	-	+/- 10%	+/- 10 mV	Subtract

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where several field measurements are required by State/Permit/Site. Use Note Logger or other Excel-type format and fill in final readings below and attach electronic data (preferred) to this FIELD form when required per permit/plan/SAP.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (Microohms @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L - ppm)	eH-ORP (mV)	Other: Units

Final Field Readings are required for entered field measurements. Enter additional readings, pre-/post-sample readings before sampling for all field parameters required by State/Permit/Site.

FIELD COMMENTS

Sample Appearance:

Odor:

Color:

Other:

Weather Conditions (required daily, or as conditions change):

Direction/Speed:

Outlook:

Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

Certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one Sampler, all should sign):

Date

Name

Signature

Company

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: FRL

Site No.:

Sample Point: PZ-24L

Sample ID

This Waste Management Field Information Form is Required
The form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only-Lab ID:

PURGE INFO

PURGE DATE (MM/DD/YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hrs:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
04/17/25	1515				1.1

Note: For Passive Sampling, replace "Water Volume Casing" and "Well Vols Purged" w/ Water Vol in Polyeth/Flex Collapsed tubing+Hex Cont Rods Purged. Attach Images as an Electronic Notes.

PURGE/SAMPLING EQUIPMENT

Purge and Sample Equipment Dedicated: Y or N

Purging Device: C

Sampling Device: C

A-Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper/Bottle; X-Other

Filter Device: Y or N; 0.45 µ or ____ µ (circle one)

Filter Type:

A-In-line Disposable; B-Pressure; C-Vacuum; X-Other

Sample Tube Type:

A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other

WELL DATA

Well Elevation (at TOC): 9804 (feet)

Depth to Water (DTW) (from TOC): 11.41 (ft)

Groundwater Elevation (site datum, from TOC): 9484.59 (feet)

Total Well Depth (from TOC): ____ (ft)

Stick Up (from ground elevation): ____ (ft)

Casing ID: ____ (in)

Casing Material:

Note: Total Well Depth, Stick Up, Casing ID etc., are optional and may be from historical data, unless required by Site/Permit. Well Elevation, DTW and Groundwater Elevation, must be entered.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Vol (mL/L)	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1356	200	1st 7.21	1st 716	9.7		1.0		
1515		2nd 7.25	2nd 558	9.6		0.0		
1610		3rd 7.28	3rd 550	9.7		0.0		
1615		4th 7.32	4th 549	9.7		0.0	-13.7	

Suggested stdg. for Low Flow Sampling per Permit/State requirements: +/-0.2 | +/-3% | | | 10% | +/-10 mV | stable or

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required in Well Spec or Permit). Above fields can be used where four (4) field measurements are required (e.g. State/Permit) for a Well Purge or other Electronic groundwater field sampling data (not natural resources, also separately) to Site. Comments fields above are provided for multiple sheets or use.

FIELD DATA

SAMPLE DATE (MM/DD/YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ Units ____

Final Field Readings are required. Use second field measurement (final stabilized reading) per or sample readings before sampling for all field parameters required by State/Permit(s).

Sample Appearance: ____ Odor: None Color: Clear Other: ____

Weather Conditions (original daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign).

Date	Name	Signature	Company
4/17/25	[illegible]	[signature]	[illegible]

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: GBL
Site No.:
Sample Point: P30 1L
Sample ID

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any Sole Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that contains the sample(s))

Laboratory Use Only/Lot ID

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (previous)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
4 17 15	1400	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Wat Vols Purged" w/ Water Vol in Sample Flow Cell and "Sample Flow Cell Vols Purged". Most changes, record data in this section

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment : Dedicated: Y or N | Filter Device: Y or N | 0.45µ | ea | µ (circle one)

Purging Device: 1
Sampling Device: 1
A- Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper/Bomb; X-Other

Filter Type: A-In-line Disposable; B-Pressure; C-Various; X-Other

Sample Tube Type: A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other

WELL DATA

Well Elevation (at TOC): 970.11 (ft msl)
Depth to Water (DTW) (from TOC): 1.30 (ft)
Groundwater Elevation (calc'd using DTW from TOC): 968.81 (ft msl)
Total Well Depth (from TOC): (ft)
Stick Up (from ground elevation): (ft)
Casing ID: in
Casing Material:

Note: Total Well Depth, Stick Up, Casing ID are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit 150 mL	pH (std)	Conductance (SC/EC) (µmhos/cm or µS/cm)	Temp. (°C)	Turbidity (NTU)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1425	0.4 1st	6.73 1st	513	10.7		0.4		
1430	2nd	6.74 2nd	512	10.7		0.4 2nd		
1435	3rd	6.70 3rd	530	10.7		0.4 3rd		
1440	4th	6.65 4th	531	10.7	1.74	0.4 4th	-118.1	
Required range for 3 passes' readings to meet Permit/Spec requirements:		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 20 mV	Inches

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field readings are required by State/Permit. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately as well. If more field meters are needed, add appropriate sheet or note*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (NTU)	DO (mg/L - ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field meter readings, final stabilized readings, prior to sample readings before sampling for all field parameters required by State/Permit/Site)*

Sample Appearance: Odor: Color: Other:

Weather Conditions (required daily, or as conditions change): Direction/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State and WM protocols (if more than one sampler, all should sign)

Date	Name	Signature	Company
4 . 17 . 15	[illegible]	[illegible]	[illegible]

DISTRIBUTION: WHITE-ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No:

Sample Point: P355L

Sample ID

This Waste Management Field Information Form is Required. This form is to be completed in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompanies the sample containers (or with the order that is supplied by the laboratory).

Sub-Facility Use Only-Loc ID:

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (minutes)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 17 25	1023				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vol Purged" w/ Time Well Is Developed For (Hrs) and Developed On (Date). Also Purged, Start Purge, Stop Purge, Sample Collected, Etc.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling equipment... Dedicated [Y] or N

Filter Device: Y or [N] Size: ____ or ____ µ (circle or fill in)

Purging Device: [ ]

Sampling Device: [ ]

A-Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper/Bucket

Filter Type: [ ]

A-In-Line Disposable; B-Pressure; C-Vacuum; X-Other: ____

Sample Tube Type: [ ]

A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other: ____

X-Other: ____

WELL DATA

Well Elevation (at TOC): 949.98 (ft msl)

Depth to Water (DTW) (from TOC): 49.75 (ft)

Groundwater Elevation (calculated, from TOC): 900.23 (ft msl)

Total Well Depth (from TOC): ____ (ft)

Stick Up (from ground elevation): ____ (ft)

Casing ID: ____ (in)

Casing Material: ____

Note: Total Well Depth, Stick Up, Casing ID, and Casing Material are optional entries for information/data unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be recorded.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate (L/min)	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp. (°C)	Turbidity (ntu)	D.O (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1st 1020	0.2	7.11	4.67	12.2		0.2		
2nd 1023		7.15	4.68	12.2		0.0		
3rd 1026		7.19	4.70	12.2		0.0		
4th 1029		7.20	4.67	12.3	1.02	-0.0	0	
Suggested range for 3 consec. readings or user-defined criteria		+/- 0.1	+/- 3%	—	—	+/- 10%	+/- 20 mV	Stable

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM Site or State. These fields can be used where four (4) Grab or Composite are required by Site Permit/Site. Use Data Logger or other electronic forms to send all required readings below and submit electronic data separately to the ____ (if none, write N/A) or provide them on paper.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L - ppm)	eH/ORP (mV)	Other: ____ Units: ____

Final Field Readings are required (i.e. meet all field requirements, final pH/other readings, pass sample readings before sampling for all field parameters required by State/Permit).

Sample Appearance: ____ Odor: None Color: Yellow Other: ____

Weather Conditions (required daily, or as conditions change). Thermometer/Sprayer: ____ Clouds: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
04/17/25	N/A		

DISTRIBUTION: WHITE/ORIGINAL - Ships with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: [illegible]
Site No.:
Sample Point:
Sample ID

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State forms. The Field Form is submitted along with the Chain of Custody forms that accompany the sample containers (i.e. with the cooler that is received by the laboratory)

Laboratory Use Only/Lab ID

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 hr Clock)	ELAPSED HRS (Decimal)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
1 1 1 2 5	[illegible]				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Pipe, Vol of Tubing/Pipe Vol Over Purged. Mark Changes recorded below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated [Y] or [N]
Pumping Device: [ ]
A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle
Sampling Device: [ ]
X-Other
Filter Device: [ ] or [N] [ ] or [ ] µ (circle or fill in)
Filter Type: [ ]
A-In-line Disposable, B-Pressure, C-Vacuum, X-Other
Sample Tube Type: [ ]
A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other

WELL DATA

Well Elevation (at TOC) (ft msl)
Depth to Water (DTW) (from TOC) [illegible] (ft)
Groundwater Elevation (elic datum, from TOC) (ft msl)
Total Well Depth (from TOC) (ft)
Stick Up (from ground elevation) (ft)
Casing ID [ ] (in)
Casing Material

Note: Total Well Depth, Stick Up, Casing ID, or any optional one can be from manufacturer's info, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be surveyed.

STABILIZATION DATA (Optional)

Sample Time (2400 hr Clock)	Rate/Unit	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	DO (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	3rd	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	3rd	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4th	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Suggested range for 3 consecutive readings per Field Sampling Guidelines		+/- 0.2	+/- 3%			+/- 10%	+/- 25 mV	+/- 0.01 ft

Stabilization Data Fields are Optional for complete stabilization tracking for parameters required by WM, Inc. or State. These fields may be used where four (4) field measurements are required by State/Permit (i.e. Low Flow or other alternate purging methods) and submitted with the Sampling Results. If more fields than are provided are needed, use additional sheet(s).

FIELD DATA

SAMPLER DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required (i.e. record field measurements just before leaving sample location. Purge multiple readings before recording for all field measurements required per method/permit).

Sample Appearance: Odor: Color: Other:

Weather Conditions (required daily, or as conditions change): Direction/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

[illegible] [illegible] [illegible] [illegible]

Date Name Signature Company

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.:

Sample Point: P342C

Sample ID

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompany the sample containers / vials that is received by the laboratory.

Laboratory Use Only/Lab ID

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (minutes)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 18 25	1014		1		

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vol Purged" w/ Water Vol in Tubing/Tote (ml and Tubing ID) + Cell Vol. Purged. Move Purged to end of table (also)

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated [Y] or N

Purging Device [C]: A-Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper/Bucket; X-Other

Sampling Device [C]

Filter Device [Y] or [N] [Large] or [ ] µ (circle or fill in)

Filter Type: [A]: A-In-line; B-Pressure; C-Vacuum; D-Disposable; X-Other

Sample Tube Type: A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other

WELL DATA

Well Elevation (at TOC) (ft msl):

Depth to Water (DTW) (from TOC): 22.6 Ft

Groundwater Elevation (use Datum, from TOC) (ft msl):

Total Well Depth (from TOC):

Stick Up (from ground elevation):

Casing ID (in):

Casing Material:

Note: Total Well Depth, Stick Up, Casing ID, and Casing Material are optional and can be taken sometimes, some sequences. See Notes. Well Elevation, DTW, and Groundwater Elevation must be recorded.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Purge/Time LAM	pH (min)	Conductance (SC/EC) (umhos/cm @ 25°C)	Temp. (°C)	Turbidity (ntu)	DO (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1045	ON 1st	7.42 1st	320 1st	7.6		0.0		
1050	2nd	7.47 2nd	304 2nd	7.6		0.0		
1055	3rd	7.55 3rd	300 3rd	7.6		0.0		
1100	4th	7.50 4th	300 4th	7.5	7.3	0.0	191	
Suggested range for Passive sampling with Purge-Safe equipment		+/- 0.2	+/- 3%			+/- 10%	+/- 20 mV	Stabilize

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM, Site or State). Some fields may be used where four (4) field measurements are required before Preservation. If a Hach Logger or other Electronic sensor is used for in-flow reading, notes and record all sensor data requirements (i.e. Etc.). If more field observations are required, use continuation sheet or Field Notes.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L ppm)	eH/ORP (mV)	Other: Date

Final Field Readings recorded (i.e. record field measurements, final stabilized readings, purge sample readings before sampling for all field parameters required by State/Permit)

Sample Appearance:

Odor: Nil

Color: Nil

Other:

Weather Conditions (required daily, or as conditions change):

Direction/Speed:

Outlook:

Preservation: Y or N

Specific Comments (including purge/well volume calculations if required):

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/18/25	Mike Fiore		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

CLIENT COPY

FIELD INFORMATION FORM

Site Name: CRL

Site No.:

Sample Point: P2 2 3 4 (Sample ID)

This Waste Management Field Information Form is Required

This Form is to be completed and submitted to any Site Visitor. The Field Form is submitted along with the Chain of Custody Form that accompany the sample containers (i.e. with the cooler that is shipped to the laboratory)

Laboratory Use Only/Lab ID

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (minutes)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLS PURGED
04 18 25	1116				

Note: For Ferrous Iron Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol to Transmission Cell Vols Purged. Mark changes, recomputations below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated: [Y] or [N]

Filter Device: [Y] or [N] [0.45µ] or [ ] µ (Circle if Filtered)

Purging Device [ ]: A-Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device [Y]: X-Other: Tubing

Filter Type: [ ] A-In-line Disposable, B-Pressure, C-Vacuum, X-Other

Sample Tube Type: [ ] A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other

WELL DATA

Well Elevation (at TOC): 9437.2 (ft msl)

Depth to Water (DTW) (from TOC): 110.0 (ft)

Groundwater Elevation (this datum, from TOC): 9447 (ft msl)

Total Well Depth (from TOC): (ft)

Stick Up (Grnd. ground Elevation): (ft)

Casing ID: (in) Casing Material:

Note: Total Well Depth, Stick Up, Casing ID and Casing Material are to be measured and recorded before the monitoring event begins. Well Elevation, DTW, and Groundwater Elevation must be surveyed.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate (L per min)	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp. (°C)	Turbidity (NTU)	DO (mg/L - ppm)	eh/ORP (mV)	DTW (ft)
1115	0.2	7.46	3166	8.0		9.0		
1120		7.46	4007	7.9		9.5		
1125		7.46	4617	7.9		9.6		
1130		7.45	4655	8.0	1.6	9.0	-152	
Stabilization Criteria for 3 Consec. Readings (see Permit for requirements)		+/- 0.1	+/- 3%	-	-	+/- 10%	+/- 20 mV	Stabilize

Stabilization Data Fields are Optional: For sampler stabilization reading for parameters required by WM Site or State. Three (min.) or five (max.) field measurements are required to have completed the Data Logger or other Electronic form. If used, fill in final readings below and submit electronic data separately to lab. If more than three are needed, use separate sheet(s) from

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (NTU)	DO (mg/L-ppm)	eh/ORP (mV)	Other: Units

Final Field Readings are required: To record final sample results, final stabilized readings, parties sample readings before sampling to see all field parameters required by State/Permit/Site

FIELD COMMENTS

Sample Appearance: Odor: None Color: Clear Other:

Weather Conditions (record daily, or as conditions change): Direction/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign)

Date	Name	Signature	Company
04/18/25	Mike Hen		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

CLIENT COPY

APPENDIX B

Field Notes

ERL - Spring GW

MRH

4/15/25 0700 - 0820 Prep
0820 - 1940 Driving [illegible] Rig Daniel Heikes EOR cont'd

	S	
P325	0.03	1.76
P324	0.03	>3.30
P323	0.80	2.17
P321	0.28	0.74

P320L Jennifer Silberhorn on call
P320C2 Jamie + Daniel offsite
P320C
P290
~~P335L~~

ERL – Spring 2025

4/16/25 0630-0700 Post
0700 – 1830 Drilling / Post
KMS, Misti Darrell Hoke

Samples PW#77 Black Case PFAS
P338L PFAS
P334L PFAS Dup

	S	Fe^{++}
P338L	0.11	1.38
P334L	0.16	0.98
P302C	BDL	1.54

P29C
P301C
P302C

KMS Soil

P305C
P311L
P311D
P315L

ERL- Spring 2025

4/17/25 0630-0700 Rep
0700-0730 Driving back to ERL
Daniel Hickes EOR onsite

	S	Fe^{+3}
P313C	>0.80	0.61
P304C	0.05	0.40
P342L	0.06	0.43

Daniel Hickes offsite

P322L
P314C
P324L
P335C

KMS samples
401 OWA
468 OWA
P329L
P301L
P403C

ERL - Spring 2025

4/8/25 0700 - 0900 Pace delivery

0800 - 0900 Prep

0900 - 1400 Diving/work MRH KAS

Pump installed in P342C

Sealed

P342C

P333L

ERL

5/19/25 KMS ERL

.5 hr prep

900 - 1400 ONSITE/Driving

Gallons Purged

KMS 17 <5 ~2

16 0

15 0

14 <5 ~1

13 <5 ~1

12 0

11 ~~15 sampled~~ KMS 5/19/25 ~10

18 NO PUMP

19 <5 ~3

20 <5 ~2

6N - 371565 Totalizer reading

APPENDIX C

Chain of Custody

Pace® Location Requested (City/State):
Pace Analytical Minnesota
2700 Elm Street, Suite 200
Minneapolis, MN 55414

CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields

LAB USE ONLY- Affix Workorder/Login Label Here

Scan QR Code for instructions

Company Name:	Waste Management National Services, Inc.	Contact/Report To:	Anna Schneider
Street Address:	4800 MarketPointe Dr Suite 200 Minneapolis, MN 55435	Phone #:	(952)833-2731
		E-Mail:	aschneider@harr.com
		Cc E-Mail:	
Customer Project #:			
Project Name:	Elk River Landfill	Invoice To:	Accounts Payable
		Invoice E-Mail:	wminvoice@contractorcompliancecenter.com
Site Collection Info/Address (City, State):		Purchase Order # (if applicable):	19055273
		Quote #:	
Turn Time Requested: [ ] 5 Day [ ] 4 Day [ ] 3 Day [ ] 2 Day [ ] 1 Day [ ] Other		County / State origin of sample(s):	Minnesota
Data Deliverables: [ ] Level II [ ] Level III [ ] Level IV [ ] EDD/EDT [ ] Other		Regulation Program (Dw, RCRA, etc.) if applicable:	Reportable: [ ] Yes [ ] No
		Rush (Pre-approval required): [ ] Same Day [ ] 1 Day [ ] 2 Day [ ] 3 Day [ ] Other _____	Cert/PWSID # or WW Permit # as applicable:
		Date Results Requested:	Field Filtered (if applicable): [ ] Yes [ ] No
			Analysis:

Specify Container Size **

Specify Container Preservative Type***

Analysis Requested

** Container Size: (1) 1L, (2) 500mL, (3) 250mL, (4) 125mL, (5) 100mL, (6) 40mL vial, (7) 1oz, (8) 4oz, (9) 8oz, (10) 16oz, (11) 32oz, (12) Other

*** Preservative Type: (1) None, (2) HNO3, (3) H2SO4, (4) NaOH, (5) HCl, (6) Methanol, (7) Na2S2O3, (8) Zinc Acetate, (9) Ascorbic Acid, (10) NaHSO4, (11) Other

Lab Use Only

Proj. Mgr: Piper Gibbs

Acctnum / Quote ID:

Table #:

Profile / Template: 45904

Prelog / Bottle Ord ID: EZ 3249485

Pace Project No./ Lab I.D.

Sample Comment

Pace may combine non-conformance identified for sample

* Matrix Codes (Insert in MATRIX box below): Drinking Water (DW), Ground Water (GW), Waste Water (WW), Product (P), Soil (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Surface Water (SW), Sediment (SED), Sludge (SL), Caulk (CK), Leachate (LE), Biosolid (BS), Other (OT)

Customer Sample ID	Matrix *	Comp / Grab	Composite Start Date	Composite Start Time	Collected or Composite End Date	Collected or Composite End Time	# Cont.	Res. Chlorine Results	Res. Chlorine Units	EPA 1613B Water
P 249477	GW	G			4/11/12	0930	2			X
P 249478	GW	G			"	1150	2			X
P 249479	GW	G			"	1115	2			X
Duplicate	WT				4/11/12		2			X
Field Blank	WT				4/11/12	0530	1			X

Additional Instructions from Pace*:

Collected By (Printed Name): Mike Heintz

Signature:

Customer Remarks / Special Conditions / Possible Hazards:

# Coolers	Thermometer ID	Temperature Read (°C)	Corr. Temp (°C)	Corrected Temp (°C)	On Ice
1					Y

Relinquished by/Company: (Signature)	Date/Time	Received by/Company: (Signature)	Date/Time	Testing Remarks:
		Fed Ex/UPS/Client	4/13/12 7:38	
Relinquished by/Company: (Signature)	Date/Time	Received by/Company: (Signature)	Date/Time	Delivered by: [ ] Pace [ ] Courier [ ] Fedex [ ] UPS [ ] Other
Relinquished by/Company: (Signature)	Date/Time	Received by/Company: (Signature)	Date/Time	
Relinquished by/Company: (Signature)	Date/Time	Received by/Company: (Signature)	Date/Time	Page: 1 of 1

Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace® Terms and Conditions found at: http://www.pacelabs.com/resource-library/resources/pace-terms-and-conditions/

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
MNA Parameters

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program (DOD, ACRA, DW, etc):

Client Project #
200

Lab Project #
WMELKRIVMN-00023

Collected by (print):

Site/Facility ID #
MN02

P.O. #

Collected by (Signature):

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ 5TD T21

Quote #

Date Results Needed

Immediately Packed on Ice: N___ Y___

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Analysis / Container / Preservative: NO2,SO4,CL,Alk 125mlHDPE-NoPres	NO2NO3 HOLD 250mlHDPE-H2SO4	RSK 175L 40mlAmb-HCl	TOC 250mlAmb-HCl	VB260ULLC 40mlAmb-HCl	VB260ULLC 40mlAmb-HCl-BK	Remarks	Sample # (Lab only)
TB		GW				3						X		
P-302C		GW				9	X	X	X	X	X			
P-304C		GW				9	X	X	X	X	X			
P-313C		GW				9	X	X	X	X	X			
P-321C		GW				9	X	X	X	X	X			
P-323C		GW				9	X	X	X	X	X			
P-325C		GW				9	X	X	X	X	X			
P-326C		GW				9	X	X	X	X	X			
P-340C		GW				9	X	X	X	X	X			
P-338C		GW				9	X	X	X	X	X			

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier

Tracking #

Relinquished by: (Signature)

Date:

Time:

Received by: (Signature)

Trip Blank Received: Yes / No
HCL / MeoH
TBR

Relinquished by: (Signature)

Date:

Time

Received by: (Signature)

Temp: °C Bottles Received:

If preservation required by Login: Date/Time

Relinquished by: (Signature)

Date:

Time:

Received for lab by: (Signature)

Date:

Time

Hold:

Condition
NCF / OK

Sample Receipt Checklist
COC Seal Present/Intact: __NP __Y __N
COC Signed/Accurate: __Y __N
Bottles Arrive Intact: __Y __N
Correct Bottles Used: __Y __N
Sufficient Volume Sent: __Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N
RAD Screen <0.5 mR/hr: __Y __N

Chain of Custody Page 1 of 1

Pace
ANALYTICAL SERVICES

MT JULIET, TN

SDG #

Table #

Acctnum: **WMELKRIVMN**
Template: **T261646**
Prelogin: **P1144758**
PM: [redacted] T. Ann Harvill
FB

Shipped Via: **FedEx Priority**

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Analyses / Container / Preservative

Chain of Custody Page of

Pace
ANALYTICAL SERVICES, LLC
MT JULIET, TN

Report to:
Jim Eidem 952-832-2893

Email To:
acshneider@barr.com;datamgt@barr.com;jeide

Project Description:
MDA Spring Sampling (4)

City/State Collected

Please Circle:
PT MT CT ET

Regulatory Program/(DOD,RCRA,DW,etc):

Client Project #
200

Lab Project #
WMELKRIVMN-00006

SDG #

Collected by (print):

Site/Facility ID #
MN02

P.O. #
13607867

Table #

Acctnum: WMELKRIVMN

Collected by (signature):

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

Template: T166602

Prelogin: P1138805

PM: 364 - T. Alan Merrill

PB: 3/10/15 BK

Immediately Packed on Ice? N___ Y___

Shipped Via: FedEx Ground

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	ALK,CHLORIDE,SULFATE 250mlHDPE-NoPres	Metals 1L-HDPE NoPres	Metals, Diss 1L-HDPE NoPres	NH3 250mlHDPE-NaThioH2SO4	TDS 1L-HDPE NoPres	V8260ULC 40mlAmb HCl	V8260ULC 40mlAmb-HCl-Blk	Remarks	Sample # (lab only)
608-OWA	G	GW		4/1/15	930	7	X		X	X	X	X			
P-608C	G	GW		4/1/15	820	7	X	X		X	X	X			
TB	G	GW		4/1/15	455	2							X		
401-OWA	G	GW		4/1/15	955	7	X		X	X	X	X			

* Matrix:
SS Soil AIR - Air F - Filter
GW - Groundwater B - Biossay
WW WasteWater
DW - Drinking Water
OT Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier

Tracking #

Sample Receipt Checklist
COC Seal Present/Intact: __NP __Y __N
COC Signed/Accurate: __Y __N
Bottles arrive intact: __Y __N
Correct bottles used: __Y __N
Sufficient volume sent: __Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N
RAD Screen <0.5 mR/hr: __Y __N

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCl / MeoH TBR
4/1/15		1600		
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp. °C Bottles Received
				If preservation required by Login: Date/Time
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: Time: Hold: Condition: NCF / OK

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschroeder@barr.com;datamgt@barr.com;jeide

Project Description:
Baseline Parameters

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program (DOD, RCRA, DW, etc):

Client Project #
300

Lab Project #
WMELKRIVMN-00022

Collected by (print):

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ 5DBOD

Quote #

Date Results Needed

Immediately Packed on Ice: N ___ Y ___

Sample ID | Comp/Grab | Matrix * | Depth | Date | Time | No. of Cntrs

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Alk, Cl, SO4 125mlHDPE-NoPres	Metals-Diss tl-HDPE NoPres	NH3,NO2NO3 250mlHDPE-H2SO4	TSS 1L-HDPE NoPres	Total Cations 250mlHDPE-HNO3	VB260ULLC 40mlAmb-HCl	VB260ULLC 40mlAmb-HCl-Blk					
P3421		GW				8	X	X	X	X	X	X						
P3421		GW		4/18/17	1100	8	X	X	X	X	X	X						
TB		GW				1							X					

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Biosolids
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking #

Relinquished by: (Signature)

Date: 4/19/17

Time: 1500

Received by: (Signature)

Trip Blank Received: Yes / No
HCL / MeOH
TBR

Relinquished by: (Signature)

Date:

Time:

Received by: (Signature)

Temp: °C Bottles Received:

If preservation required by Login: Date/Time

Relinquished by: (Signature)

Date:

Time:

Received for lab by: (Signature)

Date:

Time:

Hold:

Condition:
NCF / OK

Sample Receipt Checklist
COC Seal Present/Intact: __NP __Y __N
COC Signed/Accurate: __Y __N
Bottles arrive intact: __Y __N
Correct Bottles Used: __Y __N
Sufficient Volume Sent: __Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N
RAD Screened <0.5 mR/hr: __Y __N

Chain of Custody Page __ of __

Pace
MT JULIET, TN

SDG #

Table #

Acctnum: WMELKRIVMN
Template: T250136
Prelogin: P1144766
PM: 364 - T. Alan Harvill
PB: 4/11/17 BK

Shipped Via: FedEx Ground

Remarks | Sample # (lab only)

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Edem 952-832-2893

Email To:
eschneider@barr.com;datamgt@barr.com;jeede

Project Description:
Quarterly Routine GW-GW STD wells

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program: (SDD, RLHA, GW, etc.)

Client Project #
200

Lab Project #
WMELKRIVMN-00011

Collected by (print):

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N__ Y__

Rush? (Lab MUST Be Notified)
__ Same Day __ Five Day
__ Next Day __ 5 Day (Rad Only)
__ Two Day __ 10 Day (Rad Only)
__ Three Day __ STD TAT

Quote #

Date Results Needed

No. of Cntrs

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	VR260ULLC 40mlAmb-HCl	VR260ULLC 60mlAmb-HCl-Blk											Remarks	Sample # (lab only)
Tb P-324R?		GW				1		X												
P-335L		GW		4/16/25	0930	3	X													
P-329L		GW		4/17/25	1041	3	X													
P-331L		GW		4/17/25	1130	3	X													
P-332L		GW		4/17/25	1415	3	X													
P-320L		GW		4/16/25	1340	3	X													
P-320C2		GW		4/15/25	1535	3	X													
P-320C		GW		4/15/25	1405	3	X													
P-318C		GW		4/15/25	1455	3	X													
		GW		4/17/25	1515	3	X													

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Biosolids
WW - WasteWater
DW - Drinking Water
OT - Other _____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier

Tracking #

Relinquished by: (Signature)
Date: 4/18/25
Time: 1520
Received by: (Signature)

Relinquished by: (Signature)
Date:
Time:
Received by: (Signature)

Relinquished by: (Signature)
Date:
Time:
Received for lab by (Signature)

Trip Blank Received: Yes / No
HCL / MeoH
TBR

Temp: °C Bottles Received:

Date: Time:

Sample Receipt Checklist
COC Seal Present/Intact: __NP __Y __N
COC Signed/Accurate: __Y __N
Bottles Arrive Intact: __Y __N
Correct bottles used: __Y __N
Sufficient Volume sent: __Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N
RAD Screen <0.5 mR/hr: __Y __N

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Chain of Custody Page __ of __

Pace
MT JULIET, TN

SDG #

Table #

Acctnum: WMELKRIVMN
Template: T261654
Prelogin: P1144770
PM: 304 - T. Allan Harvey
PB: 4/18/25

Shipped Via: FedEX Standard

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eldem 952-832-2853

Email To:
aschweider@barr.com;datamgt@barr.com;jeldem

Project Description:
Quarterly Routine GW-GW STO well

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program: (SUD, RCRA, Other, etc):

Client Project #
200

Lab Project #
WMELKRIVMN-00011

Collected by (print):

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ 5 ID TAT

Quote #

Date Results Needed

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	V8260ULLC 40mlAmb-HCl	V8260ULLC 40mlAmb-HCl-BLK										
P-302A P-302B		GW		4/16/25	1413	3	X											
P-305C P-305C P-325C		GW		4/16/25	1418	3	X											
		GW		4/16/25	1510	3	X											
		GW		4/16/25	1130	3	X											
P-303A		GW		4/17/25	1110	3	X											
P-303C P-304D		GW		4/16/25	1450	3	X											
		GW		4/16/25	1510	3	X											
P-29C P-325A		GW		4/16/25	1255	3	X											
		GW		4/16/25	1455	3	X											

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

Pace
MT JULIET, TN

SDG #

Table #

Acctnum: WMELKRIVMN
Template: T261654
Prelogin: P144770
PM: 364 - T. Alan Mandl
PB:
Shipped Via: FedEX Standard

Remarks | Sample # (lab only)

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Biosolids
WW - WasteWater
DW - Drinking Water
OT - Other ___

Remarks:

pH ___ Temp ___
Flow ___ Other ___

Samples returned via:
__ UPS __ FedEx __ Courier ___

Tracking #

Sample Receipt Checklist
COC Seal Present/Intact: __NP __Y __N
COC Signed/Accurate: __Y __N
Bottles arrive intact: __Y __N
Correct bottles used: __Y __N
Sufficient volume sent: __Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N
RAD Screen <0.5 mR/hr: __Y __N

Relinquished by: (Signature)	Date:	Time	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR
	4/16/25	1510		
Relinquished by: (Signature)	Date:	Time	Received by: (Signature)	Temp: °C Bottles Received:
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: Time:

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Appendix B

Laboratory Reports

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

January 29, 2025

Anna Schneider
Barr Engineering
4300 MarketPointe Dr
Suite 200
Minneapolis, MN 55435

RE: Project: Elk River PFC Quarterly
Pace Project No.: 10720955

Dear Anna Schneider:

Enclosed are the analytical results for sample(s) received by the laboratory on January 14, 2025. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Minneapolis

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Piper Gibbs
piper.gibbs@pacelabs.com
(612)607-6456
Project Manager

Enclosures

cc: Jim Eidem, Barr Engineering
Michelle Kostrzewski, Waste Managment National Services
Margaret Treanor, Barr Engineering
Al West, Barr Engineering

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

CERTIFICATIONS

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

Pace Analytical Services, LLC - Minneapolis MN
1700 Elm Street SE, Minneapolis, MN 55414
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014
Arkansas DW Certification #: MN00064
Arkansas WW Certification #: 88-0680
California Certification #: 2929
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
DoD Certification via A2LA #: 2926.01
EPA Region 8 Tribal Water Systems+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605
Georgia Certification #: 959
GMP+ Certification #: GMP050884
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
ISO/IEC 17025 Certification via A2LA #: 2926.01
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: AI-03086
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064
Maryland Certification #: 322
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137
Minnesota Dept of Ag Approval: via MN 027-053-137
Minnesota Petrofund Registration #: 1240
Mississippi Certification #: MN00064
Missouri Certification #: 10100
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081
New Jersey Certification #: MN002
New York Certification #: 11647
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification (A2LA) #: R-036
North Dakota Certification (MN) #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification (1700) #: CL101
Oklahoma Certification #: 9507
Oregon Primary Certification #: MN300001
Oregon Secondary Certification #: MN200001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Vermont Certification #: VT-027053137
Virginia Certification #: 460163
Washington Certification #: C486
West Virginia DEP Certification #: 382
West Virginia DW Certification #: 9952 C
Wisconsin Certification #: 999407970
Wyoming UST Certification via A2LA #: 2926.01
USDA Permit #: P330-19-00208

REPORT OF LABORATORY ANALYSIS

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Minneapolis, MN 55414
(612)607-1700

SAMPLE SUMMARY

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10720955001	**SP-01 Leachate**	Water	01/13/25 13:30	01/14/25 08:45

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SAMPLE ANALYTE COUNT

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10720955001	**SP-01 Leachate**	EPA 1633 DRAFT	MJL	64	PASI-M

PASI-M = Pace Analytical Services - Minneapolis

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PROJECT NARRATIVE

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

Method: **EPA 1633 DRAFT**
Description: EPA 1633 DRAFT Landfill Leach
Client: Waste Management National Services, Inc.
Date: January 29, 2025

General Information:
1 sample was analyzed for EPA 1633 DRAFT by Pace Analytical Services Minneapolis. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA 1633 DRAFT with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Internal Standards:
All internal standards were within QC limits with any exceptions noted below.

Surrogates:
All surrogates were within QC limits with any exceptions noted below.

QC Batch: 989130

S0: Surrogate recovery outside laboratory control limits.

- SP-01 Leachate (Lab ID: 10720955001)
  - 13C2-PFTA (S)
  - 13C24:2FTS (S)
  - 13C4-PFBA (S)
  - 13C5-PFPeA (S)

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

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ANALYTICAL RESULTS

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

Sample: SP-01 Leachate **Lab ID: 10720955001** Collected: 01/13/25 13:30 Received: 01/14/25 08:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
EPA 1633 DRAFT Landfill Leach	Analytical Method: EPA 1633 DRAFT Preparation Method: EPA 1633 DRAFT Pace Analytical Services - Minneapolis							
11Cl-PF3OUdS	ND	ng/L	30.1	1	01/23/25 13:49	01/24/25 15:46	763051-92-9	
3:3 FTCA	ND	ng/L	37.6	1	01/23/25 13:49	01/24/25 15:46	356-02-5	
4:2 FTS	ND	ng/L	30.1	1	01/23/25 13:49	01/24/25 15:46	757124-72-4	
5:3 FTCA	**57500**	ng/L	188	1	01/23/25 13:49	01/24/25 15:46	914637-49-3	
6:2 FTS	**321**	ng/L	30.1	1	01/23/25 13:49	01/24/25 15:46	27619-97-2	
7:3 FTCA	**4610**	ng/L	188	1	01/23/25 13:49	01/24/25 15:46	812-70-4	
8:2 FTS	ND	ng/L	30.1	1	01/23/25 13:49	01/24/25 15:46	39108-34-4	
9Cl-PF3ONS	ND	ng/L	30.1	1	01/23/25 13:49	01/24/25 15:46	756426-58-1	
ADONA	ND	ng/L	30.1	1	01/23/25 13:49	01/24/25 15:46	919005-14-4	
HFPO-DA	ND	ng/L	30.1	1	01/23/25 13:49	01/24/25 15:46	13252-13-6	
NEtFOSAA	**59.4**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	2991-50-6	
NEtFOSA	ND	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	4151-50-2	
NEtFOSE	**157**	ng/L	75.3	1	01/23/25 13:49	01/24/25 15:46	1691-99-2	
NFDHA	ND	ng/L	15.1	1	01/23/25 13:49	01/24/25 15:46	151772-58-6	
NMeFOSAA	**157**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	2355-31-9	
NMeFOSA	ND	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	31506-32-8	
NMeFOSE	**359**	ng/L	75.3	1	01/23/25 13:49	01/24/25 15:46	24448-09-7	
PFBS	**6660**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	375-73-5	
PFDA	**47.5**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	335-76-2	
PFHxA	**4900**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	307-24-4	
PFBA	**1900**	ng/L	30.1	1	01/23/25 13:49	01/24/25 15:46	375-22-4	
PFDS	ND	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	335-77-3	
PFDoS	ND	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	79780-39-5	
PFEESA	ND	ng/L	15.1	1	01/23/25 13:49	01/24/25 15:46	113507-82-7	
PFHpS	ND	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	375-92-8	
PFMBA	ND	ng/L	15.1	1	01/23/25 13:49	01/24/25 15:46	863090-89-5	
PFMPA	ND	ng/L	15.1	1	01/23/25 13:49	01/24/25 15:46	377-73-1	
PFNS	ND	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	68259-12-1	
PFOSA	**17.5**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	754-91-6	
PFPeA	**1660**	ng/L	15.1	1	01/23/25 13:49	01/24/25 15:46	2706-90-3	
PFPeS	**22.6**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	2706-91-4	
PFDoA	ND	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	307-55-1	
PFHpA	**550**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	375-85-9	
PFHxS	**595**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	355-46-4	
PFNA	**58.2**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	375-95-1	
PFOS	**191**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	1763-23-1	
PFOA	**1550**	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	335-67-1	
PFTeDA	ND	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	376-06-7	
PFTrDA	ND	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	72629-94-8	
PFUnA	ND	ng/L	7.5	1	01/23/25 13:49	01/24/25 15:46	2058-94-8	
Surrogates								
13C2-PFDoA (S)	37	%.	35-130	1	01/23/25 13:49	01/24/25 15:46		
13C3HFPO-DA (S)	53	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
13C3-PFBS (S)	67	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
13C3-PFHxS (S)	96	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
13C4-PFBA (S)	3	%.	5-130	1	01/23/25 13:49	01/24/25 15:46		S0

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ANALYTICAL RESULTS

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

Sample: SP-01 Leachate **Lab ID: 10720955001** Collected: 01/13/25 13:30 Received: 01/14/25 08:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
EPA 1633 DRAFT Landfill Leach	Analytical Method: EPA 1633 DRAFT Preparation Method: EPA 1633 DRAFT Pace Analytical Services - Minneapolis							
Surrogates								
13C4-PFHpA (S)	106	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
13C5-PFHxA (S)	47	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
13C5-PFPeA (S)	10	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		S0
13C6-PFDA (S)	79	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
13C8-PFOA (S)	104	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
13C8-PFOS (S)	87	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
13C8-PFOSA (S)	87	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
13C9-PFNA (S)	90	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
d3-MeFOSAA (S)	75	%.	35-130	1	01/23/25 13:49	01/24/25 15:46		
d3-NMeFOSA (S)	50	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
d5-EtFOSAA (S)	82	%.	30-130	1	01/23/25 13:49	01/24/25 15:46		
d5-NEtFOSA (S)	46	%.	35-130	1	01/23/25 13:49	01/24/25 15:46		
d7-NMeFOSE (S)	50	%.	20-130	1	01/23/25 13:49	01/24/25 15:46		
d9-NEtFOSE (S)	42	%.	20-130	1	01/23/25 13:49	01/24/25 15:46		
13C2-PFTA (S)	16	%.	25-130	1	01/23/25 13:49	01/24/25 15:46		S0
13C7-PFUdA (S)	58	%.	40-130	1	01/23/25 13:49	01/24/25 15:46		
13C24:2FTS (S)	6	%.	40-220	1	01/23/25 13:49	01/24/25 15:46		S0
13C26:2FTS (S)	88	%.	40-170	1	01/23/25 13:49	01/24/25 15:46		
13C28:2FTS (S)	116	%.	40-145	1	01/23/25 13:49	01/24/25 15:46		

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QUALITY CONTROL DATA

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

QC Batch: 989130
QC Batch Method: EPA 1633 DRAFT
Analysis Method: EPA 1633 DRAFT
Analysis Description: EPA 1633 DRAFT Landfill Leach
Laboratory: Pace Analytical Services - Minneapolis
Associated Lab Samples: 10720955001

METHOD BLANK: 5164704 Matrix: Water
Associated Lab Samples: 10720955001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
11Cl-PF3OUdS	ng/L	ND	26.4	01/24/25 12:47	
3:3 FTCA	ng/L	ND	33.0	01/24/25 12:47	
4:2 FTS	ng/L	ND	26.4	01/24/25 12:47	
5:3 FTCA	ng/L	ND	165	01/24/25 12:47	
6:2 FTS	ng/L	ND	26.4	01/24/25 12:47	
7:3 FTCA	ng/L	ND	165	01/24/25 12:47	
8:2 FTS	ng/L	ND	26.4	01/24/25 12:47	
9Cl-PF3ONS	ng/L	ND	26.4	01/24/25 12:47	
ADONA	ng/L	ND	26.4	01/24/25 12:47	
HFPO-DA	ng/L	ND	26.4	01/24/25 12:47	
NEtFOSA	ng/L	ND	6.6	01/24/25 12:47	
NEtFOSAA	ng/L	ND	6.6	01/24/25 12:47	
NEtFOSE	ng/L	ND	66.0	01/24/25 12:47	
NFDHA	ng/L	ND	13.2	01/24/25 12:47	
NMeFOSA	ng/L	ND	6.6	01/24/25 12:47	
NMeFOSAA	ng/L	ND	6.6	01/24/25 12:47	
NMeFOSE	ng/L	ND	66.0	01/24/25 12:47	
PFBA	ng/L	ND	26.4	01/24/25 12:47	
PFBS	ng/L	ND	6.6	01/24/25 12:47	
PFDA	ng/L	ND	6.6	01/24/25 12:47	
PFDoA	ng/L	ND	6.6	01/24/25 12:47	
PFDoS	ng/L	ND	6.6	01/24/25 12:47	
PFDS	ng/L	ND	6.6	01/24/25 12:47	
PFEESA	ng/L	ND	13.2	01/24/25 12:47	
PFHpA	ng/L	ND	6.6	01/24/25 12:47	
PFHpS	ng/L	ND	6.6	01/24/25 12:47	
PFHxA	ng/L	ND	6.6	01/24/25 12:47	
PFHxS	ng/L	ND	6.6	01/24/25 12:47	
PFMBA	ng/L	ND	13.2	01/24/25 12:47	
PFMPA	ng/L	ND	13.2	01/24/25 12:47	
PFNA	ng/L	ND	6.6	01/24/25 12:47	
PFNS	ng/L	ND	6.6	01/24/25 12:47	
PFOA	ng/L	ND	6.6	01/24/25 12:47	
PFOS	ng/L	ND	6.6	01/24/25 12:47	
PFOSA	ng/L	ND	6.6	01/24/25 12:47	
PFPeA	ng/L	ND	13.2	01/24/25 12:47	
PFPeS	ng/L	ND	6.6	01/24/25 12:47	
PFTeDA	ng/L	ND	6.6	01/24/25 12:47	
PFTrDA	ng/L	ND	6.6	01/24/25 12:47	
PFUnA	ng/L	ND	6.6	01/24/25 12:47	

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QUALITY CONTROL DATA

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

METHOD BLANK: 5164704 Matrix: Water
Associated Lab Samples: 10720955001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
13C2-PFDoA (S)	%.	78	35-130	01/24/25 12:47	
13C2-PFTA (S)	%.	70	25-130	01/24/25 12:47	
13C24:2FTS (S)	%.	54	40-220	01/24/25 12:47	
13C26:2FTS (S)	%.	61	40-170	01/24/25 12:47	
13C28:2FTS (S)	%.	66	40-145	01/24/25 12:47	
13C3-PFBS (S)	%.	97	40-130	01/24/25 12:47	
13C3-PFHxS (S)	%.	100	40-130	01/24/25 12:47	
13C3HFPO-DA (S)	%.	96	40-130	01/24/25 12:47	
13C4-PFBA (S)	%.	92	5-130	01/24/25 12:47	
13C4-PFHpA (S)	%.	90	40-130	01/24/25 12:47	
13C5-PFHxA (S)	%.	94	40-130	01/24/25 12:47	
13C5-PFPeA (S)	%.	93	40-130	01/24/25 12:47	
13C6-PFDA (S)	%.	86	40-130	01/24/25 12:47	
13C7-PFUdA (S)	%.	79	40-130	01/24/25 12:47	
13C8-PFOA (S)	%.	94	40-130	01/24/25 12:47	
13C8-PFOS (S)	%.	92	40-130	01/24/25 12:47	
13C8-PFOSA (S)	%.	72	40-130	01/24/25 12:47	
13C9-PFNA (S)	%.	94	40-130	01/24/25 12:47	
d3-MeFOSAA (S)	%.	80	35-130	01/24/25 12:47	
d3-NMeFOSA (S)	%.	68	40-130	01/24/25 12:47	
d5-EtFOSAA (S)	%.	77	30-130	01/24/25 12:47	
d5-NEtFOSA (S)	%.	68	35-130	01/24/25 12:47	
d7-NMeFOSE (S)	%.	76	20-130	01/24/25 12:47	
d9-NEtFOSE (S)	%.	74	20-130	01/24/25 12:47	

LABORATORY CONTROL SAMPLE & LCSD: 5164705 5164706

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
11Cl-PF3OUdS	ng/L	388	246	291	63	75	55-160	17	30	
3:3 FTCA	ng/L	514	444	436	86	85	65-130	2	30	
4:2 FTS	ng/L	386	353	311	91	81	70-145	12	30	
5:3 FTCA	ng/L	2570	2090	2100	81	82	70-135	0	30	
6:2 FTS	ng/L	391	364	338	93	87	65-155	7	30	
7:3 FTCA	ng/L	2570	2050	2040	80	80	50-145	1	30	
8:2 FTS	ng/L	396	390	361	98	92	60-150	8	30	
9Cl-PF3ONS	ng/L	386	299	324	78	84	70-155	8	30	
ADONA	ng/L	388	342	330	88	85	65-145	4	30	
HFPO-DA	ng/L	411	351	344	85	84	70-140	2	30	
NEtFOSA	ng/L	103	93.4	82.5	91	81	65-145	12	30	
NEtFOSAA	ng/L	103	86.8	79.2	84	78	70-145	9	30	
NEtFOSE	ng/L	1030	937	838	91	82	70-135	11	30	
NFDHA	ng/L	206	175	172	85	84	50-150	2	30	
NMeFOSA	ng/L	103	94.9	87.6	92	86	60-150	8	30	
NMeFOSAA	ng/L	103	97.7	78.7	95	77	50-140	22	30	

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QUALITY CONTROL DATA

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

LABORATORY CONTROL SAMPLE & LCSD: 5164705 5164706

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
NMeFOSE	ng/L	1030	946	849	92	83	70-145	11	30	
PFBA	ng/L	411	369	329	90	81	70-140	11	30	
PFBS	ng/L	91.3	80.4	72.7	88	80	60-145	10	30	
PFDA	ng/L	103	91.6	82.5	89	81	70-140	10	30	
PFDoA	ng/L	103	92.6	84.4	90	83	70-140	9	30	
PFDoS	ng/L	99.7	67.9	71.7	68	72	50-145	5	30	
PFDS	ng/L	99.2	71.7	75.0	72	76	60-145	4	30	
PFEESA	ng/L	183	151	148	82	81	70-140	2	30	
PFHpA	ng/L	103	92.0	83.5	90	82	70-150	10	30	
PFHpS	ng/L	97.9	93.1	79.0	95	81	70-150	16	30	
PFHxA	ng/L	103	91.7	82.8	89	81	70-145	10	30	
PFHxS	ng/L	94.1	80.7	72.6	86	78	65-145	11	30	
PFMBA	ng/L	206	192	176	93	86	60-150	8	30	
PFMPA	ng/L	206	196	178	95	87	55-140	10	30	
PFNA	ng/L	103	90.1	83.2	88	81	70-150	8	30	
PFNS	ng/L	99	78.7	80.5	79	82	65-145	2	30	
PFOA	ng/L	103	90.7	79.3	88	78	70-150	13	30	
PFOS	ng/L	95.4	84.7	72.8	89	77	55-150	15	30	
PFOSA	ng/L	103	90.8	81.2	88	79	70-145	11	30	
PFPeA	ng/L	206	183	163	89	80	65-135	11	30	
PFPeS	ng/L	96.7	85.4	76.6	88	80	65-140	11	30	
PFTeDA	ng/L	103	92.2	81.7	90	80	60-140	12	30	
PFTrDA	ng/L	103	93.4	79.3	91	78	65-140	16	30	
PFUnA	ng/L	103	90.8	87.3	88	85	70-145	4	30	
13C2-PFDoA (S)	%.				75	88	35-130			
13C2-PFTA (S)	%.				75	80	25-130			
13C24:2FTS (S)	%.				50	52	40-220			
13C26:2FTS (S)	%.				61	61	40-170			
13C28:2FTS (S)	%.				64	64	40-145			
13C3-PFBS (S)	%.				99	102	40-130			
13C3-PFHxS (S)	%.				100	103	40-130			
13C3HFPO-DA (S)	%.				100	102	40-130			
13C4-PFBA (S)	%.				95	98	5-130			
13C4-PFHpA (S)	%.				95	98	40-130			
13C5-PFHxA (S)	%.				99	99	40-130			
13C5-PFPeA (S)	%.				97	101	40-130			
13C6-PFDA (S)	%.				93	97	40-130			
13C7-PFUdA (S)	%.				82	90	40-130			
13C8-PFOA (S)	%.				96	98	40-130			
13C8-PFOS (S)	%.				90	98	40-130			
13C8-PFOSA (S)	%.				76	82	40-130			
13C9-PFNA (S)	%.				94	102	40-130			
d3-MeFOSAA (S)	%.				76	89	35-130			
d3-NMeFOSA (S)	%.				74	74	40-130			
d5-EtFOSAA (S)	%.				71	80	30-130			
d5-NEtFOSA (S)	%.				75	77	35-130			
d7-NMeFOSE (S)	%.				79	83	20-130			

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REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

LABORATORY CONTROL SAMPLE & LCSD: 5164705 5164706

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
d9-NEtFOSE (S)	%.				79	81	20-130			

LABORATORY CONTROL SAMPLE: 5164707

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
11Cl-PF3OUdS	ng/L	32	26.1J	82	55-160	
3:3 FTCA	ng/L	42.3	37.6	89	65-130	
4:2 FTS	ng/L	31.8	28.3	89	70-145	
5:3 FTCA	ng/L	212	179	84	70-135	
6:2 FTS	ng/L	32.2	29.5	92	65-155	
7:3 FTCA	ng/L	212	164J	77	50-145	
8:2 FTS	ng/L	32.6	28.1	86	60-150	
9Cl-PF3ONS	ng/L	31.8	28.0	88	70-155	
ADONA	ng/L	32	30.3	95	65-145	
HFPO-DA	ng/L	33.9	34.2	101	70-140	
NEtFOSA	ng/L	8.5	7.6	90	65-145	
NEtFOSAA	ng/L	8.5	6.7J	79	70-145	
NEtFOSE	ng/L	84.7	77.5	92	70-135	
NFDHA	ng/L	16.9	14.1	83	50-150	
NMeFOSA	ng/L	8.5	7.6	90	60-150	
NMeFOSAA	ng/L	8.5	7.4	87	50-140	
NMeFOSE	ng/L	84.7	73.8	87	70-145	
PFBA	ng/L	33.9	31.7	94	70-140	
PFBS	ng/L	7.5	6.3J	84	60-145	
PFDA	ng/L	8.5	7.3	86	70-140	
PFDoA	ng/L	8.5	7.1	83	70-140	
PFDoS	ng/L	8.2	6.4J	78	50-145	
PFDS	ng/L	8.2	6.8	83	60-145	
PFEESA	ng/L	15.1	12.6J	84	70-140	
PFHpA	ng/L	8.5	7.4	88	70-150	
PFHpS	ng/L	8.1	7.4	91	70-150	
PFHxA	ng/L	8.5	7.7	91	70-145	
PFHxS	ng/L	7.7	7.3	94	65-145	
PFMBA	ng/L	16.9	15.4	91	60-150	
PFMPA	ng/L	16.9	15.6	92	55-140	
PFNA	ng/L	8.5	6.8	81	70-150	
PFNS	ng/L	8.1	7.2	88	65-145	
PFOA	ng/L	8.5	7.6	90	70-150	
PFOS	ng/L	7.9	7.4	94	55-150	
PFOSA	ng/L	8.5	7.4	87	70-145	
PFPeA	ng/L	16.9	15.2	90	65-135	
PFPeS	ng/L	8	7.1	90	65-140	
PFTeDA	ng/L	8.5	6.7J	79	60-140	
PFTrDA	ng/L	8.5	7.2	85	65-140	
PFUnA	ng/L	8.5	7.4	87	70-145	

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Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

LABORATORY CONTROL SAMPLE: 5164707

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
13C2-PFDoA (S)	%.			83	35-130	
13C2-PFTA (S)	%.			75	25-130	
13C24:2FTS (S)	%.			51	40-220	
13C26:2FTS (S)	%.			63	40-170	
13C28:2FTS (S)	%.			65	40-145	
13C3-PFBS (S)	%.			103	40-130	
13C3-PFHxS (S)	%.			101	40-130	
13C3HFPO-DA (S)	%.			92	40-130	
13C4-PFBA (S)	%.			91	5-130	
13C4-PFHpA (S)	%.			89	40-130	
13C5-PFHxA (S)	%.			90	40-130	
13C5-PFPeA (S)	%.			93	40-130	
13C6-PFDA (S)	%.			93	40-130	
13C7-PFUdA (S)	%.			87	40-130	
13C8-PFOA (S)	%.			96	40-130	
13C8-PFOS (S)	%.			91	40-130	
13C8-PFOSA (S)	%.			78	40-130	
13C9-PFNA (S)	%.			90	40-130	
d3-MeFOSAA (S)	%.			80	35-130	
d3-NMeFOSA (S)	%.			70	40-130	
d5-EtFOSAA (S)	%.			78	30-130	
d5-NEtFOSA (S)	%.			73	35-130	
d7-NMeFOSE (S)	%.			79	20-130	
d9-NEtFOSE (S)	%.			78	20-130	

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(612)607-1700

QUALIFIERS

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

S0	Surrogate recovery outside laboratory control limits.

REPORT OF LABORATORY ANALYSIS

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1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Elk River PFC Quarterly
Pace Project No.: 10720955

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10720955001	**SP-01 Leachate**	EPA 1633 DRAFT	989130	EPA 1633 DRAFT	989595

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Pace® Location Requested (City/State):
Pace Analytical Minneapolis
1700 Elm Street, Suite 200
Minneapolis, MN 55414

CHAIN-OF-CUSTODY Analytical Request Document

"Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields"

WO#: 10720955

Company Name:	Waste Management National Services, Inc.	Contact/Report To:	Andrea Ward
Street Address:	4330 West Point Douglas Road, S Ste 200 Minneapolis, MN 55435	Phone #:	952-832-2600
		E-Mail:	award1@wm.com
		Cell/Fax #:	
Customer Project #:			
Project Name:	EIR Rose Hill Quarterly	Invoice To:	Accounts Payable
		Invoice E-Mail:	wmmnwaste@banksapplications.com
Site/Facility ID (as applicable)		Purchase Order # (if applicable):	3071274
		Quote #:	
Time Zone Collected:	[ ]AK [ ]PT [ ]MT [ ]CT [ ]ET	County/State where collected:	Minnesota

Data Deliverables: [ ]Level II [ ]Level III [ ]Level IV [ ]Other

Regulatory Program (DW, NPDES, etc., if applicable): Reportable [ ]Yes [ ]No

Rush (Pre-approval required): [ ]Same Day [ ]1 Day [ ]2 Day [ ]3 Day [ ]Other

DW PWS ID/or WW Permit # (if applicable)

Date Results Required:

Analysis:

Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Water (WW), Product (P), Soil/Solid (SS), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Surface Water (SW), Sediment (SD), Sludge (SL), Other (OT), Leachate (LC), Biota (BT), Vapor (V)

Customer Sample ID	Matrix *	Comp / Grab	Composite Start Date	Composite Start Time	Collected or Composite End Date	Collected or Composite End Time	# of Cont.	Res. Chlorine (Y/N)	Res. Chlorine Units	EPA 1632 DRAFT Low Level Mercury	Sample Comment
SP-01 Quarterly	WW	G			1/13/25	1330	3			X	001

Pres. Key/Comments: Preservative Type ***

Analyses Requested

Lab Use Only: Proj. Mgr: Fiona Fancher; Acctnum / Client ID; Table #; Profile / Template: 45504; Prelog / Bottle Ord. ID: EZ 3071923

Sample Comment: Expected values entered in lab will trigger non-conformance

Relinquished / Additional Instructions Sent Prior*

Collected By (Printed Name):

Signature:

Customer Remarks / Special Conditions / Possible Hazards

Cooler	Temperature (°C)	Correction Factor (°C)	Corrected Temp (°C)	Custody Seal
1	1.3	-0.1	1.2	1.7	Y

Relinquished by / Company (Signature)	Date/Time	Received by / Company (Signature)	Date/Time
	1/14/25 0845	Corey Pincock	1/14/25 8:45
Relinquished by / Company (Signature)	Date/Time	Received by / Company (Signature)	Date/Time
Relinquished by / Company (Signature)	Date/Time	Received by / Company (Signature)	Date/Time

Sample Receipt Checklist

Delivered By: [ ]On Vehicle [ ]Courier [ ]FedEx [ ]UPS [ ]Other

Page: 1 of 1

By submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace® Terms and Conditions found at https://www.pacelabs.com/terms-and-conditions/pace-terms-and-conditions/

FM-FRM-CORD-0015 v02 11OCT23 P

ENV-FRM-MIN4-0150 v17_Sample Condition Upon Receipt

CLIENT NAME: [illegible] PROJECT #: WO#: 107 20955

COURIER: ☑ Client ☐ Commercial ☐ Fedex ☐ Pace ☐ Speedee ☐ UPS ☐ USPS

TRACKING NUMBER: _____ ☐ See Exceptions form ENV-FRM-MIN4-0142

Custody Seal on Cooler/Box Present: ☑ YES ☐ NO Seals Intact: ☑ YES ☐ NO Biological Tissue Frozen: ☐ YES ☐ NO ☑ N/A

Packing Material: ☐ Bubble Bags ☑ Bubble Wrap ☑ None ☐ Other Temp Blank: ☑ YES ☐ NO Type of Ice: ☐ Blue ☐ Dry ☑ Wet ☐ Melted ☐ None

Thermometer: ☑ T1 (0461) ☐ T2 (0436) ☑ T3 (0459) ☐ T4 (0402) ☐ T5 (0178) ☐ T6 (0235) ☐ T7 (0042) ☐ T8 (0775) ☐ T9 (0727) ☐ 01339252 (1710)

Did Samples Originate in West Virginia: ☐ YES ☑ NO	Were All Container Temps taken: ☐ YES ☐ NO ☑ N/A
Correction Factor: _____ Cooler Temp Read w/Temp Blank: _____ °C Cooler Temp Corrected w/Temp Blank: _____ °C	Average Corrected Temp (no Temp Blank Only): _____ °C
NOTE: Temp should be above freezing to 6°C	☐ See Exceptions From ENV-FRM-MIN4-0142 ☐ 1 Container
USDA Regulated Soil: ☑ N/A Water Sample/Other (describe): _____	Initials & Date of Person Examining Contents: ZE 1/14/25
Did Samples originate from one of the following states (check maps) – AL, GA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA: ☐ YES ☑ NO	Did samples originate from a foreign source (international, including Hawaii and Puerto Rico): ☐ YES ☑ NO

NOTE: If YES to either question, fill out a Regulated Soil Checklist (ENV-FRM-MIN4-0154) and include with SCUR/COC paperwork.

LOCATION (check one): ☐ DULUTH ☐ MINNEAPOLIS ☐ VIRGINIA

	YES	NO	N/A	COMMENT(S)
Chain of Custody Present and Filled Out?	☑	☐		1.
Chain of Custody Relinquished?	☑	☐		2.
Sampler Name and/or Signature on COC?	☑	☐	☐	3.
Samples Arrived within Hold Time?	☑	☐		4. If Fecal: ☐ <8 hrs ☐ >8 hr, <24 hr ☐ %
Short Hold Time Analysis (<72 hr)?	☐	☑		5. ☐ BOD / cBOD ☐ Fecal coliform ☐ Hex Chrom ☐ HPC ☐ Nitrate ☐ Nitrite ☐ Ortho Phos ☐ Total coliform/E. coli ☐ Other.
Rush Turn Around Time Requested?	☐	☑		6.
Sufficient Sample Volume?	☐	☐		7.
Correct Containers Used? – Pace Containers Used?	☑ ☑	☐ ☐	☐	8.
Containers Intact?	☑	☐		9.
Field Filtered Volume Received for Dissolved Tests?	☐	☐	☑	10. Is sediment visible in the dissolved container. ☐ YES ☐ NO
Is sufficient information available to reconcile the samples to the COC? NOTE: If ID/Date/Time don't match fill out section 11	☑	☐		11. If NO, write ID/Date/Time of container below: ☐ See Exceptions form ENV-FRM-MIN4-0142
Matrix: ☐ Oil ☐ Soil ☑ Water ☐ Other				
All containers needing acid/base preservation have been checked?	☐	☐	☑	12. Sample #:
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO3, H2SO4, < 2 pH, NaOH > 9 Sulfide, NaOH > 10 Cyanide)	☐	☐	☑	☐ HNO_3 ☐ H_2SO_4 ☐ NaOH ☐ Zinc Acetate
Exceptions: VOA, Coliform, TOC/DOC, Oil & Grease, DRO/8015 (water) and Dioxins/PFAS	☐	☐	☑	Positive for Residual Chlorine: ☐ YES ☐ NO
NOTE: If adding preservation to the container, verify with the PM first. Clients may require adding preservative to the field and equipment blanks when this occurs				pH Paper Lot #: Residual Chlorine / 0-6 Roll / 6-9 Strip / 0-14 Strip
				☐ See Exceptions form ENV-FRM-MIN4-0142
Headspace in Methyl Mercury Container?	☐	☐	☑	13.
Extra labels present on soil VOA or TX1005 containers?	☐	☐	☑	14.
Headspace in VOA Vials (greater than 6mm)?	☐	☐	☑	☐ See Exceptions form ENV-FRM-MIN4-0240
Trip Blanks Present?	☐	☐	☑	15.
Trip Blank Custody Seals Present?	☐	☐	☑	Pace Trip Blank Lot # (if purchased): _____

CLIENT NOTIFICATION / RESOLUTION FIELD DATA REQUIRED: ☐ YES ☐ NO

Person Contacted _____ Date & Time: _____

Comments / Resolution _____

Project Manager Review: Piper J. Dikes Date: 1/14/25

NOTE: When there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEQ Certification Office (i.e., out of hold, incorrect preservative, out of temp, incorrect containers).

Labeled By: ZE Line: 7

Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

June 04, 2025

Anna Schneider
Barr Engineering
4300 MarketPointe Dr
Suite 200
Minneapolis, MN 55435

RE: Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

Dear Anna Schneider:

Enclosed are the analytical results for sample(s) received by the laboratory on April 01, 2025. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Minneapolis

This report was revised June 4, 2025, to include surrogate data associated with dilutions.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kirsten Hogberg for
Piper Gibbs
piper.gibbs@pacelabs.com
(612)607-6456
Project Manager

Enclosures

cc: Jim Eidem, Barr Engineering
Michelle Kostrzewski, Waste Managment National Services
Margaret Treanor, Barr Engineering
Al West, Barr Engineering

REPORT OF LABORATORY ANALYSIS

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1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

CERTIFICATIONS

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

Pace Analytical Services, LLC - Minneapolis MN
1700 Elm Street SE, Minneapolis, MN 55414
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014
Arkansas DW Certification #: MN00064
Arkansas WW Certification #: 88-0680
California Certification #: 2929
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
DoD Certification via A2LA #: 2926.01
EPA Region 8 Tribal Water Systems+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605
Georgia Certification #: 959
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
ISO/IEC 17025 Certification via A2LA #: 2926.01
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: AI-03086
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064
Maryland Certification #: 322
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137
Minnesota Dept of Ag Approval: via MN 027-053-137
Minnesota Petrofund Registration #: 1240
Mississippi Certification #: MN00064
Missouri Certification #: 10100
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081
New Jersey Certification #: MN002
New York Certification #: 11647
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification via A2LA #: R-036
North Dakota Certification via MN #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification (1700) #: CL101
Oklahoma Certification #: 9507
Oregon Primary Certification #: MN300001
Oregon Secondary Certification #: MN200001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Vermont Certification #: VT-027053137
Virginia Certification #: 460163
Washington Certification #: C486
West Virginia DEP Certification #: 382
West Virginia DW Certification #: 9952 C
Wisconsin Certification #: 999407970
Wyoming UST Certification via A2LA #: 2926.01
USDA Permit #: P330-19-00208

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SAMPLE SUMMARY

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10729533001	**SP-01**	Water	04/01/25 13:20	04/01/25 15:09

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10729533001	**SP-01**	EPA 1633	MJL	65	PASI-M

PASI-M = Pace Analytical Services - Minneapolis

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PROJECT NARRATIVE

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

Method: **EPA 1633**
Description: EPA 1633 Landfill Leachate
Client: Waste Management National Services, Inc.
Date: June 04, 2025

General Information:
1 sample was analyzed for EPA 1633 by Pace Analytical Services Minneapolis. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA 1633 with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Internal Standards:
All internal standards were within QC limits with any exceptions noted below.

Surrogates:
All surrogates were within QC limits with any exceptions noted below.

QC Batch: 1002017

S0: Surrogate recovery outside laboratory control limits.

- SP-01 (Lab ID: 10729533001)
  - 13C24:2FTS (S)
  - 13C26:2FTS (S)
  - 13C28:2FTS (S)
- SRM (Lab ID: 5225629)
  - d3-MeFOSAA (S)

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

REPORT OF LABORATORY ANALYSIS

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1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

Sample: SP-01 **Lab ID: 10729533001** Collected: 04/01/25 13:20 Received: 04/01/25 15:09 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
EPA 1633 Landfill Leachate	Analytical Method: EPA 1633 Preparation Method: EPA 1633 Pace Analytical Services - Minneapolis							
11Cl-PF3OUdS	ND	ng/L	62.3	1	04/22/25 09:36	04/24/25 12:57	763051-92-9	
3:3 FTCA	**305**	ng/L	77.8	1	04/22/25 09:36	04/24/25 12:57	356-02-5	
4:2 FTS	ND	ng/L	62.3	1	04/22/25 09:36	04/24/25 12:57	757124-72-4	
5:3 FTCA	**48200**	ng/L	389	1	04/22/25 09:36	04/24/25 12:57	914637-49-3	
6:2 FTS	**294**	ng/L	62.3	1	04/22/25 09:36	04/24/25 12:57	27619-97-2	
7:3 FTCA	**1560**	ng/L	389	1	04/22/25 09:36	04/24/25 12:57	812-70-4	
8:2 FTS	ND	ng/L	62.3	1	04/22/25 09:36	04/24/25 12:57	39108-34-4	
9Cl-PF3ONS	ND	ng/L	62.3	1	04/22/25 09:36	04/24/25 12:57	756426-58-1	
ADONA	ND	ng/L	62.3	1	04/22/25 09:36	04/24/25 12:57	919005-14-4	
HFPO-DA	ND	ng/L	62.3	1	04/22/25 09:36	04/24/25 12:57	13252-13-6	
NEtFOSAA	**77.4**	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	2991-50-6	
NEtFOSA	ND	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	4151-50-2	
NEtFOSE	**201**	ng/L	156	1	04/22/25 09:36	04/24/25 12:57	1691-99-2	
NFDHA	ND	ng/L	31.1	1	04/22/25 09:36	04/24/25 12:57	151772-58-6	
NMeFOSAA	**169**	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	2355-31-9	
NMeFOSA	ND	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	31506-32-8	
NMeFOSE	**334**	ng/L	156	1	04/22/25 09:36	04/24/25 12:57	24448-09-7	
PFBS	**7540**	ng/L	156	10	04/22/25 09:36	04/23/25 17:59	375-73-5	
PFDA	**26.8**	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	335-76-2	
PFHxA	**4300**	ng/L	156	10	04/22/25 09:36	04/23/25 17:59	307-24-4	
PFBA	**13300**	ng/L	623	10	04/22/25 09:36	04/23/25 17:59	375-22-4	
PFDS	ND	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	335-77-3	
PFDoS	ND	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	79780-39-5	
PFEESA	ND	ng/L	31.1	1	04/22/25 09:36	04/24/25 12:57	113507-82-7	
PFHpS	ND	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	375-92-8	
PFMBA	ND	ng/L	31.1	1	04/22/25 09:36	04/24/25 12:57	863090-89-5	
PFMPA	**227**	ng/L	31.1	1	04/22/25 09:36	04/24/25 12:57	377-73-1	
PFNS	ND	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	68259-12-1	
PFOSA	**17.6**	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	754-91-6	
PFPeA	**1570**	ng/L	31.1	1	04/22/25 09:36	04/24/25 12:57	2706-90-3	
PFPeS	**32.7**	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	2706-91-4	
PFDoA	ND	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	307-55-1	
PFHpA	**535**	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	375-85-9	
PFHxS	**626**	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	355-46-4	
PFNA	**67.2**	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	375-95-1	
PFOS	**198**	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	1763-23-1	
PFOA	**1930**	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	335-67-1	
PFTeDA	ND	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	376-06-7	
PFTrDA	ND	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	72629-94-8	
PFUnA	ND	ng/L	15.6	1	04/22/25 09:36	04/24/25 12:57	2058-94-8	
Surrogates								
13C2-PFDoA (S)	47	%.	10-130	1	04/22/25 09:36	04/24/25 12:57		
13C3HFPO-DA (S)	80	%.	40-130	1	04/22/25 09:36	04/24/25 12:57		
13C3-PFBS (S)	79	%.	40-135	10	04/22/25 09:36	04/23/25 17:59		
13C3-PFBS (S)	88	%.	40-135	1	04/22/25 09:36	04/24/25 12:57		
13C3-PFHxS (S)	85	%.	40-130	1	04/22/25 09:36	04/24/25 12:57		

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

Sample: SP-01 **Lab ID: 10729533001** Collected: 04/01/25 13:20 Received: 04/01/25 15:09 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
EPA 1633 Landfill Leachate	Analytical Method: EPA 1633 Preparation Method: EPA 1633 Pace Analytical Services - Minneapolis							
Surrogates								
13C4-PFBA (S)	13	%.	5-130	1	04/22/25 09:36	04/24/25 12:57		
13C4-PFBA (S)	8	%.	5-130	10	04/22/25 09:36	04/23/25 17:59		
13C4-PFHpA (S)	97	%.	40-130	1	04/22/25 09:36	04/24/25 12:57		
13C5-PFHxA (S)	88	%.	40-130	10	04/22/25 09:36	04/23/25 17:59		
13C5-PFHxA (S)	89	%.	40-130	1	04/22/25 09:36	04/24/25 12:57		
13C5-PFPeA (S)	70	%.	40-130	1	04/22/25 09:36	04/24/25 12:57		
13C6-PFDA (S)	81	%.	40-130	1	04/22/25 09:36	04/24/25 12:57		
13C8-PFOA (S)	93	%.	40-130	1	04/22/25 09:36	04/24/25 12:57		
13C8-PFOS (S)	80	%.	40-130	1	04/22/25 09:36	04/24/25 12:57		
13C8-PFOSA (S)	74	%.	40-130	1	04/22/25 09:36	04/24/25 12:57		
13C9-PFNA (S)	91	%.	40-130	1	04/22/25 09:36	04/24/25 12:57		
d3-MeFOSAA (S)	97	%.	40-170	1	04/22/25 09:36	04/24/25 12:57		
d3-NMeFOSA (S)	53	%.	10-130	1	04/22/25 09:36	04/24/25 12:57		
d5-EtFOSAA (S)	107	%.	25-135	1	04/22/25 09:36	04/24/25 12:57		
d5-NEtFOSA (S)	48	%.	10-130	1	04/22/25 09:36	04/24/25 12:57		
d7-NMeFOSE (S)	47	%.	10-130	1	04/22/25 09:36	04/24/25 12:57		
d9-NEtFOSE (S)	43	%.	10-130	1	04/22/25 09:36	04/24/25 12:57		
13C2-PFTA (S)	29	%.	10-130	1	04/22/25 09:36	04/24/25 12:57		
13C7-PFUdA (S)	65	%.	30-130	1	04/22/25 09:36	04/24/25 12:57		
13C24:2FTS (S)	292	%.	40-200	1	04/22/25 09:36	04/24/25 12:57		S0
13C26:2FTS (S)	339	%.	40-200	1	04/22/25 09:36	04/24/25 12:57		S0
13C28:2FTS (S)	303	%.	40-300	1	04/22/25 09:36	04/24/25 12:57		S0
13C3-PFPrA (S)	5	%.	5-130	1	04/22/25 09:36	04/24/25 12:57		

REPORT OF LABORATORY ANALYSIS

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(612)607-1700

QUALITY CONTROL DATA

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

QC Batch: 1002017
QC Batch Method: EPA 1633
Analysis Method: EPA 1633
Analysis Description: EPA 1633 Landfill Leachate
Laboratory: Pace Analytical Services - Minneapolis

Associated Lab Samples: 10729533001

METHOD BLANK: 5225627 Matrix: Water
Associated Lab Samples: 10729533001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
11Cl-PF3OUdS	ng/L	ND	32.0	04/22/25 16:04	
3:3 FTCA	ng/L	ND	40.0	04/22/25 16:04	
4:2 FTS	ng/L	ND	32.0	04/22/25 16:04	
5:3 FTCA	ng/L	ND	200	04/22/25 16:04	
6:2 FTS	ng/L	ND	32.0	04/22/25 16:04	
7:3 FTCA	ng/L	ND	200	04/22/25 16:04	
8:2 FTS	ng/L	ND	32.0	04/22/25 16:04	
9Cl-PF3ONS	ng/L	ND	32.0	04/22/25 16:04	
ADONA	ng/L	ND	32.0	04/22/25 16:04	
HFPO-DA	ng/L	ND	32.0	04/22/25 16:04	
NEtFOSA	ng/L	ND	8.0	04/22/25 16:04	
NEtFOSAA	ng/L	ND	8.0	04/22/25 16:04	
NEtFOSE	ng/L	ND	80.0	04/22/25 16:04	
NFDHA	ng/L	ND	16.0	04/22/25 16:04	
NMeFOSA	ng/L	ND	8.0	04/22/25 16:04	
NMeFOSAA	ng/L	ND	8.0	04/22/25 16:04	
NMeFOSE	ng/L	ND	80.0	04/22/25 16:04	
PFBA	ng/L	ND	32.0	04/22/25 16:04	
PFBS	ng/L	ND	8.0	04/22/25 16:04	
PFDA	ng/L	ND	8.0	04/22/25 16:04	
PFDoA	ng/L	ND	8.0	04/22/25 16:04	
PFDoS	ng/L	ND	8.0	04/22/25 16:04	
PFDS	ng/L	ND	8.0	04/22/25 16:04	
PFEESA	ng/L	ND	16.0	04/22/25 16:04	
PFHpA	ng/L	ND	8.0	04/22/25 16:04	
PFHpS	ng/L	ND	8.0	04/22/25 16:04	
PFHxA	ng/L	ND	8.0	04/22/25 16:04	
PFHxS	ng/L	ND	8.0	04/22/25 16:04	
PFMBA	ng/L	ND	16.0	04/22/25 16:04	
PFMPA	ng/L	ND	16.0	04/22/25 16:04	
PFNA	ng/L	ND	8.0	04/22/25 16:04	
PFNS	ng/L	ND	8.0	04/22/25 16:04	
PFOA	ng/L	ND	8.0	04/22/25 16:04	
PFOS	ng/L	ND	8.0	04/22/25 16:04	
PFOSA	ng/L	ND	8.0	04/22/25 16:04	
PFPeA	ng/L	ND	16.0	04/22/25 16:04	
PFPeS	ng/L	ND	8.0	04/22/25 16:04	
PFTeDA	ng/L	ND	8.0	04/22/25 16:04	
PFTrDA	ng/L	ND	8.0	04/22/25 16:04	
PFUnA	ng/L	ND	8.0	04/22/25 16:04	

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(612)607-1700

QUALITY CONTROL DATA

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

METHOD BLANK: 5225627 Matrix: Water
Associated Lab Samples: 10729533001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
13C2-PFDoA (S)	%.	72	10-130	04/22/25 16:04	
13C2-PFTA (S)	%.	65	10-130	04/22/25 16:04	
13C24:2FTS (S)	%.	84	40-200	04/22/25 16:04	
13C26:2FTS (S)	%.	72	40-200	04/22/25 16:04	
13C28:2FTS (S)	%.	71	40-300	04/22/25 16:04	
13C3-PFBS (S)	%.	80	40-135	04/22/25 16:04	
13C3-PFHxS (S)	%.	80	40-130	04/22/25 16:04	
13C3-PFPrA (S)	%.	80	5-130	04/22/25 16:04	
13C3HFPO-DA (S)	%.	75	40-130	04/22/25 16:04	
13C4-PFBA (S)	%.	79	5-130	04/22/25 16:04	
13C4-PFHpA (S)	%.	74	40-130	04/22/25 16:04	
13C5-PFHxA (S)	%.	79	40-130	04/22/25 16:04	
13C5-PFPeA (S)	%.	79	40-130	04/22/25 16:04	
13C6-PFDA (S)	%.	77	40-130	04/22/25 16:04	
13C7-PFUdA (S)	%.	81	30-130	04/22/25 16:04	
13C8-PFOA (S)	%.	82	40-130	04/22/25 16:04	
13C8-PFOS (S)	%.	78	40-130	04/22/25 16:04	
13C8-PFOSA (S)	%.	68	40-130	04/22/25 16:04	
13C9-PFNA (S)	%.	77	40-130	04/22/25 16:04	
d3-MeFOSAA (S)	%.	64	40-170	04/22/25 16:04	
d3-NMeFOSA (S)	%.	58	10-130	04/22/25 16:04	
d5-EtFOSAA (S)	%.	60	25-135	04/22/25 16:04	
d5-NEtFOSA (S)	%.	57	10-130	04/22/25 16:04	
d7-NMeFOSE (S)	%.	66	10-130	04/22/25 16:04	
d9-NEtFOSE (S)	%.	66	10-130	04/22/25 16:04	

LABORATORY CONTROL SAMPLE: 5225628

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
11Cl-PF3OUdS	ng/L	376	338	90	55-160	
3:3 FTCA	ng/L	496	443	89	65-130	
4:2 FTS	ng/L	376	370	98	70-145	
5:3 FTCA	ng/L	2480	2460	99	70-135	
6:2 FTS	ng/L	384	381	99	65-155	
7:3 FTCA	ng/L	2480	2490	101	50-145	
8:2 FTS	ng/L	384	404	105	60-150	
9Cl-PF3ONS	ng/L	376	368	98	70-155	
ADONA	ng/L	376	416	111	65-145	
HFPO-DA	ng/L	400	407	102	70-140	
NEtFOSA	ng/L	96	102	107	65-145	
NEtFOSAA	ng/L	96	99.7	104	70-145	
NEtFOSE	ng/L	960	1020	106	70-135	
NFDHA	ng/L	200	182	91	50-150	
NMeFOSA	ng/L	96	100	104	60-150	

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QUALITY CONTROL DATA

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

LABORATORY CONTROL SAMPLE: 5225628

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
NMeFOSAA	ng/L	96	98.4	103	50-140	
NMeFOSE	ng/L	960	1020	106	70-145	
PFBA	ng/L	400	397	99	70-140	
PFBS	ng/L	88	90.2	103	60-145	
PFDA	ng/L	96	97.6	102	70-140	
PFDoA	ng/L	96	98.8	103	70-140	
PFDoS	ng/L	96	78.9	82	50-145	
PFDS	ng/L	96	91.7	96	60-145	
PFEESA	ng/L	176	182	103	70-140	
PFHpA	ng/L	96	94.9	99	70-150	
PFHpS	ng/L	96	89.5	93	70-150	
PFHxA	ng/L	96	96.4	100	70-145	
PFHxS	ng/L	88	85.7	97	65-145	
PFMBA	ng/L	200	208	104	60-150	
PFMPA	ng/L	200	214	107	55-140	
PFNA	ng/L	96	97.5	102	70-150	
PFNS	ng/L	96	85.8	89	65-145	
PFOA	ng/L	96	92.4	96	70-150	
PFOS	ng/L	96	81.2	85	55-150	
PFOSA	ng/L	96	99.3	103	70-145	
PFPeA	ng/L	200	196	98	65-135	
PFPeS	ng/L	96	94.6	99	65-140	
PFTeDA	ng/L	96	102	106	60-140	
PFTrDA	ng/L	96	96.6	101	65-140	
PFUnA	ng/L	96	102	106	70-145	
13C2-PFDoA (S)	%.			84	10-130	
13C2-PFTA (S)	%.			75	10-130	
13C24:2FTS (S)	%.			92	40-200	
13C26:2FTS (S)	%.			85	40-200	
13C28:2FTS (S)	%.			79	40-300	
13C3-PFBS (S)	%.			87	40-135	
13C3-PFHxS (S)	%.			86	40-130	
13C3-PFPrA (S)	%.			90	5-130	
13C3HFPO-DA (S)	%.			83	40-130	
13C4-PFBA (S)	%.			89	5-130	
13C4-PFHpA (S)	%.			82	40-130	
13C5-PFHxA (S)	%.			89	40-130	
13C5-PFPeA (S)	%.			88	40-130	
13C6-PFDA (S)	%.			90	40-130	
13C7-PFUdA (S)	%.			90	30-130	
13C8-PFOA (S)	%.			100	40-130	
13C8-PFOS (S)	%.			93	40-130	
13C8-PFOSA (S)	%.			77	40-130	
13C9-PFNA (S)	%.			91	40-130	
d3-MeFOSAA (S)	%.			79	40-170	
d3-NMeFOSA (S)	%.			65	10-130	
d5-EtFOSAA (S)	%.			75	25-135	

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QUALITY CONTROL DATA

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

LABORATORY CONTROL SAMPLE: 5225628

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
d5-NEtFOSA (S)	%.			66	10-130	
d7-NMeFOSE (S)	%.			76	10-130	
d9-NEtFOSE (S)	%.			74	10-130	

LABORATORY CONTROL SAMPLE: 5225629

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
11Cl-PF3OUdS	ng/L	60.2	51.4	86	55-160	
3:3 FTCA	ng/L	79.4	67.9	86	65-130	
4:2 FTS	ng/L	60.2	49.7	83	70-145	
5:3 FTCA	ng/L	397	344	87	70-135	
6:2 FTS	ng/L	61.4	52.4	85	65-155	
7:3 FTCA	ng/L	397	349	88	50-145	
8:2 FTS	ng/L	61.4	54.9	89	60-150	
9Cl-PF3ONS	ng/L	60.2	55.5	92	70-155	
ADONA	ng/L	60.2	60.4	100	65-145	
HFPO-DA	ng/L	64	58.4	91	70-140	
NEtFOSA	ng/L	15.4	14.1	92	65-145	
NEtFOSAA	ng/L	15.4	14.7	96	70-145	
NEtFOSE	ng/L	154	142	92	70-135	
NFDHA	ng/L	32	25.3	79	50-150	
NMeFOSA	ng/L	15.4	15.1	99	60-150	
NMeFOSAA	ng/L	15.4	12.5	81	50-140	
NMeFOSE	ng/L	154	148	96	70-145	
PFBA	ng/L	64	57.3	89	70-140	
PFBS	ng/L	14.1	12.7	90	60-145	
PFDA	ng/L	15.4	13.6	88	70-140	
PFDoA	ng/L	15.4	14.7	96	70-140	
PFDoS	ng/L	15.4	13.9	90	50-145	
PFDS	ng/L	15.4	13.1	85	60-145	
PFEESA	ng/L	28.2	25.0	89	70-140	
PFHpA	ng/L	15.4	14.7	95	70-150	
PFHpS	ng/L	15.4	13.5	88	70-150	
PFHxA	ng/L	15.4	14.2	93	70-145	
PFHxS	ng/L	14.1	13.9	99	65-145	
PFMBA	ng/L	32	29.3	92	60-150	
PFMPA	ng/L	32	30.6	96	55-140	
PFNA	ng/L	15.4	13.6	88	70-150	
PFNS	ng/L	15.4	12.2	79	65-145	
PFOA	ng/L	15.4	14.3	93	70-150	
PFOS	ng/L	15.4	13.4	87	55-150	
PFOSA	ng/L	15.4	14.2	92	70-145	
PFPeA	ng/L	32	28.7	90	65-135	
PFPeS	ng/L	15.4	14.4	94	65-140	
PFTeDA	ng/L	15.4	15.1	98	60-140	

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QUALITY CONTROL DATA

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

LABORATORY CONTROL SAMPLE: 5225629

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
PFTrDA	ng/L	15.4	14.9	97	65-140	
PFUnA	ng/L	15.4	13.7	89	70-145	
13C2-PFDoA (S)	%.			44	10-130	
13C2-PFTA (S)	%.			42	10-130	
13C24:2FTS (S)	%.			53	40-200	
13C26:2FTS (S)	%.			41	40-200	
13C28:2FTS (S)	%.			44	40-300	
13C3-PFBS (S)	%.			52	40-135	
13C3-PFHxS (S)	%.			49	40-130	
13C3-PFPrA (S)	%.			55	5-130	
13C3HFPO-DA (S)	%.			49	40-130	
13C4-PFBA (S)	%.			57	5-130	
13C4-PFHpA (S)	%.			44	40-130	
13C5-PFHxA (S)	%.			50	40-130	
13C5-PFPeA (S)	%.			50	40-130	
13C6-PFDA (S)	%.			46	40-130	
13C7-PFUdA (S)	%.			50	30-130	
13C8-PFOA (S)	%.			55	40-130	
13C8-PFOS (S)	%.			48	40-130	
13C8-PFOSA (S)	%.			40	40-130	
13C9-PFNA (S)	%.			47	40-130	
d3-MeFOSAA (S)	%.			38	40-170	S0
d3-NMeFOSA (S)	%.			32	10-130	
d5-EtFOSAA (S)	%.			35	25-135	
d5-NEtFOSA (S)	%.			33	10-130	
d7-NMeFOSE (S)	%.			41	10-130	
d9-NEtFOSE (S)	%.			41	10-130	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

QUALIFIERS

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

S0	Surrogate recovery outside laboratory control limits.

REPORT OF LABORATORY ANALYSIS

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1700 Elm Street
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Elk River PFC Quarterly-Revised Report
Pace Project No.: 10729533

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10729533001	**SP-01**	EPA 1633	1002017	EPA 1633	1002863

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Pace® Location Requested (City/State):
Pace Analytical Minnesota
1700 Elm Street, Suite 200
Minneapolis, MN 55414

CHAIN-OF-CUSTODY Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields

WO#: 10729533

10729533

Company Name:	Waste Management National Services, Inc.	Company/Report To:	Andrea Nord
Street Address:	4100 Peony Drive, Suite 300	Phone #:	952-832-3600
	Minneapolis, MN 55435	E-Mail:	gnord@wm.com
Customer Project #:		Cc Email:	
Project Name:	Elk Run PFC Quarterly	Invoice To:	Accounts Payable
Site Collection Info/Facility ID (as applicable):		Invoice E-Mail:	wmmwolfe@onlinepaymentcenter.com
		Purchase Order # (if applicable):	10055273
		Quote #:	
Time Zone Collected:	[ ]AK [ ]PT [ ]MT [ ]CT [ ]ET	County / State origin of sample(s):	Minnesota

Data Deliverables: [ ]Level II [ ]Level III [ ]Level IV [ ]EQuIS [ ]Other

Regulatory Program (Dw, NPDES, etc.) as applicable: Reportable ([ ]Yes [ ]No

Rush (Pre-approval required): [ ]Same Day [ ]1 Day [ ]2 Day [ ]5 Day [ ]Other

DW PWS ID # or WW Permit # as applicable:

Date Results Needed:

Field Filtered (if applicable): [ ]Yes [ ]No

Analysis Requested

Preservation Codes: H=HCl, N=HNO3, S=H2SO4, NO=NaOH, SA=Ascorbic Acid, ZA=Zinc Acetate, U=Ultrapure, O=Other

Matrix Codes: Drinking Water (DW), Source Water (SW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Tissue (TS), Bioassay (B), Vapor (V), Surface Water (SW), Sediment (SED), Sludge (SL), Other Solid (SS), Leachate (LE), Biofluid (BF), Other (OT)

Customer Sample ID	Matrix *	Comp / Grab	Composite Start Date	Composite Start Time	Collected or Composite End Date	Collected or Composite End Time	# Cont.	Res. Chlorine Results	Res. Chlorine Units
SP-01	WW	G	4/1/25	1320			3		

EPA 1633 DRAFT Landfill Leach

Proj. Mgr.: Fiona Panther

Acctnum / Client ID:

Template:

Profile / Template: 65904

Prelog / Bottle Ord. ID: EZ 3071903

Sample Comments: 001

Additional Instructions from Pace®:

Collected By (printed name): Kenneth Smith

Signature:

Customer Remarks / Special Conditions / Possible Hazards:

# Containers	Preservation Code	Condition Upon Receipt	Cooler Temp (°C)	Uncorrected Temp (°C)	Other
1	T9	for	0.8	0.9	F

Relinquished By / Company / Signature	Date / Time	Received By / Company / Signature	Date / Time	Trip Blank:
	4/1/25 1509	Pace	4-1-25 1509	
Relinquished By / Company / Signature	Date / Time	Received By / Company / Signature	Date / Time	Delivered By: [ ]Client [ ]Commercial [ ]Pace [ ]FedEx [ ]UPS [ ]Other
Relinquished By / Company / Signature	Date / Time	Received By / Company / Signature	Date / Time	

Page: 1 of 1

Terms and Conditions: https://www.pacelabs.com/resource-library/resource/pace-terms-and-conditions

ENV-FRM-CHSM-0001_v02_110121©

ENV-FRM-MIN4-0150 v19_Sample Condition Upon Receipt

Person Examining & Date: 4125 MS

PROJECT #: **WO#: 10729533**

PM: PG Due Date: 05/14/25

CLIENT: WM National

Client Name: Waste Management

Custody Seal Present: ☑ YES ☐ NO Seals Intact: ☑ YES ☐ NO

Tracking Number: ☐ See Exceptions form ENV-FRM-MIN4-0142.

Courier: ☑ Client ☐ Commercial ☐ FedEx ☐ Pace Courier/Field ☐ SpeeDee ☐ UPS ☐ USPS

Packing Material: ☐ Bubble Bags ☐ Bubble Wrap ☑ None ☐ Other: ____ Biological Tissue Frozen: ☐ YES ☑ NO

Thermometer: ☐ T1 (0461) ☐ T2 (0431) ☐ T3 (0459) ☐ T4 (0402) ☐ T5 (0187) ☐ T6 (0396) ☐ T7 (0377) ☐ T8 (0775) ☑ T9 (0428) ☐ 01339252 (0710)

Type of Ice: ☐ Blue ☐ Dry ☑ Wet ☐ Melted ☐ None

Temp Blank: ☑ YES ☐ NO

NOTE: Temp should be ≤ 6°C, but above freezing

Read Temp w/Temp Blank: 1.6 °C

Correction Factor: +0.4

Corrected Temp w/Temp Blank: 2.0 °C

Did Samples Originate in West Virginia: ☐ YES ☑ NO (list temps on exception)

Were All Container Temps Taken: ☐ YES ☐ NO ☑ N/A

Average Corrected Temp (No Temp Blank Only): ____

☐ See Exceptions form ENV-FRM-MIN4-0142. ☐ 1 Container

USDA Regulated Soil: ☑ N/A, Water Sample/Other (describe): ____

Did Samples originate from one of the following states (check map): ☐ YES ☐ NO

Circle State: AL, AR, AZ, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX, VA

Are samples from a foreign source (international, including Hawaii and Puerto Rico): ☐ YES ☐ NO

NOTE: If YES to either question, fill out a Regulated Soil Checklist (ENV-FRM-MIN4-0154) and include with SCUR/COC paperwork.

LOCATION (check one): ☐ DULUTH ☑ MINNEAPOLIS ☐ VIRGINIA	YES	NO	N/A	COMMENT(S)
Chain of Custody Present and Filled Out? (i.e., Analysis/ID/Date/Time)	☑	☐		1.
Chain of Custody Relinquished?	☑	☐		2.
Sampler Name and/or Signature on COC?	☑	☐	☐	3.
Samples Arrived within Hold Time? If Fecal: ☐ <8 hrs ☐ >8 hr but <24 hr ☐ >24 hr	☑	☐		4.
Short Hold Time Analysis (<72 hr)?	☐	☑		5. ☐ BOD / cBOD ☐ Fecal coliform ☐ Hex Chrom ☐ NPE ☐ Nitrate ☐ Nitrite ☐ Ortho Phos ☐ Total coliform/E coli ☐ Turbidity ☐ Other: ____
Rush Turn Around Time Requested?	☐	☑		6. ☐ Same Day ☐ 1 Day ☐ 2 Day ☐ 3 Day ☐ 5 Day Due Date: ____
Sufficient Sample Volume? (If NO, list approximate volume in section 7.)	☑	☐		7. ____
Correct Containers Used? – Pace Containers Used?	☑ ☑	☐ ☐	☐	8. 3x MT2VA
Containers Intact?	☑	☐		9.
Field Filtered Volume Received for Dissolved Tests?	☐	☐	☑	10. Is sediment visible in the dissolved container: ☐ YES ☐ NO
ID/Date/Time Match? (If NO, fill out section 11.) Matrix: ☐ Oil ☐ Soil ☑ Water ☐ Other	☑	☐	☐	11. ☐ See Exceptions form ENV-FRM-MIN4-0142
All containers needing acid/base preservation have been checked?	☐	☐	☑	12.

Sample #:

☐ HNO3 ____ ☐ H2SO4 ____ ☐ NaOH ____ ☐ Zinc Acetate ____

pH Paper Lot #:

☐ Residual Chlorine ____ ☐ 0-6 ROF ____ ☐ 0-6 Strip ____ ☐ 0-14 Strip ____

Positive for Residual Chlorine (NaOH containers only): ☐ YES ☐ NO

Preserved containers in compliance with EPA recommendations? (HNO3, H2SO4, < 2 pH, NaOH > 9 Sulfide, NaOH > 10 Cyanide)	☐	☐	☑	☐ See Exceptions form ENV-FRM-MIN4-0142
EXCEPTIONS (water only): VOA, Coliform, TOC/DOC, Oil & Grease, Phenols, DRO/8015, Dioxins, and PFAS	☐	☑	☐	
Extra labels present on Soil VOA or WIDRO containers? (soil only)	☐	☐	☑	13.
Headspace in Methyl Mercury Container?	☐	☐	☑	14
Headspace in VOA Vials (greater than 6mm)?	☐	☐	☑	☐ See Exceptions form ENV-FRM-MIN4-0140
Trip Blanks Present?	☐	☐	☑	15
Trip Blank Custody Seals Present?	☐	☐	☑	Pace Trip Blank Lot # (if purchased): ____

CLIENT NOTIFICATION / RESOLUTION:

Labeled By: MS Time: 13

Person Contacted & Date/Time: ____ PM Review & Date: 4/2/25 Piper J Gibbs

NOTE: When there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEQ Certification Office.

ANALYTICAL REPORT

January 29, 2025

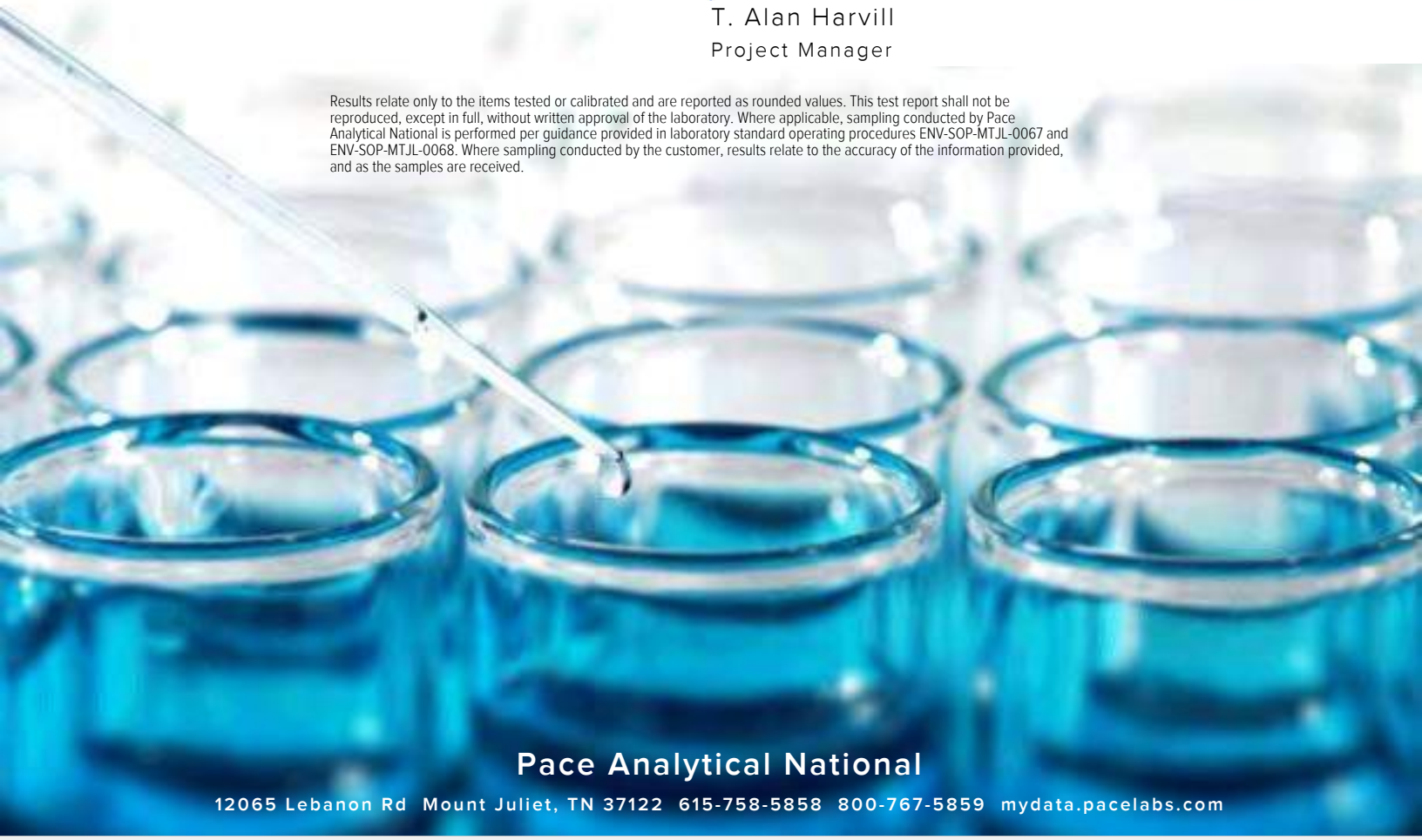
Elk River Landfill

Sample Delivery Group:	L1816567
Samples Received:	01/14/2025
Project Number:	500
Description:	Elk River QTRLY Leachate(1,4,7,10)
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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SAMPLE SUMMARY

SP-01_Leachate L1816567-01 WW

Collected by: Mike H.
Collected date/time: 01/13/25 13:30
Received date/time: 01/14/25 09:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 D-2011	WG2432967	1	01/14/25 12:49	01/14/25 14:34	MMF	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG2433209	1	01/14/25 19:14	01/14/25 19:14	KRB	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2433526	10	01/15/25 21:06	01/15/25 21:06	DLH	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2433526	50	01/15/25 21:22	01/15/25 21:22	DLH	Mt. Juliet, TN
Wet Chemistry by Method 335.4	WG2435359	2	01/19/25 07:59	01/19/25 22:00	AEC	Mt. Juliet, TN
Wet Chemistry by Method 410.4	WG2433076	25	01/14/25 16:48	01/14/25 20:49	JEG	Mt. Juliet, TN
Wet Chemistry by Method 4500H+ B-2011	WG2432906	1	01/14/25 22:34	01/14/25 22:34	BRT	Mt. Juliet, TN
Wet Chemistry by Method D93/1010A	WG2432760	1	01/14/25 12:00	01/14/25 12:00	JAS	Mt. Juliet, TN
Mercury by Method 245.1	WG2435006	10	01/21/25 14:17	01/21/25 22:53	AKB	Mt. Juliet, TN
Metals (ICP) by Method 200.7	WG2437479	1	01/22/25 08:56	01/22/25 16:35	MAP	Mt. Juliet, TN
Metals (ICP) by Method 200.7	WG2437479	5	01/22/25 08:56	01/22/25 18:42	MAP	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2435218	25	01/17/25 14:18	01/17/25 14:18	DWR	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2435323	100	01/18/25 15:52	01/18/25 15:52	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2436369	100	01/21/25 16:15	01/21/25 16:15	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2436480	100	01/21/25 13:56	01/21/25 13:56	JHH	Mt. Juliet, TN
Pesticides (GC) by Method EPA 608.3	WG2433414	1	01/15/25 04:33	01/15/25 13:54	LTB	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method EPA-608.3	WG2434422	2	01/15/25 04:33	01/16/25 16:09	NWH	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 625.1	WG2432984	5	01/14/25 15:04	01/23/25 13:00	ALM	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 625.1	WG2432984	5	01/14/25 15:04	01/24/25 23:56	MBE	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Bis(Chloro-methyl)Ether not identified as a TIC.

2,Propanol, 2-Chloroethyl vinyl ether, Acrolein will be reporting outside of seven day hold time. Sample aliquot was unpreserved due to 2-Chloroethyl vinyl ether being a target compound. HCL preservative destroys this compound, making collection in unpreserved container necessary. Initial in hold run was analyzed at 25x, however the matrix of the sample interfered with the internal standards resulting in unreportable data. The sample was analyzed again at 100x due to the matrix, however the hold time expired prior to this dilution being able to be run.

Sample Delivery Group (SDG) Narrative

Sample was prepared and/or analyzed past recommended holding time. Concentrations should be considered minimum values.

Batch	Method	Lab Sample ID
WG2436369	8260D	L1816567-01

The laboratory analysis was performed from an unpreserved, insufficiently or inadequately preserved sample.

Batch	Method	Lab Sample ID
WG2435006	245.1	L1816567-01
WG2435359	335.4	L1816567-01

The following samples were prepared and/or analyzed past recommended holding time. Concentrations should be considered minimum values.

Batch	Method	Lab Sample ID
WG2432906	4500H+ B-2011	L1816567-01

Gravimetric Analysis by Method 2540 D-2011

RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Batch	Lab Sample ID	Analytes
WG2432967	(DUP) R4167139-3	Suspended Solids

Wet Chemistry by Method 300.0

The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).

Batch	Lab Sample ID	Analytes
WG2433526	(MS) R4167421-4	Chloride and Sulfate
WG2433526	(MSD) R4167421-5	Chloride and Sulfate

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2433526	(MS) R4167421-4, (MSD) R4167421-5	Chloride

The sample concentration is too high to evaluate accurate spike recoveries.

Batch	Lab Sample ID	Analytes
WG2433526	(MS) R4167421-4, (MSD) R4167421-5	Sulfate

Wet Chemistry by Method 335.4

RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Batch	Lab Sample ID	Analytes
WG2435359	(DUP) R4168305-5	Cyanide

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2435359	(MS) R4168305-3, (MSD) R4168305-4	Cyanide

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG2435359	(MSD) R4168305-4	Cyanide

Metals (ICP) by Method 200.7

The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).

Batch	Lab Sample ID	Analytes
WG2437479	(MS) R4169491-6	Sodium
WG2437479	(MSD) R4169491-7	Sodium

The sample concentration is too high to evaluate accurate spike recoveries.

Batch	Lab Sample ID	Analytes
WG2437479	(MS) R4169491-6, (MSD) R4169491-7	Sodium

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2435218	L1816567-01	Bromomethane

Pesticides (GC) by Method EPA 608.3

RPD between the primary and confirmatory analysis exceeded 40%

Batch	Lab Sample ID	Analytes
WG2433414	(MS) R4167713-1	15 analytes
WG2433414	(MSD) R4167713-2	13 analytes

Pesticides (GC) by Method EPA 608.3

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG2433414	Decachlorobiphenyl	(MS) R4167713-1, (MSD) R4167713-2, L1816567-01
WG2433414	Tetrachloro-m-xylene	(MSD) R4167713-2

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2433414	(MS) R4167713-1, (MSD) R4167713-2	4,4-DDD, 4,4-DDE, 4,4-DDT, Aldrin, Endosulfan I, Endrin, Endrin aldehyde, Heptachlor and Heptachlor epoxide

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG2433414	(MSD) R4167713-2	4,4-DDE

Polychlorinated Biphenyls (GC) by Method EPA-608.3

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG2434422	Decachlorobiphenyl	(MSD) R4167707-4, L1816567-01
WG2434422	Tetrachloro-m-xylene	L1816567-01

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2434422	(MS) R4167707-3, (MSD) R4167707-4	PCB 1016 and PCB 1260

Semi Volatile Organic Compounds (GC/MS) by Method 625.1

Analyte reported using a calibration and validation based on Azobenzene (CAS 103-33-3). 1,2-Diphenylhydrazine decomposes into Azobenzene during the analysis.

Batch	Analyte	Lab Sample ID
WG2432984	1,2-Diphenylhydrazine	(BLANK) R4167892-2, (LCS) R4167892-1, (MS) R4167892-3, (MSD) R4167892-4, L1816567-01

Surrogate recovery cannot be used for control limit evaluation due to dilution.

Batch	Analyte	Lab Sample ID
WG2432984	2,4,6-Tribromophenol	(MS) R4167892-3, (MSD) R4167892-4
WG2432984	2-Fluorobiphenyl	(MS) R4167892-3, (MSD) R4167892-4
WG2432984	2-Fluorophenol	(MS) R4167892-3, (MSD) R4167892-4
WG2432984	Nitrobenzene-d5	(MS) R4167892-3, (MSD) R4167892-4
WG2432984	Phenol-d5	(MS) R4167892-3, (MSD) R4167892-4
WG2432984	p-Terphenyl-d14	(MS) R4167892-3, (MSD) R4167892-4

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG2432984	p-Terphenyl-d14	L1816567-01

The sample matrix interfered with the ability to make any accurate determination; spike value is high.

Batch	Lab Sample ID	Analytes
WG2432984	(MS) R4167892-3, (MSD) R4167892-4	2,4-Dinitrophenol

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2432984	(MS) R4167892-3, (MSD) R4167892-4	2-Chloronaphthalene, Benzidine, Hexachlorocyclopentadiene and n-Nitrosodiphenylamine

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG2432984	(MSD) R4167892-4	Hexachlorocyclopentadiene

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	8	su
Temperature (on-site)	16.3	Deg. C

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	32.7		4.00	1	01/14/2025 14:34	WG2432967

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	9120		20.0	1	01/14/2025 19:14	WG2433209

Sample Narrative:

L1816567-01 WG2433209: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	2850		2.60	50	01/15/2025 21:22	WG2433526
Sulfate	30.4		5.00	10	01/15/2025 21:06	WG2433526

Sample Narrative:

L1816567-01 WG2433526: Dilution due to matrix impact on instrumentation at lower dilution

Wet Chemistry by Method 335.4

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Cyanide	ND		0.0100	2	01/19/2025 22:00	WG2435359

Wet Chemistry by Method 410.4

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
COD	3920		75.0	25	01/14/2025 20:49	WG2433076

Wet Chemistry by Method 4500H+ B-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	SU			date / time	
pH	7.90	T8	1	01/14/2025 22:34	WG2432906

Sample Narrative:

L1816567-01 WG2432906: 7.9 at 19.4C

Wet Chemistry by Method D93/1010A

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	deg F			date / time	
Flashpoint	DNF at 170		1	01/14/2025 12:00	WG2432760

Mercury by Method 245.1

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Mercury	ND		0.000490	10	01/21/2025 22:53	WG2435006

Metals (ICP) by Method 200.7

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
Silver	ND		0.00600	1	01/22/2025 16:35	WG2437479
Arsenic	0.142		0.0100	1	01/22/2025 16:35	WG2437479
Beryllium	ND		0.00200	1	01/22/2025 16:35	WG2437479
Boron	20.0		0.200	1	01/22/2025 16:35	WG2437479
Calcium	144		1.00	1	01/22/2025 16:35	WG2437479
Cadmium	ND		0.00200	1	01/22/2025 16:35	WG2437479
Chromium	0.413		0.0100	1	01/22/2025 16:35	WG2437479
Copper	ND		0.0100	1	01/22/2025 16:35	WG2437479
Potassium	798		1.00	5	01/22/2025 18:42	WG2437479
Magnesium	166		1.00	1	01/22/2025 16:35	WG2437479
Molybdenum	0.0128		0.0100	1	01/22/2025 16:35	WG2437479
Sodium	2460		1.00	5	01/22/2025 18:42	WG2437479
Nickel	0.325		0.0100	1	01/22/2025 16:35	WG2437479
Lead	ND		0.0100	1	01/22/2025 16:35	WG2437479
Antimony	0.0217		0.0200	1	01/22/2025 16:35	WG2437479
Selenium	ND		0.0250	1	01/22/2025 16:35	WG2437479
Thallium	ND		0.0200	1	01/22/2025 16:35	WG2437479
Zinc	0.510		0.0500	1	01/22/2025 16:35	WG2437479

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
1,1,1-Trichloroethane	ND		0.00100	25	01/17/2025 14:18	WG2435218
2-Propanol	3.80	Q	0.165	100	01/21/2025 16:15	WG2436369
1,1,2,2-Tetrachloroethane	ND		0.00100	25	01/17/2025 14:18	WG2435218
2-Chloroethyl vinyl ether	ND	Q	0.0575	100	01/21/2025 16:15	WG2436369
1,1,2-Trichloroethane	ND		0.00100	25	01/17/2025 14:18	WG2435218
Acrolein	ND	Q	0.254	100	01/21/2025 16:15	WG2436369
1,1-Dichloroethane	ND		0.00100	25	01/17/2025 14:18	WG2435218
1,1-Dichloroethene	ND		0.00100	25	01/17/2025 14:18	WG2435218
1,2,4-Trichlorobenzene	ND		0.00440	25	01/17/2025 14:18	WG2435218
1,2-Dichloroethane	ND		0.00100	25	01/17/2025 14:18	WG2435218
1,2-Dichloropropane	ND		0.00142	25	01/17/2025 14:18	WG2435218
2-Butanone (MEK)	3.64		0.0635	25	01/17/2025 14:18	WG2435218
4-Methyl-2-pentanone (MIBK)	0.0473		0.00500	25	01/17/2025 14:18	WG2435218
Acetone	4.32		0.146	100	01/18/2025 15:52	WG2435323
Acrylonitrile	ND		0.00500	25	01/17/2025 14:18	WG2435218
Benzene	0.00145		0.00100	25	01/17/2025 14:18	WG2435218
Bromodichloromethane	ND		0.00100	25	01/17/2025 14:18	WG2435218
Bromoform	ND		0.00117	25	01/17/2025 14:18	WG2435218
Bromomethane	ND	C3	0.00197	25	01/17/2025 14:18	WG2435218
Carbon tetrachloride	ND		0.00100	25	01/17/2025 14:18	WG2435218
Chlorobenzene	ND		0.00100	25	01/17/2025 14:18	WG2435218
Chloroethane	ND		0.00170	25	01/17/2025 14:18	WG2435218
Chloroform	ND		0.00103	25	01/17/2025 14:18	WG2435218
Chloromethane	ND		0.00435	25	01/17/2025 14:18	WG2435218
Dibromochloromethane	ND		0.00100	25	01/17/2025 14:18	WG2435218
Ethyl ether	0.0228		0.00100	25	01/17/2025 14:18	WG2435218
Ethylbenzene	0.0212		0.00295	100	01/18/2025 15:52	WG2435323
Hexachloro-1,3-butadiene	ND		0.00200	25	01/17/2025 14:18	WG2435218
Methylene Chloride	ND		0.00664	25	01/17/2025 14:18	WG2435218
Naphthalene	0.0345		0.0195	100	01/18/2025 15:52	WG2435323
Tetrachloroethene	ND		0.00100	25	01/17/2025 14:18	WG2435218
Tetrahydrofuran	1.72		0.00500	25	01/17/2025 14:18	WG2435218
Toluene	0.0199		0.00130	25	01/17/2025 14:18	WG2435218
Total Xylene	0.0552		0.00352	100	01/18/2025 15:52	WG2435323

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
Trichloroethene	ND		0.00100	25	01/17/2025 14:18	WG2435218
Vinyl chloride	ND		0.00462	100	01/21/2025 13:56	WG2436480
cis-1,3-Dichloropropene	ND		0.00100	25	01/17/2025 14:18	WG2435218
m&p-Xylene	0.0395		0.00760	100	01/18/2025 15:52	WG2435323
o-Xylene	0.0157		0.00352	100	01/18/2025 15:52	WG2435323
trans-1,2-Dichloroethene	ND		0.00104	25	01/17/2025 14:18	WG2435218
trans-1,3-Dichloropropene	ND		0.00114	25	01/17/2025 14:18	WG2435218
(S) 4-Bromofluorobenzene	*100*			*67.0-138*	*01/17/2025 14:18*	WG2435218
(S) 4-Bromofluorobenzene	*106*			*67.0-138*	*01/18/2025 15:52*	WG2435323
(S) 4-Bromofluorobenzene	*95.8*			*67.0-138*	*01/21/2025 13:56*	WG2436480
(S) Toluene-d8	*97.8*			*75.0-131*	*01/17/2025 14:18*	WG2435218
(S) Toluene-d8	*97.6*			*75.0-131*	*01/18/2025 15:52*	WG2435323
(S) Toluene-d8	*104*			*75.0-131*	*01/21/2025 13:56*	WG2436480
(S) 1,2-Dichloroethane-d4	*90.2*			*70.0-130*	*01/17/2025 14:18*	WG2435218
(S) 1,2-Dichloroethane-d4	*90.8*			*70.0-130*	*01/18/2025 15:52*	WG2435323
(S) 1,2-Dichloroethane-d4	*101*			*70.0-130*	*01/21/2025 13:56*	WG2436480
(S) 1,2-Dichloroethane-d4	*90.4*			*70.0-130*	*01/21/2025 16:15*	WG2436369
(S) 4-Bromofluorobenzene	*105*			*77.0-126*	*01/21/2025 16:15*	WG2436369
(S) Toluene-d8	*103*			*80.0-120*	*01/21/2025 16:15*	WG2436369

Pesticides (GC) by Method EPA 608.3

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
4,4-DDD	ND		0.0000500	1	01/15/2025 13:54	WG2433414
4,4-DDE	ND		0.0000500	1	01/15/2025 13:54	WG2433414
4,4-DDT	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Aldrin	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Alpha BHC	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Beta BHC	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Chlordane	ND		0.000500	1	01/15/2025 13:54	WG2433414
Delta BHC	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Dieldrin	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Endosulfan I	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Endosulfan II	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Endosulfan sulfate	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Endrin	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Endrin aldehyde	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Gamma BHC	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Heptachlor	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Heptachlor epoxide	ND		0.0000500	1	01/15/2025 13:54	WG2433414
Toxaphene	ND		0.000500	1	01/15/2025 13:54	WG2433414
(S) Tetrachloro-m-xylene	*24.2*			*10.0-135*	*01/15/2025 13:54*	WG2433414
(S) Decachlorobiphenyl	*2.90*	J2		*10.0-144*	*01/15/2025 13:54*	WG2433414

Sample Narrative:

L1816567-01 WG2433414: Sample produced emulsion during Extraction process, low surr/spike recoveries due to matrix.

Polychlorinated Biphenyls (GC) by Method EPA-608.3

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
PCB 1016	ND		0.000200	2	01/16/2025 16:09	WG2434422
PCB 1221	ND		0.000200	2	01/16/2025 16:09	WG2434422
PCB 1232	ND		0.000200	2	01/16/2025 16:09	WG2434422
PCB 1242	ND		0.000200	2	01/16/2025 16:09	WG2434422
PCB 1248	ND		0.000200	2	01/16/2025 16:09	WG2434422

Polychlorinated Biphenyls (GC) by Method EPA-608.3

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
PCB 1254	ND		0.000200	2	01/16/2025 16:09	WG2434422
PCB 1260	ND		0.000240	2	01/16/2025 16:09	WG2434422
(S) Tetrachloro-m-xylene	*9.65*	J2		*10.0-135*	*01/16/2025 16:09*	WG2434422
(S) Decachlorobiphenyl	*1.91*	J2		*10.0-144*	*01/16/2025 16:09*	WG2434422

Sample Narrative:

L1816567-01 WG2434422: Dilution due to sulfur cleanup.

Semi Volatile Organic Compounds (GC/MS) by Method 625.1

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		0.0100	5	01/23/2025 13:00	WG2432984
1,2-Dichlorobenzene	ND		0.0100	5	01/23/2025 13:00	WG2432984
1,2-Diphenylhydrazine	ND	N2	0.0100	5	01/23/2025 13:00	WG2432984
1,3-Dichlorobenzene	ND		0.0100	5	01/23/2025 13:00	WG2432984
1,4-Dichlorobenzene	ND		0.0100	5	01/23/2025 13:00	WG2432984
2,2-Oxybis(1-Chloropropane)	ND		0.00500	5	01/23/2025 13:00	WG2432984
2,4,6-Trichlorophenol	ND		0.0100	5	01/23/2025 13:00	WG2432984
2,4-Dichlorophenol	ND		0.0100	5	01/23/2025 13:00	WG2432984
2,4-Dimethylphenol	ND		0.0100	5	01/23/2025 13:00	WG2432984
2,4-Dinitrophenol	ND		0.0163	5	01/23/2025 13:00	WG2432984
2,4-Dinitrotoluene	ND		0.0100	5	01/23/2025 13:00	WG2432984
2,6-Dinitrotoluene	ND		0.0100	5	01/23/2025 13:00	WG2432984
2-Chloronaphthalene	ND		0.00500	5	01/23/2025 13:00	WG2432984
2-Chlorophenol	ND		0.0100	5	01/23/2025 13:00	WG2432984
2-Nitrophenol	ND		0.0100	5	01/23/2025 13:00	WG2432984
3,3-Dichlorobenzidine	ND		5.00	5	01/23/2025 13:00	WG2432984
4,6-Dinitro-2-methylphenol	ND		0.0132	5	01/23/2025 13:00	WG2432984
4-Bromophenyl-phenylether	ND		0.00500	5	01/23/2025 13:00	WG2432984
4-Chloro-3-methylphenol	ND		0.0100	5	01/23/2025 13:00	WG2432984
4-Chlorophenyl-phenylether	ND		0.00500	5	01/23/2025 13:00	WG2432984
4-Nitrophenol	ND		0.0150	5	01/23/2025 13:00	WG2432984
Acenaphthene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Acenaphthylene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Anthracene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Benzidine	ND		0.0800	5	01/23/2025 13:00	WG2432984
Benzo(A)Anthracene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Benzo(a)pyrene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Benzo(b)fluoranthene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Benzo(g,h,i)perylene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Benzo(k)fluoranthene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Benzylbutyl phthalate	ND		0.00500	5	01/23/2025 13:00	WG2432984
Bis(2-Ethylhexyl)phthalate	ND		0.0100	5	01/23/2025 13:00	WG2432984
Bis(2-chlorethoxy)methane	ND		0.0100	5	01/23/2025 13:00	WG2432984
Bis(2-chloroethyl)ether	ND		0.0100	5	01/23/2025 13:00	WG2432984
Chrysene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Di-n-butyl phthalate	ND		0.00500	5	01/23/2025 13:00	WG2432984
Di-n-octyl phthalate	ND		0.00500	5	01/23/2025 13:00	WG2432984
Dibenz(a,h)anthracene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Diethyl phthalate	ND		0.00500	5	01/23/2025 13:00	WG2432984
Dimethyl phthalate	ND		0.00500	5	01/23/2025 13:00	WG2432984
Fluoranthene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Fluorene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Hexachloro-1,3-butadiene	ND		0.0100	5	01/23/2025 13:00	WG2432984
Hexachlorobenzene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Hexachlorocyclopentadiene	ND		0.0117	5	01/23/2025 13:00	WG2432984

Semi Volatile Organic Compounds (GC/MS) by Method 625.1

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
Hexachloroethane	ND		0.0100	5	01/23/2025 13:00	WG2432984
Indeno(1,2,3-cd)pyrene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Isophorone	ND		0.0100	5	01/23/2025 13:00	WG2432984
Naphthalene	0.00446		0.00186	5	01/23/2025 13:00	WG2432984
Nitrobenzene	ND		0.0100	5	01/23/2025 13:00	WG2432984
Pentachlorophenol	ND		0.0100	5	01/23/2025 13:00	WG2432984
Phenanthrene	ND		0.00500	5	01/23/2025 13:00	WG2432984
Phenol	0.139		0.0100	5	01/24/2025 23:56	WG2432984
Pyrene	ND		0.00500	5	01/23/2025 13:00	WG2432984
n-Nitrosodi-n-propylamine	ND		0.00500	5	01/23/2025 13:00	WG2432984
n-Nitrosodimethylamine	ND		0.0100	5	01/23/2025 13:00	WG2432984
n-Nitrosodiphenylamine	ND		0.0100	5	01/23/2025 13:00	WG2432984
(S) Phenol-d5	*61.2*			*8.00-424*	*01/23/2025 13:00*	WG2432984
(S) Phenol-d5	*43.1*			*8.00-424*	*01/24/2025 23:56*	WG2432984
(S) Nitrobenzene-d5	*62.9*			*15.0-314*	*01/24/2025 23:56*	WG2432984
(S) Nitrobenzene-d5	*88.7*			*15.0-314*	*01/23/2025 13:00*	WG2432984
(S) 2,4,6-Tribromophenol	*71.4*			*10.0-153*	*01/23/2025 13:00*	WG2432984
(S) 2,4,6-Tribromophenol	*77.0*			*10.0-153*	*01/24/2025 23:56*	WG2432984
(S) p-Terphenyl-d14	*13.5*	J2		*29.0-141*	*01/23/2025 13:00*	WG2432984
(S) p-Terphenyl-d14	*12.4*	J2		*29.0-141*	*01/24/2025 23:56*	WG2432984
(S) 2-Fluorophenol	*43.1*			*10.0-120*	*01/24/2025 23:56*	WG2432984
(S) 2-Fluorophenol	*78.6*			*10.0-120*	*01/23/2025 13:00*	WG2432984
(S) 2-Fluorobiphenyl	*52.8*			*22.0-127*	*01/23/2025 13:00*	WG2432984
(S) 2-Fluorobiphenyl	*48.7*			*22.0-127*	*01/24/2025 23:56*	WG2432984

Sample Narrative:

L1816567-01 WG2432984: Dilution and surrogate failure due to matrix interference.

Method Blank (MB)

(MB) R4167139-1 01/14/25 14:34

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Suspended Solids	ND		0.350	2.50

L1816520-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1816520-01 01/14/25 14:34 • (DUP) R4167139-3 01/14/25 14:34

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	183	220	1	18.4	P1	10

L1816531-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1816531-01 01/14/25 14:34 • (DUP) R4167139-4 01/14/25 14:34

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	71.6	67.4	1	6.06		10

Laboratory Control Sample (LCS)

(LCS) R4167139-2 01/14/25 14:34

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Suspended Solids	773	718	92.9	85.0-115	

Method Blank (MB)

(MB) R4166935-2 01/14/25 18:04

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	ND		2.71	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1816221-16 Original Sample (OS) • Duplicate (DUP)

(OS) L1816221-16 01/14/25 18:41 • (DUP) R4166935-3 01/14/25 18:47

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	8190	8150	1	0.421		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5 Headspace

L1816577-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1816577-01 01/14/25 20:04 • (DUP) R4166935-4 01/14/25 20:10

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	869	874	1	0.639		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5 Headspace

Laboratory Control Sample (LCS)

(LCS) R4166935-1 01/14/25 17:57

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	101	101	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R4167421-1 01/15/25 20:10

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloride	ND		0.0519	1.00
Sulfate	ND		0.0774	5.00

L1816926-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1816926-01 01/16/25 01:54 • (DUP) R4167421-6 01/16/25 02:11

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	10.1	10.1	1	0.0218		15
Sulfate	9.60	9.40	1	2.12		15

Laboratory Control Sample (LCS)

(LCS) R4167421-2 01/15/25 20:27

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40.0	39.8	99.4	90.0-110	
Sulfate	40.0	39.9	99.8	90.0-110	

L1816911-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1816911-02 01/16/25 00:46 • (MS) R4167421-4 01/16/25 01:20 • (MSD) R4167421-5 01/16/25 01:37

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	40.0	137	149	149	30.6	30.6	1	90.0-110	E J6	E J6	0.00536	15
Sulfate	40.0	2200	1790	1790	0.000	0.000	1	90.0-110	E V	E V	0.101	15

L1816926-01 Original Sample (OS) • Matrix Spike (MS)

(OS) L1816926-01 01/16/25 01:54 • (MS) R4167421-7 01/16/25 02:28

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	40.0	10.1	48.5	96.1	1	90.0-110	
Sulfate	40.0	9.60	47.9	95.6	1	90.0-110	

Method Blank (MB)

(MB) R4168305-1 01/19/25 21:40

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Cyanide	ND		0.00180	0.00500

L1816701-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1816701-01 01/19/25 22:03 • (DUP) R4168305-5 01/19/25 22:04

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Cyanide	ND	ND	1	200	P1	20

Laboratory Control Sample (LCS)

(LCS) R4168305-2 01/19/25 21:41

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Cyanide	0.100	0.101	101	87.1-120	

L1816484-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1816484-01 01/19/25 21:50 • (MS) R4168305-3 01/19/25 21:51 • (MSD) R4168305-4 01/19/25 21:53

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Cyanide	0.100	ND	ND	0.0566	3.42	54.4	1	90.0-110	J6	J3 J6	164	20

Method Blank (MB)

(MB) R4166931-1 01/14/25 20:43

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
COD	ND		3.00	10.0

L1816492-07 Original Sample (OS) • Duplicate (DUP)

(OS) L1816492-07 01/14/25 20:46 • (DUP) R4166931-5 01/14/25 20:46

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	ND	ND	1	0.000		20

L1816492-08 Original Sample (OS) • Duplicate (DUP)

(OS) L1816492-08 01/14/25 20:47 • (DUP) R4166931-6 01/14/25 20:47

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	44.5	43.4	1	2.36		20

Laboratory Control Sample (LCS)

(LCS) R4166931-2 01/14/25 20:44

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
COD	500	516	103	90.0-110	

L1816492-05 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1816492-05 01/14/25 20:46 • (MS) R4166931-3 01/14/25 20:46 • (MSD) R4166931-4 01/14/25 20:46

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
COD	500	16.8	520	522	101	101	1	90.0-110			0.376	20

L1816606-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1816606-01 01/14/25 22:34 • (DUP) R4166957-2 01/14/25 22:34

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	7.93	7.94	1	0.126		1

Sample Narrative:

OS: 7.93 at 19.5C

DUP: 7.94 at 19.7C

Laboratory Control Sample (LCS)

(LCS) R4166957-1 01/14/25 22:34

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	su	su	%	%	
pH	10.0	9.99	99.9	99.0-101	

Sample Narrative:

LCS: 9.99 at 18.7C

L1816273-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1816273-01 01/14/25 12:00 • (DUP) R4166758-3 01/14/25 12:00

	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Analyte	deg F	deg F		%		%
Flashpoint	DNF at 170	DNF at 170	1	0.000		10

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4166758-1 01/14/25 12:00 • (LCSD) R4166758-2 01/14/25 12:00

	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Analyte	deg F	deg F	deg F	%	%	%			%	%
Flashpoint	126	128	122	102	97.1	96.0-104			4.79	10

Method Blank (MB)

(MB) R4169096-1 01/21/25 22:30

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Mercury	ND		0.0000490	0.000200

Laboratory Control Sample (LCS)

(LCS) R4169096-2 01/21/25 22:33

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Mercury	0.00300	0.00290	96.5	85.0-115	

L1817213-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1817213-04 01/21/25 22:35 • (MS) R4169096-4 01/21/25 22:40 • (MSD) R4169096-5 01/21/25 22:43

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	ND	0.00303	0.00295	101	98.3	1	70.0-130			2.59	20

L1817571-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1817571-02 01/21/25 22:46 • (MS) R4169096-6 01/21/25 22:48 • (MSD) R4169096-7 01/21/25 22:51

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	0.000358	0.00277	0.00294	80.4	86.2	1	70.0-130			6.07	20

Method Blank (MB)

(MB) R4169491-3 01/22/25 16:25

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Silver	ND		0.00270	0.00500
Arsenic	ND		0.00640	0.0100
Beryllium	ND		0.000700	0.00200
Boron	ND		0.0159	0.200
Calcium	ND		0.100	1.00
Cadmium	ND		0.000700	0.00200
Chromium	0.00213	J	0.00180	0.0100
Copper	ND		0.00700	0.0100
Potassium	ND		0.107	1.00
Magnesium	ND		0.0168	1.00
Molybdenum	ND		0.00170	0.00500
Sodium	ND		0.0939	1.00
Nickel	ND	J	0.00580	0.0100
Lead	ND		0.00200	0.00500
Antimony	ND		0.00770	0.0100
Selenium	ND		0.00760	0.0100
Thallium	ND		0.00670	0.0100
Zinc	0.0112	J	0.00340	0.0500

Laboratory Control Sample (LCS)

(LCS) R4169491-4 01/22/25 16:26

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Silver	0.200	0.204	102	85.0-115	
Arsenic	1.00	0.971	97.1	85.0-115	
Beryllium	1.00	1.00	100	85.0-115	
Boron	1.00	0.950	95.0	85.0-115	
Calcium	10.0	10.0	100	85.0-115	
Cadmium	1.00	0.989	98.9	85.0-115	
Chromium	1.00	1.01	101	85.0-115	
Copper	1.00	1.01	101	85.0-115	
Potassium	10.0	10.1	101	85.0-115	
Magnesium	10.0	9.71	97.1	85.0-115	
Molybdenum	1.00	1.00	100	85.0-115	
Sodium	10.0	10.4	104	85.0-115	
Nickel	1.00	0.949	94.9	85.0-115	
Lead	1.00	0.972	97.2	85.0-115	
Antimony	1.00	0.998	99.8	85.0-115	

Laboratory Control Sample (LCS)

(LCS) R4169491-4 01/22/25 16:26

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Selenium	1.00	0.952	95.2	85.0-115	
Thallium	1.00	1.01	101	85.0-115	
Zinc	1.00	1.02	102	85.0-115	

L1819018-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1819018-02 01/22/25 16:28 • (MS) R4169491-6 01/22/25 16:31 • (MSD) R4169491-7 01/22/25 16:33

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Silver	0.200	ND	0.220	0.217	110	109	1	70.0-130			1.13	20
Arsenic	1.00	ND	1.07	1.05	107	105	1	70.0-130			1.14	20
Beryllium	1.00	ND	1.03	1.03	103	103	1	70.0-130			0.282	20
Boron	1.00	ND	1.14	1.15	98.6	99.6	1	70.0-130			0.830	20
Calcium	10.0	26.7	36.9	37.4	102	108	1	70.0-130			1.56	20
Cadmium	1.00	ND	1.05	1.04	105	104	1	70.0-130			0.570	20
Chromium	1.00	ND	1.04	1.03	104	102	1	70.0-130			1.02	20
Copper	1.00	ND	1.03	1.02	103	102	1	70.0-130			0.612	20
Potassium	10.0	17.3	29.2	29.4	119	121	1	70.0-130			0.492	20
Magnesium	10.0	4.75	13.7	13.9	89.7	91.6	1	70.0-130			1.33	20
Molybdenum	1.00	0.351	1.41	1.39	106	104	1	70.0-130			0.936	20
Sodium	10.0	2340	2400	2420	621	813	1	70.0-130	E V	E V	0.794	20
Nickel	1.00	0.0216	1.04	1.03	102	101	1	70.0-130			0.939	20
Lead	1.00	ND	0.992	0.982	99.2	98.2	1	70.0-130			1.01	20
Antimony	1.00	ND	1.06	1.04	106	104	1	70.0-130			1.19	20
Selenium	1.00	ND	1.09	1.08	109	108	1	70.0-130			1.02	20
Thallium	1.00	ND	0.983	0.969	98.3	96.9	1	70.0-130			1.47	20
Zinc	1.00	ND	0.993	0.985	98.9	98.0	1	70.0-130			0.813	20

Method Blank (MB)

(MB) R4167891-3 01/17/25 10:45

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
1,1,1-Trichloroethane	ND		0.0000369	0.000100
1,1,2,2-Tetrachloroethane	ND		0.0000278	0.000100
1,1,2-Trichloroethane	ND		0.0000239	0.000100
1,1-Dichloroethane	ND		0.0000196	0.000100
1,1-Dichloroethene	ND		0.0000242	0.000100
1,2,4-Trichlorobenzene	ND		0.000176	0.000500
1,2-Dichloroethane	ND		0.0000260	0.000100
1,2-Dichloropropane	ND		0.0000568	0.000200
2-Butanone (MEK)	ND		0.00254	0.00400
4-Methyl-2-pentanone (MIBK)	ND		0.0000912	0.00100
Acrylonitrile	ND		0.000144	0.000500
Benzene	ND		0.0000187	0.0000400
Bromodichloromethane	ND		0.0000290	0.000100
Bromoform	ND		0.0000468	0.00100
Bromomethane	ND		0.0000788	0.000500
Carbon tetrachloride	ND		0.0000359	0.000200
Chlorobenzene	ND		0.00000840	0.000100
Chloroethane	ND		0.0000680	0.000200
Chloroform	ND		0.0000412	0.000100
Chloromethane	ND		0.000174	0.000500
Dibromochloromethane	ND		0.0000245	0.000100
Ethyl ether	ND		0.0000356	0.000100
Hexachloro-1,3-butadiene	ND		0.0000485	0.00100
Methylene Chloride	ND		0.000266	0.00100
Tetrachloroethene	ND		0.0000358	0.000100
Tetrahydrofuran	ND		0.000141	0.000500
Toluene	ND		0.0000520	0.000200
Trichloroethene	ND		0.0000234	0.0000400
cis-1,3-Dichloropropene	ND		0.0000303	0.000100
trans-1,2-Dichloroethene	ND		0.0000416	0.000200
trans-1,3-Dichloropropene	ND		0.0000456	0.000200
(S) 4-Bromofluorobenzene	*95.0*			*67.0-138*
(S) Toluene-d8	*102*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*91.1*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4167891-1 01/17/25 09:26 • (LCSD) R4167891-2 01/17/25 09:46

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1-Trichloroethane	0.00500	0.00524	0.00513	105	103	69.0-126			2.12	20
1,1,2,2-Tetrachloroethane	0.00500	0.00484	0.00458	96.8	91.6	68.0-128			5.52	20
1,1,2-Trichloroethane	0.00500	0.00543	0.00521	109	104	78.0-123			4.14	20
1,1-Dichloroethane	0.00500	0.00502	0.00494	100	98.8	70.0-127			1.61	20
1,1-Dichloroethene	0.00500	0.00506	0.00495	101	99.0	65.0-131			2.20	20
1,2,4-Trichlorobenzene	0.00500	0.00399	0.00403	79.8	80.6	62.0-137			0.998	20
1,2-Dichloroethane	0.00500	0.00511	0.00507	102	101	65.0-131			0.786	20
1,2-Dichloropropane	0.00500	0.00530	0.00487	106	97.4	74.0-125			8.46	20
2-Butanone (MEK)	0.0250	0.0233	0.0212	93.2	84.8	30.0-160			9.44	24
4-Methyl-2-pentanone (MIBK)	0.0250	0.0241	0.0227	96.4	90.8	56.0-143			5.98	20
Acrylonitrile	0.0250	0.0204	0.0198	81.6	79.2	45.0-153			2.99	22
Benzene	0.00500	0.00514	0.00497	103	99.4	70.0-123			3.36	20
Bromodichloromethane	0.00500	0.00508	0.00505	102	101	73.0-121			0.592	20
Bromoform	0.00500	0.00439	0.00440	87.8	88.0	64.0-132			0.228	20
Bromomethane	0.00500	0.00361	0.00371	72.2	74.2	56.0-147			2.73	20
Carbon tetrachloride	0.00500	0.00535	0.00524	107	105	66.0-128			2.08	20
Chlorobenzene	0.00500	0.00525	0.00511	105	102	76.0-128			2.70	20
Chloroethane	0.00500	0.00421	0.00423	84.2	84.6	61.0-134			0.474	20
Chloroform	0.00500	0.00472	0.00475	94.4	95.0	72.0-123			0.634	20
Chloromethane	0.00500	0.00547	0.00533	109	107	51.0-138			2.59	20
Dibromochloromethane	0.00500	0.00526	0.00522	105	104	74.0-127			0.763	20
Ethyl ether	0.00500	0.00484	0.00504	96.8	101	64.0-137			4.05	20
Hexachloro-1,3-butadiene	0.00500	0.00430	0.00439	86.0	87.8	57.0-150			2.07	20
Methylene Chloride	0.00500	0.00412	0.00412	82.4	82.4	68.0-123			0.000	20
Tetrachloroethene	0.00500	0.00583	0.00547	117	109	70.0-136			6.37	20
Tetrahydrofuran	0.00500	0.00468	0.00379	93.6	75.8	37.0-146	J	J	21.0	24
Toluene	0.00500	0.00558	0.00526	112	105	75.0-121			5.90	20
Trichloroethene	0.00500	0.00594	0.00562	119	112	76.0-126			5.54	20
cis-1,3-Dichloropropene	0.00500	0.00546	0.00521	109	104	76.0-127			4.69	20
trans-1,2-Dichloroethene	0.00500	0.00480	0.00475	96.0	95.0	71.0-125			1.05	20
trans-1,3-Dichloropropene	0.00500	0.00566	0.00537	113	107	73.0-127			5.26	20
(S) 4-Bromofluorobenzene				*96.9*	*101*	*67.0-138*				
(S) Toluene-d8				*101*	*100*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*94.9*	*96.1*	*70.0-130*				

Method Blank (MB)

(MB) R4168482-3 01/18/25 12:26

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Acetone	ND		0.00146	0.00200
Ethylbenzene	ND		0.0000295	0.000100
Naphthalene	ND		0.000195	0.000500
Total Xylene	ND		0.0000352	0.000260
m&p-Xylene	ND		0.0000760	0.000160
o-Xylene	ND		0.0000352	0.000100
(S) 4-Bromofluorobenzene	*103*			*67.0-138*
(S) Toluene-d8	*97.1*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*90.4*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4168482-1 01/18/25 11:08 • (LCSD) R4168482-2 01/18/25 11:27

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	0.0250	0.0233	0.0215	93.2	86.0	10.0-160			8.04	31
Ethylbenzene	0.00500	0.00473	0.00493	94.6	98.6	74.0-126			4.14	20
Naphthalene	0.00500	0.00429	0.00429	85.8	85.8	59.0-130			0.000	20
Total Xylene	0.0150	0.0138	0.0141	92.0	94.0	72.0-127			2.15	20
m&p-Xylene	0.0100	0.00920	0.00940	92.0	94.0	76.0-126			2.15	20
o-Xylene	0.00500	0.00464	0.00467	92.8	93.4	79.0-124			0.644	20
(S) 4-Bromofluorobenzene				*101*	*98.7*	*67.0-138*				
(S) Toluene-d8				*95.1*	*98.7*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*95.8*	*93.6*	*70.0-130*				

Method Blank (MB)

(MB) R4168993-4 01/21/25 11:08

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
2-Propanol	ND		0.00165	0.00500
2-Chloroethyl vinyl ether	ND		0.000575	0.0500
Acrolein	ND		0.00254	0.0500
(S) 1,2-Dichloroethane-d4	*92.0*			*70.0-130*
(S) 4-Bromofluorobenzene	*105*			*77.0-126*
(S) Toluene-d8	*105*			*80.0-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4168993-1 01/21/25 09:19 • (LCSD) R4168993-2 01/21/25 09:40

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
2-Chloroethyl vinyl ether	0.0250	0.0212	0.0214	84.8	85.6	51.0-160	J	J	0.939	20
Acrolein	0.0250	0.0235	0.0234	94.0	93.6	10.0-160	J	J	0.426	26
(S) 1,2-Dichloroethane-d4				*93.1*	*92.6*	*70.0-130*				
(S) 4-Bromofluorobenzene				*98.1*	*96.6*	*77.0-126*				
(S) Toluene-d8				*96.5*	*96.9*	*80.0-120*				

Laboratory Control Sample (LCS)

(LCS) R4168993-3 01/21/25 10:02

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
2-Propanol	0.0500	0.0521	104	10.0-160	
(S) 1,2-Dichloroethane-d4			*85.1*	*70.0-130*	
(S) 4-Bromofluorobenzene			*104*	*77.0-126*	
(S) Toluene-d8			*101*	*80.0-120*	

Method Blank (MB)

(MB) R4168897-3 01/21/25 11:58

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Vinyl chloride	ND		0.0000462	0.0000500
(S) 4-Bromofluorobenzene	*95.3*			*67.0-138*
(S) Toluene-d8	*103*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*99.6*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4168897-1 01/21/25 10:37 • (LCSD) R4168897-2 01/21/25 10:57

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Vinyl chloride	0.00500	0.00489	0.00436	97.8	87.2	63.0-134			11.5	20
(S) 4-Bromofluorobenzene				*96.6*	*93.8*	*67.0-138*				
(S) Toluene-d8				*102*	*100*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*101*	*104*	*70.0-130*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R4167197-1 01/15/25 11:59

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
4,4-DDD	ND		0.0000170	0.0000500
4,4-DDE	ND		0.0000164	0.0000500
4,4-DDT	ND		0.0000177	0.0000500
Aldrin	ND		0.00000813	0.0000500
Alpha BHC	ND		0.0000166	0.0000500
Beta BHC	ND		0.0000184	0.0000500
Chlordane	ND		0.0000977	0.000500
Delta BHC	ND		0.0000197	0.0000500
Dieldrin	ND		0.00000751	0.0000500
Endosulfan I	ND		0.0000179	0.0000500
Endosulfan II	ND		0.0000176	0.0000500
Endosulfan sulfate	ND		0.0000196	0.0000500
Endrin	ND		0.0000189	0.0000500
Endrin aldehyde	ND		0.0000142	0.0000500
Gamma BHC	ND		0.0000176	0.0000500
Heptachlor	ND		0.0000108	0.0000500
Heptachlor epoxide	ND		0.0000175	0.0000500
Toxaphene	ND		0.000168	0.000500
(S) Tetrachloro-m-xylene	*98.4*			*10.0-135*
(S) Decachlorobiphenyl	*63.2*			*10.0-144*

Laboratory Control Sample (LCS)

(LCS) R4167197-5 01/15/25 12:09

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
4,4-DDD	0.00100	0.00107	107	31.0-141	
4,4-DDE	0.00100	0.00103	103	30.0-145	
4,4-DDT	0.00100	0.00102	102	25.0-160	
Aldrin	0.00100	0.000997	99.7	42.0-140	
Alpha BHC	0.00100	0.00105	105	37.0-140	
Beta BHC	0.00100	0.00106	106	17.0-147	
Delta BHC	0.00100	0.000981	98.1	19.0-140	
Dieldrin	0.00100	0.00108	108	36.0-146	
Endosulfan I	0.00100	0.00108	108	45.0-153	
Endosulfan II	0.00100	0.00110	110	1.00-202	
Endosulfan sulfate	0.00100	0.00108	108	26.0-144	
Endrin	0.00100	0.00109	109	30.0-147	
Endrin aldehyde	0.00100	0.00103	103	56.0-128	

Laboratory Control Sample (LCS)

(LCS) R4167197-5 01/15/25 12:09

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Gamma BHC	0.00100	0.00106	106	32.0-140	
Heptachlor	0.00100	0.00101	101	34.0-140	
Heptachlor epoxide	0.00100	0.00106	106	37.0-142	
(S) Tetrachloro-m-xylene			*91.7*	*10.0-135*	
(S) Decachlorobiphenyl			*59.3*	*10.0-144*	

L1816680-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1816680-01 01/16/25 16:20 • (MS) R4167713-1 01/16/25 16:31 • (MSD) R4167713-2 01/16/25 16:41

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
4,4-DDD	0.00100	ND	0.000150	0.000106	15.0	10.6	1	31.0-141	J6 P	J6 P	34.4	39
4,4-DDE	0.00100	ND	0.000116	0.0000649	11.6	6.49	1	30.0-145	J6 P	J3 J6 P	56.5	35
4,4-DDT	0.00100	ND	0.000113	0.0000816	11.3	8.16	1	25.0-160	J6 P	J6 P	32.3	42
Aldrin	0.00100	ND	0.000119	0.0000864	11.9	8.64	1	42.0-140	J6 P	J6 P	31.7	35
Alpha BHC	0.00100	ND	0.000539	0.000527	53.9	52.7	1	37.0-140	P	P	2.25	36
Beta BHC	0.00100	ND	0.000486	0.000490	48.6	49.0	1	17.0-147	P	P	0.820	44
Delta BHC	0.00100	ND	0.000537	0.000544	53.7	54.4	1	19.0-140	P	P	1.30	52
Dieldrin	0.00100	ND	0.000568	0.000560	56.8	56.0	1	36.0-146	P	P	1.42	49
Endosulfan I	0.00100	ND	0.000459	0.000423	45.9	42.3	1	45.0-153	P	J6	8.16	28
Endosulfan II	0.00100	ND	0.000288	0.000238	28.8	23.8	1	1.00-202	P	P	19.0	53
Endosulfan sulfate	0.00100	ND	0.000362	0.000319	36.2	31.9	1	26.0-144			12.6	38
Endrin	0.00100	ND	0.000295	0.000250	29.5	25.0	1	30.0-147	J6 P	J6 P	16.5	48
Endrin aldehyde	0.00100	ND	0.0000979	0.0000986	9.79	9.86	1	56.0-128	J6 P	J6	0.712	20
Gamma BHC	0.00100	ND	0.000547	0.000492	54.7	49.2	1	32.0-140	P	P	10.6	39
Heptachlor	0.00100	ND	0.000182	0.000132	18.2	13.2	1	34.0-140	J6 P	J6 P	31.8	43
Heptachlor epoxide	0.00100	ND	0.000230	0.000186	23.0	18.6	1	37.0-142	J6 P	J6 P	21.2	26
(S) Tetrachloro-m-xylene					*14.6*	*9.94*		*10.0-135*		J2		
(S) Decachlorobiphenyl					*5.96*	*3.55*		*10.0-144*	J2	J2		

Sample Narrative:

OS: Surrogate failure due to matrix interference

Method Blank (MB)

(MB) R4167707-1 01/16/25 14:44

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
PCB 1016	ND		0.000200	0.000400
PCB 1221	ND		0.000146	0.000400
PCB 1232	ND		0.0000840	0.000400
PCB 1242	ND		0.0000940	0.000400
PCB 1248	ND		0.000172	0.000400
PCB 1254	ND		0.0000940	0.000400
PCB 1260	ND		0.000240	0.000400
(S) Tetrachloro-m-xylene	*81.0*			*10.0-135*
(S) Decachlorobiphenyl	*56.3*			*10.0-144*

Sample Narrative:

BLANK: Dilution due to sulfur cleanup.

Laboratory Control Sample (LCS)

(LCS) R4167707-2 01/16/25 14:55

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
PCB 1016	0.00250	0.00253	101	50.0-140	
PCB 1260	0.00250	0.00206	82.4	8.00-140	
(S) Tetrachloro-m-xylene			*74.6*	*10.0-135*	
(S) Decachlorobiphenyl			*45.4*	*10.0-144*	

Sample Narrative:

LCS: Dilution due to sulfur cleanup.

L1816680-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1816680-01 01/16/25 15:37 • (MS) R4167707-3 01/16/25 15:48 • (MSD) R4167707-4 01/16/25 15:59

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
PCB 1016	0.00250	ND	0.000902	0.000642	36.1	25.7	2	50.0-140	J6	J6	33.7	36
PCB 1260	0.00250	ND	0.000419	0.000286	0.000	0.000	2	8.00-140	J6	J6	0.000	38
(S) Tetrachloro-m-xylene					*22.4*	*17.8*		*10.0-135*				
(S) Decachlorobiphenyl					*10.6*	*7.56*		*10.0-144*		J2		

Sample Narrative:

OS: Dilution due to sulfur cleanup.

MS: Dilution due to sulfur cleanup.

L1816680-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1816680-01 01/16/25 15:37 • (MS) R4167707-3 01/16/25 15:48 • (MSD) R4167707-4 01/16/25 15:59

	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	mg/l	mg/l	mg/l	mg/l	%	%		%			%	%

MSD: Dilution due to sulfur cleanup.

Method Blank (MB)

(MB) R4167892-2 01/17/25 10:22

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
1,2,4-Trichlorobenzene	ND		0.000355	0.0100
1,2-Dichlorobenzene	ND		0.0000713	0.0100
1,2-Diphenylhydrazine	ND	N2	0.000318	0.0100
1,3-Dichlorobenzene	ND		0.000132	0.0100
1,4-Dichlorobenzene	ND		0.0000942	0.0100
2,2-Oxybis(1-Chloropropane)	ND		0.000445	0.0100
2,4,6-Trichlorophenol	ND		0.000297	0.0100
2,4-Dichlorophenol	ND		0.000284	0.0100
2,4-Dimethylphenol	ND		0.000624	0.0100
2,4-Dinitrophenol	ND		0.00325	0.0100
2,4-Dinitrotoluene	ND		0.00165	0.0100
2,6-Dinitrotoluene	ND		0.000279	0.0100
2-Chloronaphthalene	ND		0.000330	0.00100
2-Chlorophenol	ND		0.000283	0.0100
2-Nitrophenol	ND		0.000320	0.0100
3,3-Dichlorobenzidine	ND		0.00202	0.0100
4,6-Dinitro-2-methylphenol	ND		0.00263	0.0100
4-Bromophenyl-phenylether	ND		0.000335	0.0100
4-Chloro-3-methylphenol	ND		0.000263	0.0100
4-Chlorophenyl-phenylether	ND		0.000303	0.0100
4-Nitrophenol	ND		0.00201	0.0100
Acenaphthene	ND		0.000316	0.00100
Acenaphthylene	ND		0.000309	0.00100
Anthracene	ND		0.000291	0.00100
Benzidine	ND		0.00432	0.0100
Benzo(A)Anthracene	ND		0.0000975	0.00100
Benzo(a)pyrene	ND		0.000340	0.00100
Benzo(b)fluoranthene	ND		0.0000896	0.00100
Benzo(g,h,i)perylene	ND		0.000161	0.00100
Benzo(k)fluoranthene	ND		0.000355	0.00100
Benzylbutyl phthalate	ND		0.000275	0.00300
Bis(2-Ethylhexyl)phthalate	ND		0.000709	0.00300
Bis(2-chlorethoxy)methane	ND		0.000329	0.0100
Bis(2-chloroethyl)ether	ND		0.00162	0.0100
Chrysene	ND		0.000332	0.00100
Di-n-butyl phthalate	ND		0.000266	0.00300
Di-n-octyl phthalate	ND		0.000278	0.00300
Dibenz(a,h)anthracene	ND		0.000279	0.00100
Diethyl phthalate	ND		0.000282	0.00300
Dimethyl phthalate	ND		0.000283	0.00300

Method Blank (MB)

(MB) R4167892-2 01/17/25 10:22

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Fluoranthene	ND		0.000310	0.00100
Fluorene	ND		0.000323	0.00100
Hexachloro-1,3-butadiene	ND		0.000329	0.0100
Hexachlorobenzene	ND		0.000341	0.00100
Hexachlorocyclopentadiene	ND		0.00233	0.0100
Hexachloroethane	ND		0.000365	0.0100
Indeno(1,2,3-cd)pyrene	ND		0.000279	0.00100
Isophorone	ND		0.000272	0.0100
Naphthalene	ND		0.000372	0.00100
Nitrobenzene	ND		0.000367	0.0100
Pentachlorophenol	ND		0.000313	0.0100
Phenanthrene	ND	J	0.000366	0.00100
Phenol	ND		0.000334	0.0100
Pyrene	ND		0.000330	0.00100
n-Nitrosodi-n-propylamine	ND		0.000403	0.0100
n-Nitrosodimethylamine	ND		0.00126	0.0100
n-Nitrosodiphenylamine	ND		0.00119	0.0100
(S) Phenol-d5	*21.8*			*8.00-424*
(S) Nitrobenzene-d5	*56.5*			*15.0-314*
(S) 2,4,6-Tribromophenol	*42.8*			*10.0-153*
(S) p-Terphenyl-d14	*68.6*			*29.0-141*
(S) 2-Fluorophenol	*33.2*			*10.0-120*
(S) 2-Fluorobiphenyl	*61.1*			*22.0-127*

Laboratory Control Sample (LCS)

(LCS) R4167892-1 01/17/25 10:01

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
1,2,4-Trichlorobenzene	0.0500	0.0298	59.6	44.0-142	
1,2-Dichlorobenzene	0.0500	0.0333	66.6	27.0-120	
1,2-Diphenylhydrazine	0.0500	0.0363	72.6	37.0-125	N2
1,3-Dichlorobenzene	0.0500	0.0326	65.2	26.0-120	
1,4-Dichlorobenzene	0.0500	0.0324	64.8	26.0-120	
2,2-Oxybis(1-Chloropropane)	0.0500	0.0331	66.2	36.0-166	
2,4,6-Trichlorophenol	0.0500	0.0344	68.8	37.0-144	
2,4-Dichlorophenol	0.0500	0.0305	61.0	39.0-135	
2,4-Dimethylphenol	0.0500	0.0207	41.4	32.0-120	
2,4-Dinitrophenol	0.0500	0.0296	59.2	1.00-191	

Laboratory Control Sample (LCS)

(LCS) R4167892-1 01/17/25 10:01

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
2,4-Dinitrotoluene	0.0500	0.0372	74.4	39.0-139	
2,6-Dinitrotoluene	0.0500	0.0380	76.0	50.0-158	
2-Chloronaphthalene	0.0500	0.0356	71.2	60.0-120	
2-Chlorophenol	0.0500	0.0271	54.2	23.0-134	
2-Nitrophenol	0.0500	0.0333	66.6	29.0-182	
3,3-Dichlorobenzidine	0.100	0.0667	66.7	1.00-262	
4,6-Dinitro-2-methylphenol	0.0500	0.0345	69.0	1.00-181	
4-Bromophenyl-phenylether	0.0500	0.0379	75.8	53.0-127	
4-Chloro-3-methylphenol	0.0500	0.0285	57.0	22.0-147	
4-Chlorophenyl-phenylether	0.0500	0.0353	70.6	25.0-158	
4-Nitrophenol	0.0500	0.0148	29.6	1.00-132	
Acenaphthene	0.0500	0.0357	71.4	47.0-145	
Acenaphthylene	0.0500	0.0344	68.8	33.0-145	
Anthracene	0.0500	0.0372	74.4	27.0-133	
Benzidine	0.100	0.00979	9.79	1.00-120	J
Benzo(A)Anthracene	0.0500	0.0396	79.2	33.0-143	
Benzo(a)pyrene	0.0500	0.0403	80.6	17.0-163	
Benzo(b)fluoranthene	0.0500	0.0414	82.8	24.0-159	
Benzo(g,h,i)perylene	0.0500	0.0378	75.6	1.00-219	
Benzo(k)fluoranthene	0.0500	0.0410	82.0	11.0-162	
Benzylbutyl phthalate	0.0500	0.0387	77.4	1.00-152	
Bis(2-Ethylhexyl)phthalate	0.0500	0.0365	73.0	8.00-158	
Bis(2-chlorethoxy)methane	0.0500	0.0314	62.8	1.00-219	
Bis(2-chloroethyl)ether	0.0500	0.0335	67.0	33.0-185	
Chrysene	0.0500	0.0386	77.2	17.0-168	
Di-n-butyl phthalate	0.0500	0.0420	84.0	1.00-120	
Di-n-octyl phthalate	0.0500	0.0391	78.2	4.00-146	
Dibenz(a,h)anthracene	0.0500	0.0406	81.2	1.00-227	
Diethyl phthalate	0.0500	0.0369	73.8	1.00-120	
Dimethyl phthalate	0.0500	0.0365	73.0	1.00-120	
Fluoranthene	0.0500	0.0410	82.0	26.0-137	
Fluorene	0.0500	0.0355	71.0	59.0-121	
Hexachloro-1,3-butadiene	0.0500	0.0286	57.2	24.0-120	
Hexachlorobenzene	0.0500	0.0350	70.0	1.00-152	
Hexachlorocyclopentadiene	0.0500	0.0131	26.2	10.0-120	
Hexachloroethane	0.0500	0.0306	61.2	40.0-120	
Indeno(1,2,3-cd)pyrene	0.0500	0.0408	81.6	1.00-171	
Isophorone	0.0500	0.0297	59.4	21.0-196	
Naphthalene	0.0500	0.0303	60.6	21.0-133	
Nitrobenzene	0.0500	0.0320	64.0	35.0-180	

Laboratory Control Sample (LCS)

(LCS) R4167892-1 01/17/25 10:01

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Pentachlorophenol	0.0500	0.0157	31.4	14.0-176	
Phenanthrene	0.0500	0.0368	73.6	54.0-120	
Phenol	0.0500	0.0148	29.6	5.00-120	
Pyrene	0.0500	0.0410	82.0	52.0-120	
n-Nitrosodi-n-propylamine	0.0500	0.0320	64.0	1.00-230	
n-Nitrosodimethylamine	0.0500	0.0215	43.0	10.0-120	
n-Nitrosodiphenylamine	0.0500	0.0378	75.6	44.0-120	
(S) Phenol-d5			*27.0*	*8.00-424*	
(S) Nitrobenzene-d5			*57.2*	*15.0-314*	
(S) 2,4,6-Tribromophenol			*66.5*	*10.0-153*	
(S) p-Terphenyl-d14			*75.1*	*29.0-141*	
(S) 2-Fluorophenol			*39.0*	*10.0-120*	
(S) 2-Fluorobiphenyl			*66.1*	*22.0-127*	

L1816145-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1816145-06 01/17/25 19:02 • (MS) R4167892-3 01/17/25 19:24 • (MSD) R4167892-4 01/17/25 19:46

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
1,2,4-Trichlorobenzene	0.0500	ND	0.0318	0.0281	63.6	56.2	20	44.0-142			12.4	50
1,2-Dichlorobenzene	0.0500	ND	0.0306	0.0264	61.2	52.8	20	14.0-125			14.7	24
1,2-Diphenylhydrazine	0.0500	ND	0.0321	0.0312	64.2	62.4	20	18.0-156	N2	N2	2.84	34
1,3-Dichlorobenzene	0.0500	ND	0.0295	0.0268	59.0	53.6	20	12.0-123			9.59	22
1,4-Dichlorobenzene	0.0500	ND	0.0281	0.0268	56.2	53.6	20	12.0-125			4.74	23
2,2-Oxybis(1-Chloropropane)	0.0500	ND	0.0308	0.0250	61.6	50.0	20	36.0-166			20.8	76
2,4,6-Trichlorophenol	0.0500	ND	0.0345	0.0299	69.0	59.8	20	37.0-144			14.3	58
2,4-Dichlorophenol	0.0500	ND	0.0332	0.0302	66.4	60.4	20	39.0-135			9.46	50
2,4-Dimethylphenol	0.0500	ND	0.0328	0.0301	65.6	60.2	20	32.0-120			8.59	58
2,4-Dinitrophenol	0.0500	ND	0.161	0.157	322	314	20	1.00-191	J5	J5	2.52	132
2,4-Dinitrotoluene	0.0500	ND	ND	ND	60.0	53.2	20	39.0-139			12.0	42
2,6-Dinitrotoluene	0.0500	ND	0.0318	0.0305	63.6	61.0	20	50.0-158			4.17	48
2-Chloronaphthalene	0.0500	ND	0.0314	0.0289	62.8	57.8	20	60.0-120		J6	8.29	24
2-Chlorophenol	0.0500	ND	0.0272	0.0245	54.4	49.0	20	23.0-134			10.4	61
2-Nitrophenol	0.0500	ND	0.0327	0.0317	65.4	63.4	20	29.0-182			3.11	55
3,3-Dichlorobenzidine	0.100	ND	ND	ND	9.20	12.6	20	1.00-262			31.2	108
4,6-Dinitro-2-methylphenol	0.0500	ND	0.0691	0.0671	138	134	20	1.00-181			2.94	203
4-Bromophenyl-phenylether	0.0500	ND	0.0342	0.0300	68.4	60.0	20	53.0-127			13.1	43
4-Chloro-3-methylphenol	0.0500	ND	0.0393	0.0337	78.6	67.4	20	22.0-147			15.3	73
4-Chlorophenyl-phenylether	0.0500	ND	0.0311	0.0278	62.2	55.6	20	25.0-158			11.2	61

L1816145-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1816145-06 01/17/25 19:02 • (MS) R4167892-3 01/17/25 19:24 • (MSD) R4167892-4 01/17/25 19:46

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
4-Nitrophenol	0.0500	ND	ND	ND	37.0	42.0	20	1.00-132			12.7	131
Acenaphthene	0.0500	ND	0.0321	0.0293	64.2	58.6	20	47.0-145			9.12	48
Acenaphthylene	0.0500	ND	0.0435	0.0277	87.0	55.4	20	33.0-145			44.4	74
Anthracene	0.0500	ND	0.0337	0.0287	67.4	57.4	20	27.0-133			16.0	66
Benzidine	0.100	ND	ND	ND	0.000	0.000	20	1.00-120	J6	J6	0.000	40
Benzo(A)Anthracene	0.0500	ND	0.0314	0.0278	62.8	55.6	20	33.0-143			12.2	53
Benzo(a)pyrene	0.0500	ND	0.0264	0.0226	52.8	45.2	20	17.0-163			15.5	72
Benzo(b)fluoranthene	0.0500	ND	0.0287	0.0263	57.4	52.6	20	24.0-159			8.73	71
Benzo(g,h,i)perylene	0.0500	ND	0.0281	0.0265	56.2	53.0	20	1.00-219			5.86	97
Benzo(k)fluoranthene	0.0500	ND	0.0284	0.0237	56.8	47.4	20	11.0-162			18.0	63
Benzylbutyl phthalate	0.0500	ND	0.0602	0.0565	120	113	20	1.00-152			6.34	60
Bis(2-Ethylhexyl)phthalate	0.0500	ND	0.0554	0.0524	111	105	20	8.00-158			5.57	82
Bis(2-chlorethoxy)methane	0.0500	ND	0.0411	0.0360	82.2	72.0	20	33.0-184			13.2	54
Bis(2-chloroethyl)ether	0.0500	ND	ND	ND	63.4	53.2	20	12.0-158			17.5	108
Chrysene	0.0500	ND	0.0313	0.0280	62.6	56.0	20	17.0-168			11.1	87
Di-n-butyl phthalate	0.0500	ND	0.0363	0.0310	72.6	62.0	20	1.00-120			15.8	47
Di-n-octyl phthalate	0.0500	ND	0.0590	0.0551	118	110	20	4.00-146			6.84	69
Dibenz(a,h)anthracene	0.0500	ND	0.0293	0.0258	58.6	51.6	20	1.00-227			12.7	126
Diethyl phthalate	0.0500	ND	0.0374	0.0322	74.8	64.4	20	1.00-120			14.9	100
Dimethyl phthalate	0.0500	ND	0.0350	0.0315	70.0	63.0	20	1.00-120			10.5	183
Fluoranthene	0.0500	ND	0.0345	0.0299	69.0	59.8	20	26.0-137			14.3	66
Fluorene	0.0500	ND	0.0344	0.0300	68.8	60.0	20	59.0-121			13.7	38
Hexachloro-1,3-butadiene	0.0500	ND	0.0292	0.0258	58.4	51.6	20	24.0-120			12.4	62
Hexachlorobenzene	0.0500	ND	0.0324	0.0283	64.8	56.6	20	1.00-152			13.5	55
Hexachlorocyclopentadiene	0.0500	ND	ND	ND	15.7	9.48	20	10.0-146		J3 J6	49.3	34
Hexachloroethane	0.0500	ND	0.0280	0.0260	56.0	52.0	20	40.0-120			7.41	52
Indeno(1,2,3-cd)pyrene	0.0500	ND	0.0318	0.0272	63.6	54.4	20	1.00-171			15.6	99
Isophorone	0.0500	ND	0.0319	0.0280	63.8	56.0	20	21.0-196			13.0	93
Naphthalene	0.0500	ND	0.0379	0.0317	61.9	49.5	20	21.0-133			17.8	65
Nitrobenzene	0.0500	ND	0.0320	0.0270	64.0	54.0	20	35.0-180			16.9	62
Pentachlorophenol	0.0500	ND	0.0427	0.0403	85.4	80.6	20	14.0-176			5.78	86
Phenanthrene	0.0500	ND	0.0352	0.0302	70.4	60.4	20	54.0-120			15.3	39
Phenol	0.0500	0.130	0.164	0.142	68.0	24.0	20	5.00-120			14.4	64
Pyrene	0.0500	ND	0.0347	0.0293	69.4	58.6	20	52.0-120			16.9	49
n-Nitrosodi-n-propylamine	0.0500	ND	0.0318	0.0255	63.6	51.0	20	1.00-230			22.0	87
n-Nitrosodimethylamine	0.0500	ND	0.0434	0.0420	86.8	84.0	20	10.0-120			3.28	40
n-Nitrosodiphenylamine	0.0500	ND	0.0348	0.0319	0.000	0.000	20	16.0-160	J6	J6	0.000	28
(S) Phenol-d5					*46.8*	*50.5*		*8.00-424*	J7	J7		
(S) Nitrobenzene-d5					*97.5*	*49.1*		*15.0-314*	J7	J7		
(S) 2,4,6-Tribromophenol					*48.1*	*56.5*		*10.0-153*	J7	J7		

L1816145-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1816145-06 01/17/25 19:02 • (MS) R4167892-3 01/17/25 19:24 • (MSD) R4167892-4 01/17/25 19:46

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
(S) p-Terphenyl-d14					*68.1*	*56.3*		*29.0-141*	J7	J7		
(S) 2-Fluorophenol					*39.5*	*34.8*		*10.0-120*	J7	J7		
(S) 2-Fluorobiphenyl					*60.4*	*52.4*		*22.0-127*	J7	J7		

Sample Narrative:

OS: Dilution due to matrix.

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J3	The associated batch QC was outside the established quality control range for precision.
J5	The sample matrix interfered with the ability to make any accurate determination; spike value is high.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
J7	Surrogate recovery cannot be used for control limit evaluation due to dilution.
N2	Analyte reported using a calibration and validation based on Azobenzene (CAS 103-33-3). 1,2-Diphenylhydrazine decomposes into Azobenzene during the analysis.
P	RPD between the primary and confirmatory analysis exceeded 40%.

GLOSSARY OF TERMS

Qualifier	Description
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.
Q	Sample was prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
Elk River QTRLY Leachate(1,4,7,10)

City/State Collected:

Please Circle: PT MT CT ET

Phone: 952-832-2893

Client Project #
S00

Lab Project #
WMELKRIVMN-00003

Collected by (print):
Mike Hunt

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N___ Y_✓_

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

No. of Cntrs

Analysis / Container / Preservation

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	608.3 100ml Amb-NoPres	625.1 100ml Amb-NaTio	Alk, Cl,SO4,pH 500mlHDPE-NoPres	CN 250mlHDPEAmb-NaOH >12	COD 250mlHDPE-H2SO4 <2	FLASH 250mlAmb-NoPres	Metals 250mlHDPE-HNO3 <2	TSS 1L-HDPE NoPres	V8260LLAPSNP 40mlAmb-HCl	V8260ULLC 40mlAmb HCl	Remarks	Sample # (lab only)
SP-01_Leachate	G	GW		1/13/25	1350	16	X	X	X	X	X	X	X	X	X	X		-01

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking #

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y / N
COC Signed/Accurate:		Y / N
Bottles arrive intact:		Y / N
Correct bottles used:		Y / N
Sufficient volume sent:		Y / N
If Applicable		
VOA Zero Headspace:		Y / N
Preservation Correct/Checked:		Y / N
RAD Screen <0.5 mR/hr:		Y / N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No (HCl / MeoH) TBR	If preservation required by Login: Date/Time
	1/13/25	1500	Fed Ex	TLA9	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: °C Bottles Received:	
				0.1+0=0.1 15	
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: Time:	Hold: Condition: NCF / OK
			OC	1-14-25 0930	

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

SDG # L1811467
K168

Acctnum: WMELKRIVMN
Template: T170179
Prelogin: P1120369
PM: 364 - T. Alan Harvill
PB: LA 12/13/24
Shipped Via: FedEx Ground

FIELD INFORMATION FORM

Surface Water, Stormwater and Leachate

WASTE MANAGEMENT

Site Name: Elk River Landfill

Sample I.D.: SP 01 Landfill

Laboratory Use Only / Lab I.D.: L0116067

Sampling Method & Equipment

Purge and Sample Equipment:

Sampling Method: [D] D - Direct, I - Indirect, V - Visual

Sampling Equipment: [S] D - Dipper, T - Transfer Vessel, S - Sample Bottle, O - Other [ ]

Sample Type: [G] Grab / Composite (circle one)

Field Measurements

Sample Date MM/DD/YYYY	Sample Time 24 Hr. Clock	pH (std. Units)	CONDUCTIVITY (umhos/cm @ 25°C)	Temp °C	TURBIDITY (NTUs)	DO mg/L - ppm	eH/ORP (std. Units)
01/13/2025	1330	8.00		16.3			

Record final stabilized field readings.

Field Observations

Sample Appearance: Odor: Strong Color: Dk. Grey Other:

Sheen Present [Y] or [N] Foam Present: [Y] or [N] Floating Solids: [Y] or [N]

Weather Conditions: (required daily, or as conditions change):

Direction/Speed: Precipitation: [Y] or [N]

Specific Comments:

Date	Name	Signature	Company
1/13/25	M. Le Hen		

ANALYTICAL REPORT

February 12, 2025

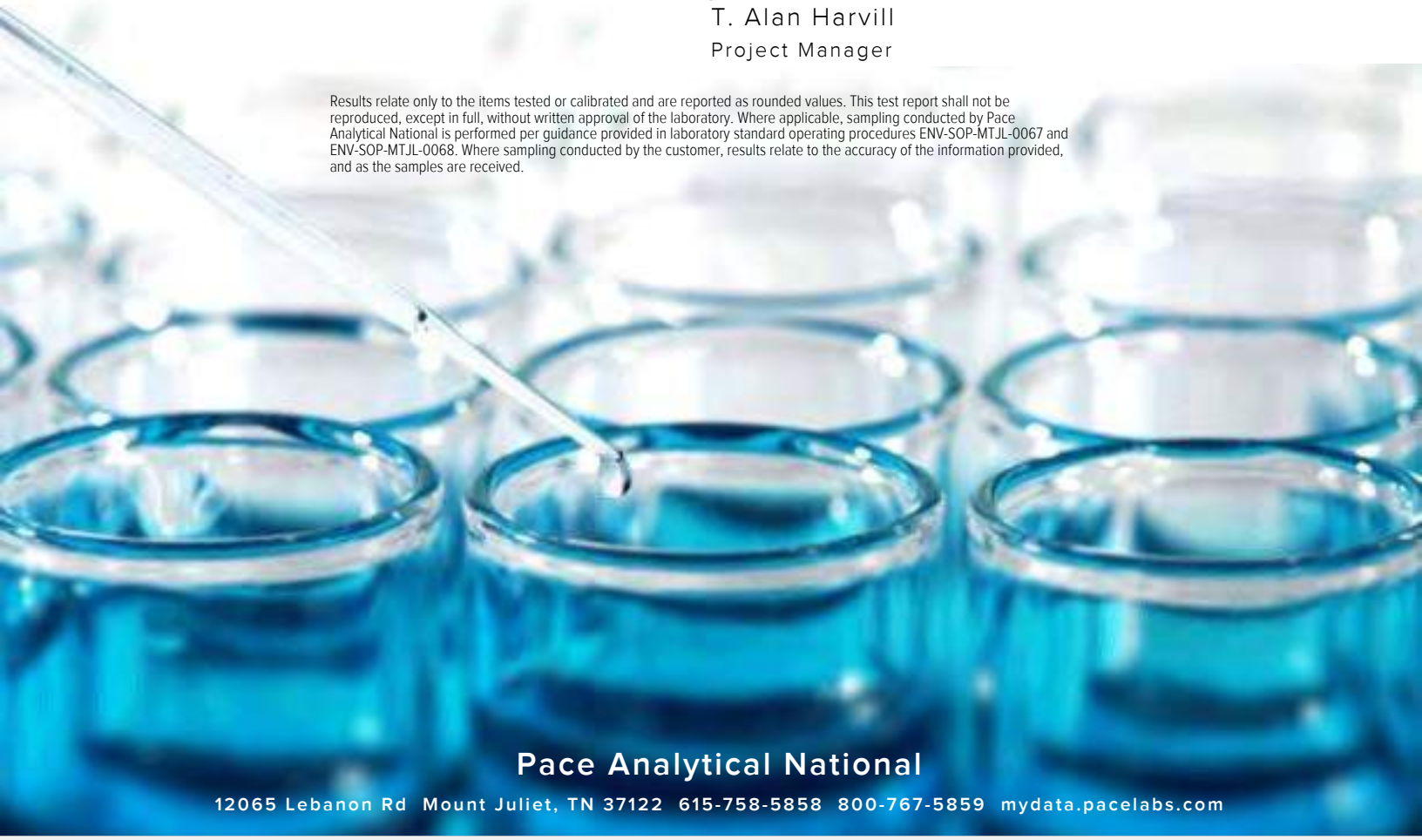
Elk River Landfill

Sample Delivery Group:	L1824935
Samples Received:	02/08/2025
Project Number:	500
Description:	Elk River- Monthly Leachate
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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SAMPLE SUMMARY

SP-01_Leachate L1824935-01 WW

Collected by	Collected date/time	Received date/time
Mike Hamer	02/07/25 11:00	02/08/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 D-2011	WG2449705	1	02/11/25 12:53	02/11/25 14:19	MMF	Mt. Juliet, TN
Wet Chemistry by Method 410.4	WG2449073	10	02/11/25 14:10	02/11/25 20:43	ARV	Mt. Juliet, TN
Wet Chemistry by Method 4500H+ B-2011	WG2448989	1	02/10/25 13:26	02/10/25 13:26	BJM	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Sample Delivery Group (SDG) Narrative

The laboratory analysis was performed from an unpreserved, insufficiently or inadequately preserved sample.

Batch	Method	Lab Sample ID
WG2449073	410.4	L1824935-01

The following samples were prepared and/or analyzed past recommended holding time. Concentrations should be considered minimum values.

Batch	Method	Lab Sample ID
WG2448989	4500H+ B-2011	L1824935-01

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	8.55	su
Temperature (on-site)	16	Deg C

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	94.8		4.00	1	02/11/2025 14:19	WG2449705

Wet Chemistry by Method 410.4

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
COD	3640		30.0	10	02/11/2025 20:43	WG2449073

Wet Chemistry by Method 4500H+ B-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	SU			date / time	
pH	7.83	T8	1	02/10/2025 13:26	WG2448989

Sample Narrative:

L1824935-01 WG2448989: 7.83 at 19.7C

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R4176013-1 02/11/25 14:19

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Suspended Solids	ND		0.350	2.50

L1824629-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1824629-01 02/11/25 14:19 • (DUP) R4176013-3 02/11/25 14:19

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	86.7	87.1	1	0.506		10

Laboratory Control Sample (LCS)

(LCS) R4176013-2 02/11/25 14:19

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Suspended Solids	773	850	110	85.0-115	

Method Blank (MB)

(MB) R4175604-1 02/11/25 20:40

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
COD	ND		3.00	10.0

L1824666-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1824666-01 02/11/25 20:41 • (DUP) R4175604-5 02/11/25 20:41

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	6540	6540	10	0.0229		20

L1824935-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1824935-01 02/11/25 20:43 • (DUP) R4175604-6 02/11/25 20:43

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	3640	3760	10	3.24		20

Laboratory Control Sample (LCS)

(LCS) R4175604-2 02/11/25 20:40

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
COD	500	504	101	90.0-110	

L1824664-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1824664-01 02/11/25 20:41 • (MS) R4175604-3 02/11/25 20:41 • (MSD) R4175604-4 02/11/25 20:41

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
COD	500	401	930	920	106	104	1	90.0-110			1.07	20

L1824560-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1824560-01 02/10/25 13:26 • (DUP) R4175002-2 02/10/25 13:26

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	7.38	7.36	1	0.271		1

Sample Narrative:

OS: 7.38 at 20.3C

DUP: 7.36 at 20.4C

Laboratory Control Sample (LCS)

(LCS) R4175002-1 02/10/25 13:26

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	su	su	%	%	
pH	10.0	10.0	100	99.0-101	

Sample Narrative:

LCS: 10 at 20.5C

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

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Qualifier	Description
T8	Sample(s) received past/too close to holding time expiration.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
Elk River- Monthly Leachate

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program (DOD, RCRA, DW, etc):

Client Project #
500

Lab Project #
WMELKRIVMN-00004

Collected by (print):
Mike Hamer

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

No. of Cntrs

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	COD 250mlHDPE-H2SO4	PH 125mlHDPE-NoPres	TSS 1L-HDPE NoPres	Remarks	Sample # (lab only)
SP-01_Leachate		GW		2/7/25	1140	3	X	X	X		-01

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

SDG # 1824935
J158

Acctnum: **WMELKRIVMN**
Template: **T170196**
Prelogin: **P1125309**
PM: **364 - T. Alan Harvill**
PB: **2/21/25CC**
Shipped Via: **FedEX Ground**

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS ✓ FedEx __ Courier _____

Tracking # 4208 1334 4517

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N
RAD Screen <0.5 mR/hr:		Y N

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
	2/7/25	1400	Fed Ex
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes / No
HCL / MeoH
TBR

Temp: 2.4+0.4=2.8 °C Bottles Received: 3

Date: 2/8/25 Time: 0930

If preservation required by Login: Date/Time

Hold:

Condition NCF / OK

FIELD INFORMATION FORM

Surface Water, Stormwater and Leachate

WASTE MANAGEMENT

Site Name: Elk River Landfill

Sample I.D.: SP-01 Leachate

Laboratory Use Only / Lab I.D.: L1824935

Sampling Method & Equipment

Purge and Sample Equipment:

Sampling Method: D — D - Direct, I - Indirect, V - Visual

Sampling Equipment: S — D - Dipper, T - Transfer Vessel, S - Sample Bottle, O - Other

Sample Type: G — Grab / Composite (circle one)

Field Measurements

Sample Date MM/DD/YYYY	Sample Time 24 Hr. Clock	pH (std. Units)	CONDUCTIVITY (umhos/cm @ 25°C)	Temp °C	TURBIDITY (NTUs)	DO mg/L - ppm	eH/ORP (std. Units)
02/07/2025	1100	8.55		16.0			

Record final stabilized field readings.

Field Observations

Sample Appearance: Odor: DK Gray Color: Medium to Light Other:

Sheen Present [Y] or [N] Foam Present [Y] or [N] Floating Solids: [Y] or [N]

Weather Conditions: (required daily, or as conditions change):

Direction/Speed: Precipitation: [Y] or [N]

Specific Comments:

Date	Name	Signature	Company
2/7/25	Mike Hess		ALS

ANALYTICAL REPORT

March 11, 2025

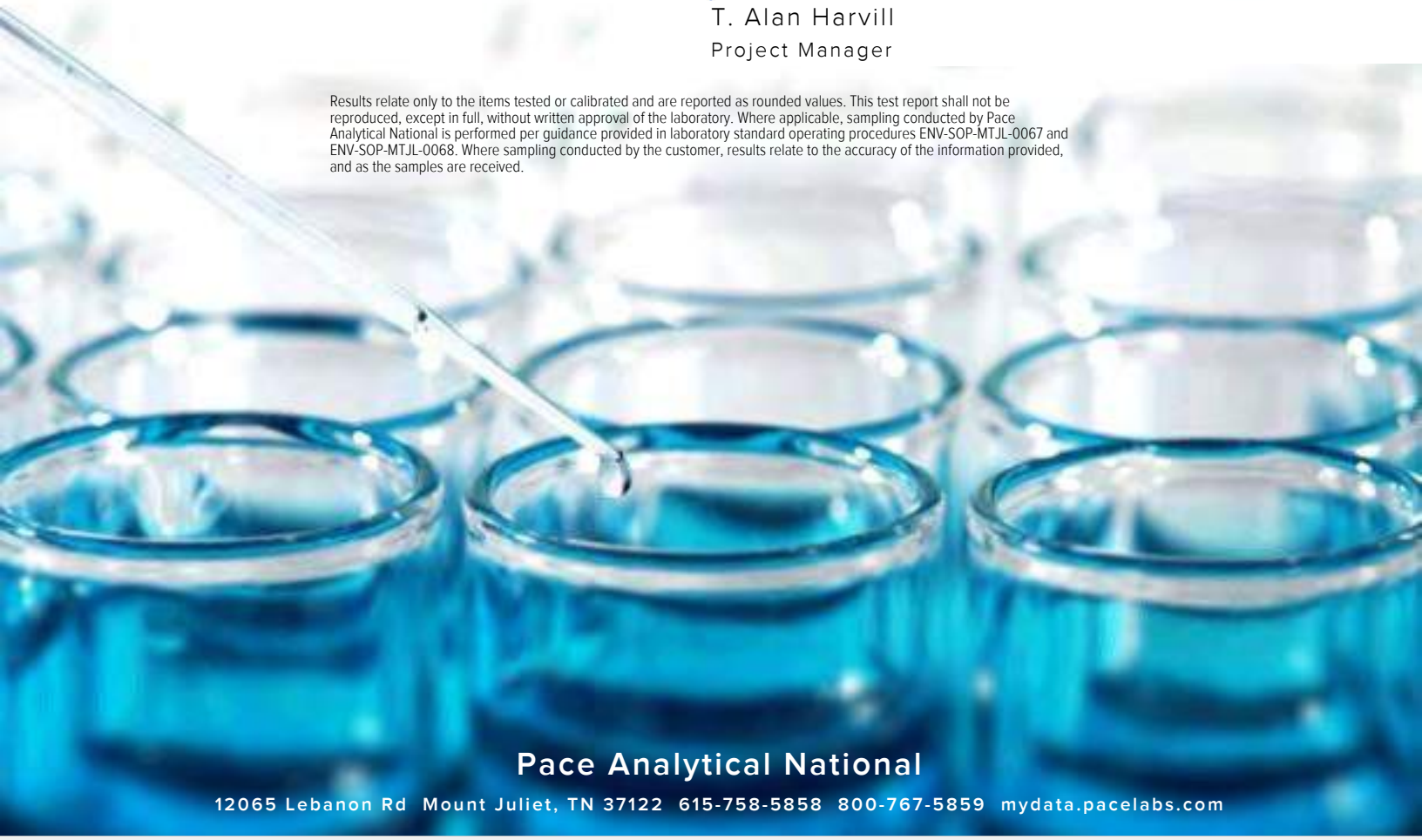
Elk River Landfill

Sample Delivery Group:	L1833771
Samples Received:	03/07/2025
Project Number:	500
Description:	Elk River- Monthly Leachate
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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Wet Chemistry by Method 410.4 7

Wet Chemistry by Method 4500H+ B-2011 8

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SAMPLE SUMMARY

SP-01_Leachate L1833771-01 WW

Collected by: Kenneth Smith
Collected date/time: 03/06/25 12:00
Received date/time: 03/07/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 D-2011	WG2465249	1	03/08/25 18:19	03/09/25 21:44	BDC	Mt. Juliet, TN
Wet Chemistry by Method 410.4	WG2465179	5	03/08/25 15:00	03/08/25 18:50	JEG	Mt. Juliet, TN
Wet Chemistry by Method 4500H+ B-2011	WG2465885	1	03/10/25 12:30	03/10/25 12:30	BJM	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Sample Delivery Group (SDG) Narrative

The following samples were prepared and/or analyzed past recommended holding time. Concentrations should be considered minimum values.

Batch	Method	Lab Sample ID
WG2465885	4500H+ B-2011	L1833771-01

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	7.43	su
Temperature (on-site)	15.61	Deg C

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	138		4.00	1	03/09/2025 21:44	WG2465249

Wet Chemistry by Method 410.4

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
COD	4060		15.0	5	03/08/2025 18:50	WG2465179

Wet Chemistry by Method 4500H+ B-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	SU			date / time	
pH	7.92	T8	1	03/10/2025 12:30	WG2465885

Sample Narrative:

L1833771-01 WG2465885: 7.92 at 19.1C

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R4184532-1 03/09/25 21:44

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Suspended Solids	ND		0.350	2.50

L1833701-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1833701-03 03/09/25 21:44 • (DUP) R4184532-3 03/09/25 21:44

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	277	280	1	1.08		10

L1833723-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1833723-01 03/09/25 21:44 • (DUP) R4184532-4 03/09/25 21:44

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	248	256	1	3.17		10

Laboratory Control Sample (LCS)

(LCS) R4184532-2 03/09/25 21:44

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Suspended Solids	773	774	100	85.0-115	

Method Blank (MB)

(MB) R4184154-1 03/08/25 18:48

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
COD	ND		3.00	10.0

L1833736-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1833736-01 03/08/25 18:50 • (DUP) R4184154-5 03/08/25 18:50

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	3720	3630	5	2.50		20

L1833771-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1833771-01 03/08/25 18:50 • (DUP) R4184154-6 03/08/25 18:51

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	4060	4120	5	1.45		20

Laboratory Control Sample (LCS)

(LCS) R4184154-2 03/08/25 18:48

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
COD	500	506	101	90.0-110	

L1833566-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1833566-01 03/08/25 18:48 • (MS) R4184154-3 03/08/25 18:49 • (MSD) R4184154-4 03/08/25 18:49

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
COD	500	60.7	539	540	95.6	95.9	1	90.0-110			0.269	20

L1833103-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1833103-01 03/10/25 12:30 • (DUP) R4184534-2 03/10/25 12:30

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	>13	>13	1	0.000		1

Sample Narrative:

OS: 13.34 at 25C

DUP: 13.34 at 25.4C

L1834160-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1834160-01 03/10/25 12:30 • (DUP) R4184534-3 03/10/25 12:30

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	7.89	7.91	1	0.253		1

Sample Narrative:

OS: 7.89 at 20.2C

DUP: 7.91 at 20.4C

Laboratory Control Sample (LCS)

(LCS) R4184534-1 03/10/25 12:30

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	su	su	%	%	
pH	10.0	10.0	100	99.0-101	

Sample Narrative:

LCS: 10.02 at 19.9C

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Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
Elk River- Monthly Leachate

City/State Collected:

Please Circle:
PT MT CT ET

Regulatory Program(DOD,RCRA,DW,etc):

Client Project #
500

Lab Project #
WMELKRIVMN-00004

Collected by (print):
Kenneth Smith

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately
Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

No. of Entrs

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Entrs	COD 250mlHDPE-H2SO4	PH 125mlHDPE-NoPres	TSS 1L-HDPE NoPres							Remarks	Sample # (lab only)
SP-01_Leachate	G	GW		3/6/25	1200	3	X	X	X								-01

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

12065 Lebanon Rd Mount Juliet, TN 37122
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at:
https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1833771

Table H158

Acctnum: WMELKRIVMN
Template: T170196
Prelogin: P1131017
PM: 364 - T. Alan Harvill
PB: LLA 2/20/25
Shipped Via: FedEX Ground

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other ___

Remarks:

pH ___ Temp ___
Flow ___ Other ___

Samples returned via:
__ UPS __ FedEx __ Courier ___

Tracking # 4708 1353 7543

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles Arrive Intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / (No) HCL / MeoH TBR	
	3/6/25	1300			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 0.7 °C Bottles Received: 3	If preservation required by Login: Date/Time
				TR#90.7 104-1	
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 3-7-25 Time: 0900	Hold: Condition: NCF / OK

FIELD INFORMATION FORM

Surface Water, Stormwater and Leachate

WASTE MANAGEMENT

Site Name: ERL

Sample I.D.: SP-01

Laboratory Use Only / Lab I.D.: L1833771

Sampling Method & Equipment

Purge and Sample Equipment:

Sampling Method: D — D - Direct, I - Indirect, V - Visual

Sampling Equipment: D — D - Dipper, T - Transfer Vessel, S - Sample Bottle, O - Other: Nozzle

Sample Type: Grab / Composite (circle one)

Field Measurements

Sample Date MM/DD/YYYY	Sample Time 24 Hr. Clock	pH (std. Units)	CONDUCTIVITY (umhos/cm @ 25°C)	Temp °C	TURBIDITY (NTUs)	DO mg/L - ppm	eH/ORP (std. Units)
03/06/2025	1200	7.93	7726	15.61			

Record final stabilized field readings.

Field Observations

Sample Appearance: Odor: Moderate Color: Black Other:

Sheen Present Y or (N) Foam Present (Y) or N Floating Solids: Y or (N)

Weather Conditions: (required daily, or as conditions change):

Direction/Speed: 9mph E Precipitation: Y or (N)

Specific Comments:

Date	Name	Signature	Company
3/6/25	Kenneth Smith		Alliance

ANALYTICAL REPORT

March 21, 2025

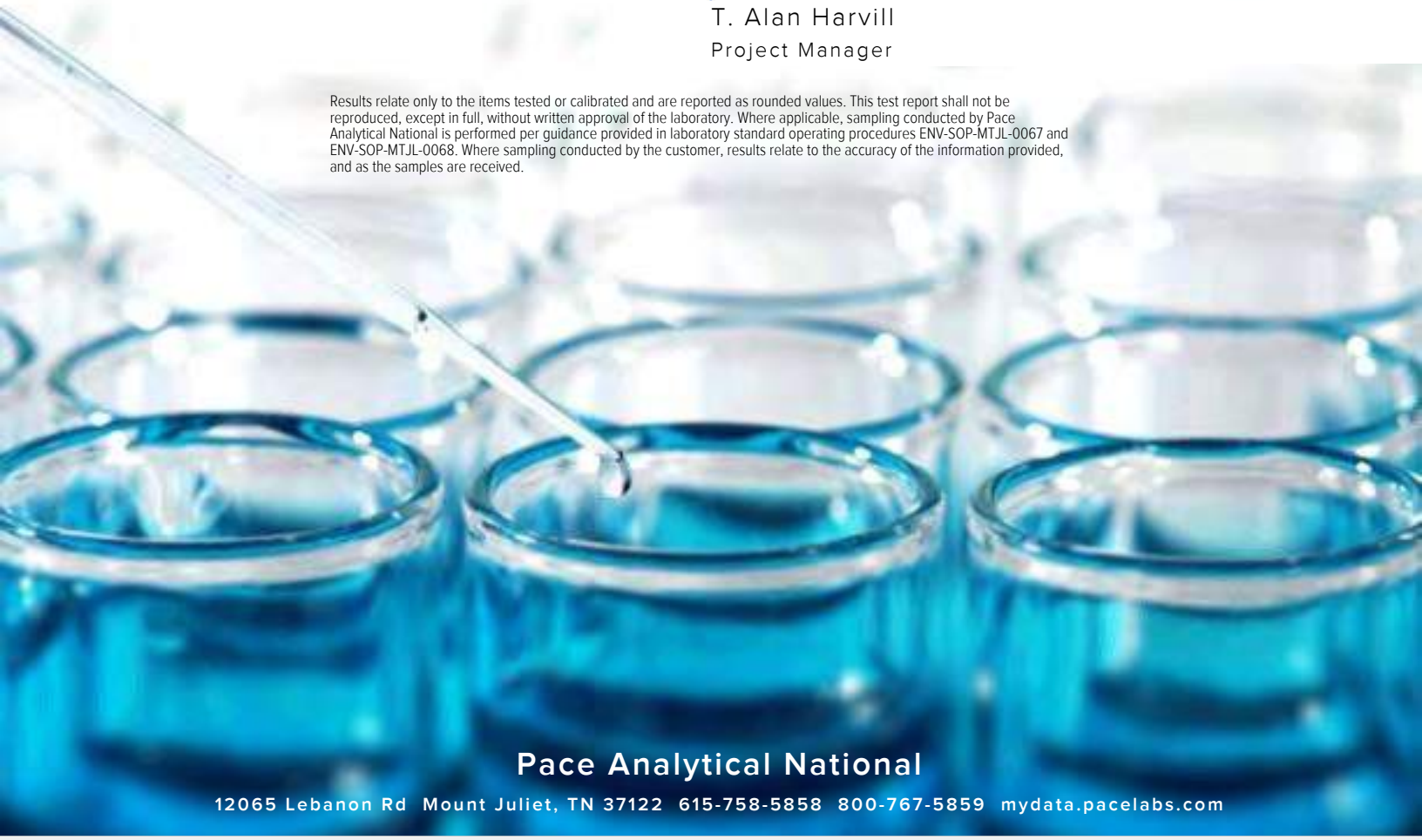
Elk River Landfill

Sample Delivery Group:	L1836539
Samples Received:	03/14/2025
Project Number:	200
Description:	Quarterly Lysimeters (2,4,7,10)
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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SAMPLE SUMMARY

LYS-11 L1836539-01 GW

Collected by: Mike H.
Collected date/time: 03/13/25 10:40
Received date/time: 03/14/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG2470029	1	03/16/25 10:45	03/17/25 13:01	MMF	Mt. Juliet, TN
Gravimetric Analysis by Method 2540 D-2011	WG2470045	1	03/16/25 11:44	03/17/25 18:28	BDC	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG2470353	1	03/17/25 12:03	03/17/25 12:03	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2469652	20	03/20/25 14:55	03/20/25 14:55	DLH	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2469652	5	03/20/25 14:41	03/20/25 14:41	DLH	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG2471374	1	03/19/25 00:04	03/19/25 16:09	MAP	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2472093	1	03/19/25 14:26	03/19/25 14:26	ACG	Mt. Juliet, TN

LYS-17 L1836539-02 GW

Collected by: Mike H.
Collected date/time: 03/13/25 10:30
Received date/time: 03/14/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG2470029	1	03/16/25 10:45	03/17/25 13:01	MMF	Mt. Juliet, TN
Gravimetric Analysis by Method 2540 D-2011	WG2470045	1	03/16/25 11:44	03/17/25 18:28	BDC	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG2470353	1	03/17/25 10:49	03/17/25 10:49	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2469652	1	03/20/25 15:08	03/20/25 15:08	DLH	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG2471374	1	03/19/25 00:04	03/19/25 15:55	MAP	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2472093	1	03/19/25 14:45	03/19/25 14:45	ACG	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Wet Chemistry by Method 300.0

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2469652	(MS) R4189244-6, (MSD) R4189244-7	Chloride

Metals (ICP) by Method 6010D

Analysis was filtered in the laboratory.

Batch	Method	Lab Sample ID
WG2471374	6010D	L1836539-01, 02

The sample concentration is too high to evaluate accurate spike recoveries.

Batch	Lab Sample ID	Analytes
WG2471374	(MS) R4188516-4, (MSD) R4188516-5, L1836539-01	Calcium,Dissolved and Magnesium,Dissolved

The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.

Batch	Lab Sample ID	Analytes
WG2471374	L1836539-01	Calcium,Dissolved, Magnesium,Dissolved, Potassium,Dissolved and Sodium,Dissolved

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2472093	L1836539-01	1,1,2,2-Tetrachloroethane, 1,2,3-Trichloropropane, 1,4-Dichlorobenzene, 4-Chlorotoluene, Acetone, Naphthalene, n-Propylbenzene and Tetrahydrofuran
WG2472093	L1836539-02	1,1,2,2-Tetrachloroethane, 1,2,3-Trichloropropane, 1,4-Dichlorobenzene, 4-Chlorotoluene, Acetone, Naphthalene, n-Propylbenzene and Tetrahydrofuran

Volatile Organic Compounds (GC/MS) by Method 8260D

The associated batch QC was below the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG2472093	(LCS) R4188314-1, L1836539-01, 02	1,4-Dichlorobenzene

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	1820		10.0	1	03/17/2025 13:01	WG2470029

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	144		4.00	1	03/17/2025 18:28	WG2470045

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
Alkalinity,Bicarbonate	660000		20000	1	03/17/2025 12:03	WG2470353

Sample Narrative:

L1836539-01 WG2470353: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
Chloride	80800		1000	5	03/20/2025 14:41	WG2469652
Sulfate	554000		5000	20	03/20/2025 14:55	WG2469652

Metals (ICP) by Method 6010D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Calcium,Dissolved	360	O1 V	1.00	1	03/19/2025 16:09	WG2471374
Potassium,Dissolved	12.5	O1	1.00	1	03/19/2025 16:09	WG2471374
Magnesium,Dissolved	140	O1 V	1.00	1	03/19/2025 16:09	WG2471374
Sodium,Dissolved	44.8	O1	1.00	1	03/19/2025 16:09	WG2471374

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
1,1,1,2-Tetrachloroethane	ND		0.000100	1	03/19/2025 14:26	WG2472093
1,1,1-Trichloroethane	ND		0.000100	1	03/19/2025 14:26	WG2472093
1,1,2,2-Tetrachloroethane	ND	C3	0.000100	1	03/19/2025 14:26	WG2472093
1,1-Dichloroethane	ND		0.000100	1	03/19/2025 14:26	WG2472093
1,1-Dichloroethene	ND		0.000100	1	03/19/2025 14:26	WG2472093
1,1-Dichloropropene	ND		0.000100	1	03/19/2025 14:26	WG2472093
1,2,3-Trichlorobenzene	ND		0.000500	1	03/19/2025 14:26	WG2472093
1,2,3-Trichloropropane	ND	C3	0.000500	1	03/19/2025 14:26	WG2472093
1,2,4-Trichlorobenzene	ND		0.000500	1	03/19/2025 14:26	WG2472093
1,2,4-Trimethylbenzene	ND		0.000200	1	03/19/2025 14:26	WG2472093
1,2-Dibromo-3-Chloropropane	ND		0.00100	1	03/19/2025 14:26	WG2472093
1,2-Dibromoethane	ND		0.000100	1	03/19/2025 14:26	WG2472093
1,2-Dichlorobenzene	ND		0.000200	1	03/19/2025 14:26	WG2472093
1,2-Dichloroethane	ND		0.000100	1	03/19/2025 14:26	WG2472093
1,2-Dichloropropane	ND		0.000200	1	03/19/2025 14:26	WG2472093
1,3,5-Trimethylbenzene	ND		0.000200	1	03/19/2025 14:26	WG2472093
1,3-Dichlorobenzene	ND		0.000200	1	03/19/2025 14:26	WG2472093
1,3-Dichloropropane	ND		0.000200	1	03/19/2025 14:26	WG2472093
1,4-Dichlorobenzene	ND	C3 J4	0.000200	1	03/19/2025 14:26	WG2472093
2,2-Dichloropropane	ND		0.000100	1	03/19/2025 14:26	WG2472093
2-Butanone (MEK)	ND		0.00400	1	03/19/2025 14:26	WG2472093

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
2-Chlorotoluene	ND		0.000100	1	03/19/2025 14:26	WG2472093
4-Chlorotoluene	ND	C3	0.000200	1	03/19/2025 14:26	WG2472093
4-Methyl-2-pentanone (MIBK)	ND		0.00100	1	03/19/2025 14:26	WG2472093
Acetone	ND	C3	0.00200	1	03/19/2025 14:26	WG2472093
Allyl chloride	ND		0.00100	1	03/19/2025 14:26	WG2472093
Benzene	0.0000770		0.0000400	1	03/19/2025 14:26	WG2472093
Bromobenzene	ND		0.000500	1	03/19/2025 14:26	WG2472093
Bromochloromethane	ND		0.000200	1	03/19/2025 14:26	WG2472093
Bromodichloromethane	ND		0.000100	1	03/19/2025 14:26	WG2472093
Bromoform	ND		0.00100	1	03/19/2025 14:26	WG2472093
Bromomethane	ND		0.000500	1	03/19/2025 14:26	WG2472093
Carbon tetrachloride	ND		0.000200	1	03/19/2025 14:26	WG2472093
Chlorobenzene	ND		0.000100	1	03/19/2025 14:26	WG2472093
Chlorodibromomethane	ND		0.000100	1	03/19/2025 14:26	WG2472093
Chloroethane	ND		0.000200	1	03/19/2025 14:26	WG2472093
Chloroform	ND		0.000100	1	03/19/2025 14:26	WG2472093
Chloromethane	ND		0.000500	1	03/19/2025 14:26	WG2472093
Dibromomethane	ND		0.000200	1	03/19/2025 14:26	WG2472093
Dichlorodifluoromethane	ND		0.000100	1	03/19/2025 14:26	WG2472093
Dichlorofluoromethane	ND		0.000100	1	03/19/2025 14:26	WG2472093
Ethyl ether	0.000778		0.000100	1	03/19/2025 14:26	WG2472093
Ethylbenzene	ND		0.000100	1	03/19/2025 14:26	WG2472093
Hexachloro-1,3-butadiene	ND		0.00100	1	03/19/2025 14:26	WG2472093
Isopropylbenzene	ND		0.000100	1	03/19/2025 14:26	WG2472093
Methyl tert-butyl ether	ND		0.0000400	1	03/19/2025 14:26	WG2472093
Methylene Chloride	ND		0.00100	1	03/19/2025 14:26	WG2472093
Naphthalene	ND	C3	0.000500	1	03/19/2025 14:26	WG2472093
Styrene	ND		0.000500	1	03/19/2025 14:26	WG2472093
Tetrachloroethene	ND		0.000100	1	03/19/2025 14:26	WG2472093
Tetrahydrofuran	0.0287	C3	0.000500	1	03/19/2025 14:26	WG2472093
Toluene	ND		0.000200	1	03/19/2025 14:26	WG2472093
Total 1,2-Dichloroethene	0.000272		0.000100	1	03/19/2025 14:26	WG2472093
Total 1,3-Dichloropropene	ND		0.000100	1	03/19/2025 14:26	WG2472093
Trichloroethene	0.0000690		0.0000400	1	03/19/2025 14:26	WG2472093
Trichlorofluoromethane	ND		0.000100	1	03/19/2025 14:26	WG2472093
Vinyl chloride	ND		0.0000500	1	03/19/2025 14:26	WG2472093
Xylenes, Total	ND		0.000260	1	03/19/2025 14:26	WG2472093
cis-1,2-Dichloroethene	0.000272		0.000100	1	03/19/2025 14:26	WG2472093
cis-1,3-Dichloropropene	ND		0.000100	1	03/19/2025 14:26	WG2472093
n-Butylbenzene	ND		0.000500	1	03/19/2025 14:26	WG2472093
n-Propylbenzene	ND	C3	0.000200	1	03/19/2025 14:26	WG2472093
p-Isopropyltoluene	ND		0.000200	1	03/19/2025 14:26	WG2472093
sec-Butylbenzene	ND		0.000500	1	03/19/2025 14:26	WG2472093
tert-Butylbenzene	ND		0.000200	1	03/19/2025 14:26	WG2472093
trans-1,2-Dichloroethene	ND		0.000200	1	03/19/2025 14:26	WG2472093
trans-1,3-Dichloropropene	ND		0.000200	1	03/19/2025 14:26	WG2472093
(S) 1,2-Dichloroethane-d4	*94.4*			*70.0-130*	*03/19/2025 14:26*	WG2472093
(S) Toluene-d8	*96.4*			*75.0-131*	*03/19/2025 14:26*	WG2472093
(S) 4-Bromofluorobenzene	*107*			*67.0-138*	*03/19/2025 14:26*	WG2472093

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	672		10.0	1	03/17/2025 13:01	WG2470029

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	143		4.00	1	03/17/2025 18:28	WG2470045

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
Alkalinity,Bicarbonate	487000		20000	1	03/17/2025 10:49	WG2470353

Sample Narrative:

L1836539-02 WG2470353: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
Chloride	75000		1000	1	03/20/2025 15:08	WG2469652
Sulfate	28700		5000	1	03/20/2025 15:08	WG2469652

Metals (ICP) by Method 6010D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Calcium,Dissolved	118		1.00	1	03/19/2025 15:55	WG2471374
Potassium,Dissolved	6.88		1.00	1	03/19/2025 15:55	WG2471374
Magnesium,Dissolved	56.7		1.00	1	03/19/2025 15:55	WG2471374
Sodium,Dissolved	25.0		1.00	1	03/19/2025 15:55	WG2471374

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
1,1,1,2-Tetrachloroethane	ND		0.000100	1	03/19/2025 14:45	WG2472093
1,1,1-Trichloroethane	ND		0.000100	1	03/19/2025 14:45	WG2472093
1,1,2,2-Tetrachloroethane	ND	C3	0.000100	1	03/19/2025 14:45	WG2472093
1,1-Dichloroethane	ND		0.000100	1	03/19/2025 14:45	WG2472093
1,1-Dichloroethene	ND		0.000100	1	03/19/2025 14:45	WG2472093
1,1-Dichloropropene	ND		0.000100	1	03/19/2025 14:45	WG2472093
1,2,3-Trichlorobenzene	ND		0.000500	1	03/19/2025 14:45	WG2472093
1,2,3-Trichloropropane	ND	C3	0.000500	1	03/19/2025 14:45	WG2472093
1,2,4-Trichlorobenzene	ND		0.000500	1	03/19/2025 14:45	WG2472093
1,2,4-Trimethylbenzene	ND		0.000200	1	03/19/2025 14:45	WG2472093
1,2-Dibromo-3-Chloropropane	ND		0.00100	1	03/19/2025 14:45	WG2472093
1,2-Dibromoethane	ND		0.000100	1	03/19/2025 14:45	WG2472093
1,2-Dichlorobenzene	ND		0.000200	1	03/19/2025 14:45	WG2472093
1,2-Dichloroethane	ND		0.000100	1	03/19/2025 14:45	WG2472093
1,2-Dichloropropane	ND		0.000200	1	03/19/2025 14:45	WG2472093
1,3,5-Trimethylbenzene	ND		0.000200	1	03/19/2025 14:45	WG2472093
1,3-Dichlorobenzene	ND		0.000200	1	03/19/2025 14:45	WG2472093
1,3-Dichloropropane	ND		0.000200	1	03/19/2025 14:45	WG2472093
1,4-Dichlorobenzene	ND	C3 J4	0.000200	1	03/19/2025 14:45	WG2472093
2,2-Dichloropropane	ND		0.000100	1	03/19/2025 14:45	WG2472093
2-Butanone (MEK)	ND		0.00400	1	03/19/2025 14:45	WG2472093

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
2-Chlorotoluene	ND		0.000100	1	03/19/2025 14:45	WG2472093
4-Chlorotoluene	ND	C3	0.000200	1	03/19/2025 14:45	WG2472093
4-Methyl-2-pentanone (MIBK)	ND		0.00100	1	03/19/2025 14:45	WG2472093
Acetone	0.00444	C3	0.00200	1	03/19/2025 14:45	WG2472093
Allyl chloride	ND		0.00100	1	03/19/2025 14:45	WG2472093
Benzene	ND		0.0000400	1	03/19/2025 14:45	WG2472093
Bromobenzene	ND		0.000500	1	03/19/2025 14:45	WG2472093
Bromochloromethane	ND		0.000200	1	03/19/2025 14:45	WG2472093
Bromodichloromethane	ND		0.000100	1	03/19/2025 14:45	WG2472093
Bromoform	ND		0.00100	1	03/19/2025 14:45	WG2472093
Bromomethane	ND		0.000500	1	03/19/2025 14:45	WG2472093
Carbon tetrachloride	ND		0.000200	1	03/19/2025 14:45	WG2472093
Chlorobenzene	ND		0.000100	1	03/19/2025 14:45	WG2472093
Chlorodibromomethane	ND		0.000100	1	03/19/2025 14:45	WG2472093
Chloroethane	ND		0.000200	1	03/19/2025 14:45	WG2472093
Chloroform	ND		0.000100	1	03/19/2025 14:45	WG2472093
Chloromethane	ND		0.000500	1	03/19/2025 14:45	WG2472093
Dibromomethane	ND		0.000200	1	03/19/2025 14:45	WG2472093
Dichlorodifluoromethane	ND		0.000100	1	03/19/2025 14:45	WG2472093
Dichlorofluoromethane	ND		0.000100	1	03/19/2025 14:45	WG2472093
Ethyl ether	0.000474		0.000100	1	03/19/2025 14:45	WG2472093
Ethylbenzene	ND		0.000100	1	03/19/2025 14:45	WG2472093
Hexachloro-1,3-butadiene	ND		0.00100	1	03/19/2025 14:45	WG2472093
Isopropylbenzene	ND		0.000100	1	03/19/2025 14:45	WG2472093
Methyl tert-butyl ether	ND		0.0000400	1	03/19/2025 14:45	WG2472093
Methylene Chloride	ND		0.00100	1	03/19/2025 14:45	WG2472093
Naphthalene	ND	C3	0.000500	1	03/19/2025 14:45	WG2472093
Styrene	ND		0.000500	1	03/19/2025 14:45	WG2472093
Tetrachloroethene	ND		0.000100	1	03/19/2025 14:45	WG2472093
Tetrahydrofuran	0.00117	C3	0.000500	1	03/19/2025 14:45	WG2472093
Toluene	ND		0.000200	1	03/19/2025 14:45	WG2472093
Total 1,2-Dichloroethene	ND		0.000100	1	03/19/2025 14:45	WG2472093
Total 1,3-Dichloropropene	ND		0.000100	1	03/19/2025 14:45	WG2472093
Trichloroethene	ND		0.0000400	1	03/19/2025 14:45	WG2472093
Trichlorofluoromethane	ND		0.000100	1	03/19/2025 14:45	WG2472093
Vinyl chloride	ND		0.0000500	1	03/19/2025 14:45	WG2472093
Xylenes, Total	ND		0.000260	1	03/19/2025 14:45	WG2472093
cis-1,2-Dichloroethene	ND		0.000100	1	03/19/2025 14:45	WG2472093
cis-1,3-Dichloropropene	ND		0.000100	1	03/19/2025 14:45	WG2472093
n-Butylbenzene	ND		0.000500	1	03/19/2025 14:45	WG2472093
n-Propylbenzene	ND	C3	0.000200	1	03/19/2025 14:45	WG2472093
p-Isopropyltoluene	ND		0.000200	1	03/19/2025 14:45	WG2472093
sec-Butylbenzene	ND		0.000500	1	03/19/2025 14:45	WG2472093
tert-Butylbenzene	ND		0.000200	1	03/19/2025 14:45	WG2472093
trans-1,2-Dichloroethene	ND		0.000200	1	03/19/2025 14:45	WG2472093
trans-1,3-Dichloropropene	ND		0.000200	1	03/19/2025 14:45	WG2472093
(S) 1,2-Dichloroethane-d4	*101*			*70.0-130*	*03/19/2025 14:45*	WG2472093
(S) Toluene-d8	*95.6*			*75.0-131*	*03/19/2025 14:45*	WG2472093
(S) 4-Bromofluorobenzene	*110*			*67.0-138*	*03/19/2025 14:45*	WG2472093

Method Blank (MB)

(MB) R4188469-1 03/17/25 13:01

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Dissolved Solids	ND		2.82	10.0

L1836366-13 Original Sample (OS) • Duplicate (DUP)

(OS) L1836366-13 03/17/25 13:01 • (DUP) R4188469-3 03/17/25 13:01

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	264	269	1	1.88		10

L1836645-12 Original Sample (OS) • Duplicate (DUP)

(OS) L1836645-12 03/17/25 13:01 • (DUP) R4188469-4 03/17/25 13:01

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	832	820	1	1.45		10

Laboratory Control Sample (LCS)

(LCS) R4188469-2 03/17/25 13:01

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Dissolved Solids	8800	8720	99.1	90.0-110	

Method Blank (MB)

(MB) R4187631-1 03/17/25 18:28

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Suspended Solids	ND		0.350	2.50

L1836393-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1836393-02 03/17/25 18:28 • (DUP) R4187631-3 03/17/25 18:28

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	145	142	1	2.32		10

L1836539-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1836539-01 03/17/25 18:28 • (DUP) R4187631-4 03/17/25 18:28

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	144	135	1	6.03		10

Laboratory Control Sample (LCS)

(LCS) R4187631-2 03/17/25 18:28

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Suspended Solids	773	790	102	85.0-115	

Method Blank (MB)

(MB) R4187363-2 03/17/25 09:03

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Alkalinity,Bicarbonate	ND		2710	20000

Sample Narrative:

BLANK: Endpoint pH 4.5

L1836130-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1836130-01 03/17/25 09:31 • (DUP) R4187363-3 03/17/25 09:38

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity,Bicarbonate	425000	423000	1	0.519		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1836539-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1836539-01 03/17/25 12:03 • (DUP) R4187363-4 03/17/25 12:08

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity,Bicarbonate	660000	656000	1	0.548		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Method Blank (MB)

(MB) R4189244-1 03/20/25 11:41

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Chloride	111		51.9	1000
Sulfate	182		77.4	5000

L1836532-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1836532-01 03/20/25 12:36 • (DUP) R4189244-3 03/20/25 12:53

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	5960	6300	1	5.41		15
Sulfate	7910	7890	1	0.268		15

L1836774-08 Original Sample (OS) • Duplicate (DUP)

(OS) L1836774-08 03/20/25 16:43 • (DUP) R4189244-5 03/20/25 16:56

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	33500	33500	1	0.0203		15
Sulfate	ND	ND	1	5.70		15

Laboratory Control Sample (LCS)

(LCS) R4189244-2 03/20/25 11:54

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40000	38400	95.9	90.0-110	
Sulfate	40000	38700	96.6	90.0-110	

L1836532-01 Original Sample (OS) • Matrix Spike (MS)

(OS) L1836532-01 03/20/25 12:36 • (MS) R4189244-4 03/20/25 13:07

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	40000	5960	44700	96.8	1	90.0-110	
Sulfate	40000	7910	46700	97.0	1	90.0-110	

L1836774-08 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1836774-08 03/20/25 16:43 • (MS) R4189244-6 03/20/25 17:10 • (MSD) R4189244-7 03/20/25 17:23

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	40000	33500	67300	66200	84.4	81.8	1	90.0-110	J6	J6	1.61	15
Sulfate	40000	ND	41500	40900	101	99.9	1	90.0-110			1.57	15

Method Blank (MB)

(MB) R4188516-1 03/19/25 16:03

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Calcium,Dissolved	ND		0.0463	1.00
Potassium,Dissolved	0.202		0.102	1.00
Magnesium,Dissolved	ND		0.0111	1.00
Sodium,Dissolved	0.463	J	0.0985	1.00

Laboratory Control Sample (LCS)

(LCS) R4188516-2 03/19/25 16:06

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Calcium,Dissolved	10.0	10.4	104	80.0-120	
Potassium,Dissolved	10.0	10.1	101	80.0-120	
Magnesium,Dissolved	10.0	10.5	105	80.0-120	
Sodium,Dissolved	10.0	10.5	105	80.0-120	

L1836539-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1836539-01 03/19/25 16:09 • (MS) R4188516-4 03/19/25 17:27 • (MSD) R4188516-5 03/19/25 17:30

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Calcium,Dissolved	10.0	360	365	363	54.3	30.8	1	75.0-125	V	V	0.647	20
Potassium,Dissolved	10.0	12.5	22.6	22.5	101	99.8	1	75.0-125			0.464	20
Magnesium,Dissolved	10.0	140	146	146	57.9	62.0	1	75.0-125	V	V	0.279	20
Sodium,Dissolved	10.0	44.8	55.1	54.3	102	94.5	1	75.0-125			1.43	20

Method Blank (MB)

(MB) R4188314-3 03/19/25 10:56

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
1,1,1,2-Tetrachloroethane	ND		0.0000379	0.000100
1,1,1-Trichloroethane	ND		0.0000369	0.000100
1,1,2,2-Tetrachloroethane	ND		0.0000278	0.000100
1,1-Dichloroethane	ND		0.0000196	0.000100
1,1-Dichloroethene	ND		0.0000242	0.000100
1,1-Dichloropropene	ND		0.0000324	0.000100
1,2,3-Trichlorobenzene	ND		0.000293	0.000500
1,2,3-Trichloropropane	ND		0.0000648	0.000500
1,2,4-Trichlorobenzene	ND		0.000176	0.000500
1,2,4-Trimethylbenzene	ND		0.0000632	0.000200
1,2-Dibromo-3-Chloropropane	ND		0.000156	0.00100
1,2-Dibromoethane	ND		0.0000259	0.000100
1,2-Dichlorobenzene	ND		0.0000170	0.000200
1,2-Dichloroethane	ND		0.0000260	0.000100
1,2-Dichloropropane	ND		0.0000568	0.000200
1,3,5-Trimethylbenzene	ND		0.0000800	0.000200
1,3-Dichlorobenzene	ND		0.0000240	0.000200
1,3-Dichloropropane	ND		0.0000200	0.000200
1,4-Dichlorobenzene	ND		0.0000280	0.000200
2,2-Dichloropropane	ND		0.0000552	0.000100
2-Butanone (MEK)	ND		0.00254	0.00400
2-Chlorotoluene	ND		0.0000346	0.000100
4-Chlorotoluene	ND		0.0000180	0.000200
4-Methyl-2-pentanone (MIBK)	ND		0.0000912	0.00100
Acetone	ND		0.00146	0.00200
Allyl chloride	ND		0.000160	0.00100
Benzene	ND		0.0000187	0.0000400
Bromobenzene	ND		0.0000360	0.000500
Bromochloromethane	ND		0.0000226	0.000200
Bromodichloromethane	ND		0.0000290	0.000100
Bromoform	ND		0.0000468	0.00100
Bromomethane	ND		0.0000788	0.000500
Carbon tetrachloride	ND		0.0000359	0.000200
Chlorobenzene	ND		0.00000840	0.000100
Chlorodibromomethane	ND		0.0000245	0.000100
Chloroethane	ND		0.0000680	0.000200
Chloroform	0.0000420	J	0.0000412	0.000100
Chloromethane	ND		0.000174	0.000500
Dibromomethane	ND		0.0000300	0.000200
Dichlorodifluoromethane	ND		0.0000644	0.000200

Method Blank (MB)

(MB) R4188314-3 03/19/25 10:56

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Dichlorofluoromethane	ND		0.0000490	0.000100
Ethyl ether	ND		0.0000356	0.000100
Ethylbenzene	ND		0.0000295	0.000100
Hexachloro-1,3-butadiene	ND		0.0000485	0.00100
Isopropylbenzene	ND		0.0000170	0.000100
Methyl tert-butyl ether	ND		0.0000140	0.0000400
Methylene Chloride	ND		0.000266	0.00100
Naphthalene	ND		0.000195	0.000500
Styrene	ND		0.00000916	0.000500
Tetrachloroethene	ND		0.0000358	0.000100
Tetrahydrofuran	ND		0.000141	0.000500
Toluene	ND		0.0000520	0.000200
Total 1,2-Dichloroethene	ND		0.0000848	0.000100
Total 1,3-Dichloropropene	ND		0.0000271	0.000100
Trichloroethene	ND		0.0000234	0.0000400
Trichlorofluoromethane	ND		0.0000331	0.000100
Vinyl chloride	ND		0.0000462	0.0000500
Xylenes, Total	ND		0.0000352	0.000260
cis-1,2-Dichloroethene	ND		0.0000294	0.000100
cis-1,3-Dichloropropene	ND		0.0000303	0.000100
n-Butylbenzene	ND		0.000210	0.000500
n-Propylbenzene	ND		0.0000380	0.000200
p-Isopropyltoluene	ND		0.000102	0.000200
sec-Butylbenzene	ND		0.000115	0.000500
tert-Butylbenzene	ND		0.0000780	0.000200
trans-1,2-Dichloroethene	ND		0.0000416	0.000200
trans-1,3-Dichloropropene	ND		0.0000456	0.000200
(S) 1,2-Dichloroethane-d4	*95.9*			*70.0-130*
(S) Toluene-d8	*95.1*			*75.0-131*
(S) 4-Bromofluorobenzene	*109*			*67.0-138*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4188314-1 03/19/25 09:20 • (LCSD) R4188314-2 03/19/25 09:39

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	0.00500	0.00537	0.00544	107	109	74.0-129			1.30	20
1,1,1-Trichloroethane	0.00500	0.00528	0.00551	106	110	69.0-126			4.26	20
1,1,2,2-Tetrachloroethane	0.00500	0.00388	0.00390	77.6	78.0	68.0-128			0.514	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4188314-1 03/19/25 09:20 • (LCSD) R4188314-2 03/19/25 09:39

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1-Dichloroethane	0.00500	0.00461	0.00466	92.2	93.2	70.0-127			1.08	20
1,1-Dichloroethene	0.00500	0.00448	0.00463	89.6	92.6	65.0-131			3.29	20
1,1-Dichloropropene	0.00500	0.00432	0.00429	86.4	85.8	73.0-125			0.697	20
1,2,3-Trichlorobenzene	0.00500	0.00436	0.00426	87.2	85.2	59.0-139			2.32	20
1,2,3-Trichloropropane	0.00500	0.00380	0.00396	76.0	79.2	67.0-129			4.12	20
1,2,4-Trichlorobenzene	0.00500	0.00440	0.00439	88.0	87.8	62.0-137			0.228	20
1,2,4-Trimethylbenzene	0.00500	0.00414	0.00432	82.8	86.4	70.0-126			4.26	20
1,2-Dibromo-3-Chloropropane	0.00500	0.00440	0.00466	88.0	93.2	59.0-130			5.74	20
1,2-Dibromoethane	0.00500	0.00453	0.00450	90.6	90.0	74.0-128			0.664	20
1,2-Dichlorobenzene	0.00500	0.00411	0.00417	82.2	83.4	76.0-124			1.45	20
1,2-Dichloroethane	0.00500	0.00402	0.00416	80.4	83.2	65.0-131			3.42	20
1,2-Dichloropropane	0.00500	0.00475	0.00479	95.0	95.8	74.0-125			0.839	20
1,3,5-Trimethylbenzene	0.00500	0.00407	0.00407	81.4	81.4	73.0-127			0.000	20
1,3-Dichlorobenzene	0.00500	0.00417	0.00421	83.4	84.2	76.0-125			0.955	20
1,3-Dichloropropane	0.00500	0.00410	0.00429	82.0	85.8	80.0-125			4.53	20
1,4-Dichlorobenzene	0.00500	0.00378	0.00394	75.6	78.8	77.0-121	J4		4.15	20
2,2-Dichloropropane	0.00500	0.00563	0.00576	113	115	59.0-135			2.28	20
2-Butanone (MEK)	0.0250	0.0208	0.0226	83.2	90.4	30.0-160			8.29	24
2-Chlorotoluene	0.00500	0.00405	0.00407	81.0	81.4	75.0-124			0.493	20
4-Chlorotoluene	0.00500	0.00376	0.00391	75.2	78.2	75.0-124			3.91	20
4-Methyl-2-pentanone (MIBK)	0.0250	0.0215	0.0223	86.0	89.2	56.0-143			3.65	20
Acetone	0.0250	0.0119	0.0136	47.6	54.4	10.0-160			13.3	31
Allyl chloride	0.0250	0.0247	0.0261	98.8	104	70.0-131			5.51	20
Benzene	0.00500	0.00444	0.00444	88.8	88.8	70.0-123			0.000	20
Bromobenzene	0.00500	0.00402	0.00426	80.4	85.2	73.0-121			5.80	20
Bromochloromethane	0.00500	0.00485	0.00509	97.0	102	77.0-128			4.83	20
Bromodichloromethane	0.00500	0.00527	0.00550	105	110	73.0-121			4.27	20
Bromoform	0.00500	0.00512	0.00539	102	108	64.0-132			5.14	20
Bromomethane	0.00500	0.00438	0.00433	87.6	86.6	56.0-147			1.15	20
Carbon tetrachloride	0.00500	0.00571	0.00577	114	115	66.0-128			1.05	20
Chlorobenzene	0.00500	0.00429	0.00444	85.8	88.8	76.0-128			3.44	20
Chlorodibromomethane	0.00500	0.00451	0.00468	90.2	93.6	74.0-127			3.70	20
Chloroethane	0.00500	0.00431	0.00422	86.2	84.4	61.0-134			2.11	20
Chloroform	0.00500	0.00453	0.00461	90.6	92.2	72.0-123			1.75	20
Chloromethane	0.00500	0.00407	0.00406	81.4	81.2	51.0-138			0.246	20
Dibromomethane	0.00500	0.00439	0.00464	87.8	92.8	75.0-122			5.54	20
Dichlorodifluoromethane	0.00500	0.00570	0.00575	114	115	43.0-156			0.873	20
Dichlorofluoromethane	0.00500	0.00412	0.00412	82.4	82.4	65.0-137			0.000	20
Ethyl ether	0.00500	0.00401	0.00448	80.2	89.6	64.0-137			11.1	20
Ethylbenzene	0.00500	0.00446	0.00470	89.2	94.0	74.0-126			5.24	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4188314-1 03/19/25 09:20 • (LCSD) R4188314-2 03/19/25 09:39

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Hexachloro-1,3-butadiene	0.00500	0.00456	0.00486	91.2	97.2	57.0-150			6.37	20
Isopropylbenzene	0.00500	0.00538	0.00530	108	106	72.0-127			1.50	20
Methyl tert-butyl ether	0.00500	0.00496	0.00560	99.2	112	66.0-132			12.1	20
Methylene Chloride	0.00500	0.00465	0.00455	93.0	91.0	68.0-123			2.17	20
Naphthalene	0.00500	0.00394	0.00380	78.8	76.0	59.0-130			3.62	20
Styrene	0.00500	0.00461	0.00469	92.2	93.8	72.0-127			1.72	20
Tetrachloroethene	0.00500	0.00474	0.00474	94.8	94.8	70.0-136			0.000	20
Tetrahydrofuran	0.00500	0.00313	0.00315	62.6	63.0	37.0-146			0.637	24
Toluene	0.00500	0.00420	0.00426	84.0	85.2	75.0-121			1.42	20
Total 1,2-Dichloroethene	0.0100	0.00972	0.0103	97.2	103	70.0-130			5.79	20
Total 1,3-Dichloropropene	0.0100	0.00931	0.00966	93.1	96.6	73.0-127			3.69	20
Trichloroethene	0.00500	0.00497	0.00490	99.4	98.0	76.0-126			1.42	20
Trichlorofluoromethane	0.00500	0.00469	0.00479	93.8	95.8	61.0-142			2.11	20
Vinyl chloride	0.00500	0.00431	0.00425	86.2	85.0	63.0-134			1.40	20
Xylenes, Total	0.0150	0.0133	0.0134	88.7	89.3	72.0-127			0.749	20
cis-1,2-Dichloroethene	0.00500	0.00465	0.00492	93.0	98.4	73.0-125			5.64	20
cis-1,3-Dichloropropene	0.00500	0.00482	0.00503	96.4	101	76.0-127			4.26	20
n-Butylbenzene	0.00500	0.00418	0.00431	83.6	86.2	68.0-135			3.06	20
n-Propylbenzene	0.00500	0.00396	0.00393	79.2	78.6	74.0-126			0.760	20
p-Isopropyltoluene	0.00500	0.00460	0.00478	92.0	95.6	72.0-133			3.84	20
sec-Butylbenzene	0.00500	0.00412	0.00416	82.4	83.2	74.0-130			0.966	20
tert-Butylbenzene	0.00500	0.00398	0.00395	79.6	79.0	75.0-127			0.757	20
trans-1,2-Dichloroethene	0.00500	0.00507	0.00542	101	108	71.0-125			6.67	20
trans-1,3-Dichloropropene	0.00500	0.00449	0.00463	89.8	92.6	73.0-127			3.07	20
(S) 1,2-Dichloroethane-d4				*96.6*	*97.2*	*70.0-130*				
(S) Toluene-d8				*96.3*	*96.8*	*75.0-131*				
(S) 4-Bromofluorobenzene				*107*	*107*	*67.0-138*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J4	The associated batch QC was outside the established quality control range for accuracy.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
O1	The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
Quarterly Lysimeters (2,4,7,10)

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program (DOD, RCRA, DW, etc):

Client Project #
200

Lab Project #
WMELKRIVMN-00010

Collected by (print):
Mike Haw

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice: N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

Analysis / Container / Preservative

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

SDG # 183659

J080

Acctnum: WMELKRIVMN
Template: T166536
Prelogin: P1137351
PM: 364 - T. Alan Harvill
PB: 03/07/25

Shipped Via: FedEX Standard

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No of Cntrs	ALK,CL,SO4 1L-HDPE NoPres	Diss Mtls 1L-HDPE NoPres	TDS 1L-HDPE NoPres	TSS 1L-HDPE NoPres	V8260ULLC 40mlAmb-HCl	Remarks	Sample # (lab only)
~~LYS-01~~		GW				7	X	X	X	X	X		
LYS-11		GW	~~3/12/25~~	3/13/25	1040	7	X	X	X	X	X		-01
~~LYS-02~~		GW				7	X	X	X	X	X		
~~LYS-03~~		GW				7	X	X	X	X	X		
~~LYS-04~~		GW				7	X	X	X	X	X		
~~LYS-05~~		GW				7	X	X	X	X	X		
~~LYS-06~~		GW				7	X	X	X	X	X		
LYS-17		GW		3/12/25	1630	7	X	X	X	X	X		-02
~~LYS-08~~		GW				7	X	X	X	X	X		
~~LYS-19~~		GW				7	X	X	X	X	X		

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS ✓ FedEx __ Courier

Tracking # 4439 2441 7447

Sample Receipt Checklist
COC Seal Present/Intact: NP ✓ N
COC Signed/Accurate: ✓ N
Bottles arrive intact: ✓ N
Correct bottles used: ✓ N
Sufficient volume sent: ✓ N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: ✓ N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	3/13/25	1500	FedEx
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: (Yes) No
HCL / MeoH
TBR

Temp: 1.4 °C Bottles Received: 14
TEMP 2.8+0.4=3.2

Date: 3/14/25 Time: 0900

If preservation required by Login: Date/Time

Hold:

Condition: NCF / (OK)

FIELD INFORMATION FORM

Surface Water, Stormwater and Leachate

WASTE MANAGEMENT

Site Name: Elk River Landfill

Sample I.D.: LYS-11

Laboratory Use Only / Lab I.D.: L1836539

Sampling Method & Equipment

Purge and Sample Equipment:

Sampling Method: D — D - Direct, I - Indirect, V - Visual

Sampling Equipment: O — D - Dipper, T - Transfer Vessel, S - Sample Bottle, O - Other: Dedicated Bladder Pump

Sample Type: G — Grab / Composite (circle one)

Field Measurements

Sample Date MM/DD/YYYY	Sample Time 24 Hr. Clock	pH (std. Units)	CONDUCTIVITY (umhos/cm @ 25°C)	Temp °C	TURBIDITY (NTUs)	DO mg/L - ppm	eH/ORP (std. Units)
03/13/2025	1040	6.52	2251	13.1			

Record final stabilized field readings.

Field Observations

Sample Appearance: Odor: None Color: None Other:

Sheen Present: Y or N Foam Present: Y or N Floating Solids: Y or N

Weather Conditions: (required daily, or as conditions change):

Direction/Speed: Precipitation: Y or N

Specific Comments:

Date	Name	Signature	Company
3/13/25	Mike Hu		AL

FIELD INFORMATION FORM

Surface Water, Stormwater and Leachate

WASTE MANAGEMENT

Site Name: Elk River Landfill

Sample I.D.: MW-17

Laboratory Use Only / Lab I.D.: L1836539

Sampling Method & Equipment

Purge and Sample Equipment:

Sampling Method: D — D - Direct, I - Indirect, V - Visual

Sampling Equipment: D — D - Dipper, T - Transfer Vessel

S - Sample Bottle, O - Other: Air lift pump

Sample Type: ( ) / (Grab) / Composite (circle one)

Field Measurements

Sample Date MM/DD/YYYY	Sample Time 24 Hr. Clock	pH (std. Units)	CONDUCTIVITY (umhos/cm @ 25°C)	Temp °C	TURBIDITY (NTUs)	DO mg/L - ppm	eH/ORP (std. Units)
03-13-25	1030	7.79	1062	18.7			

Record final stabilized field readings.

Field Observations

Sample Appearance: Odor: Mild Color: Tan / Green Other:

Sheen Present [Y] or [N] Foam Present: [Y] or [N] Floating Solids: [Y] or [N]

Weather Conditions: (required daily, or as conditions change):

Direction/Speed: NW @ 5mph Precipitation: [Y] or [N]

Specific Comments: Purged ~15 gallons pre sample

Date	Name	Signature	Company
3/13/25	Kenneth Smith		Alliance

ANALYTICAL REPORT

May 12, 2025

Revised Report

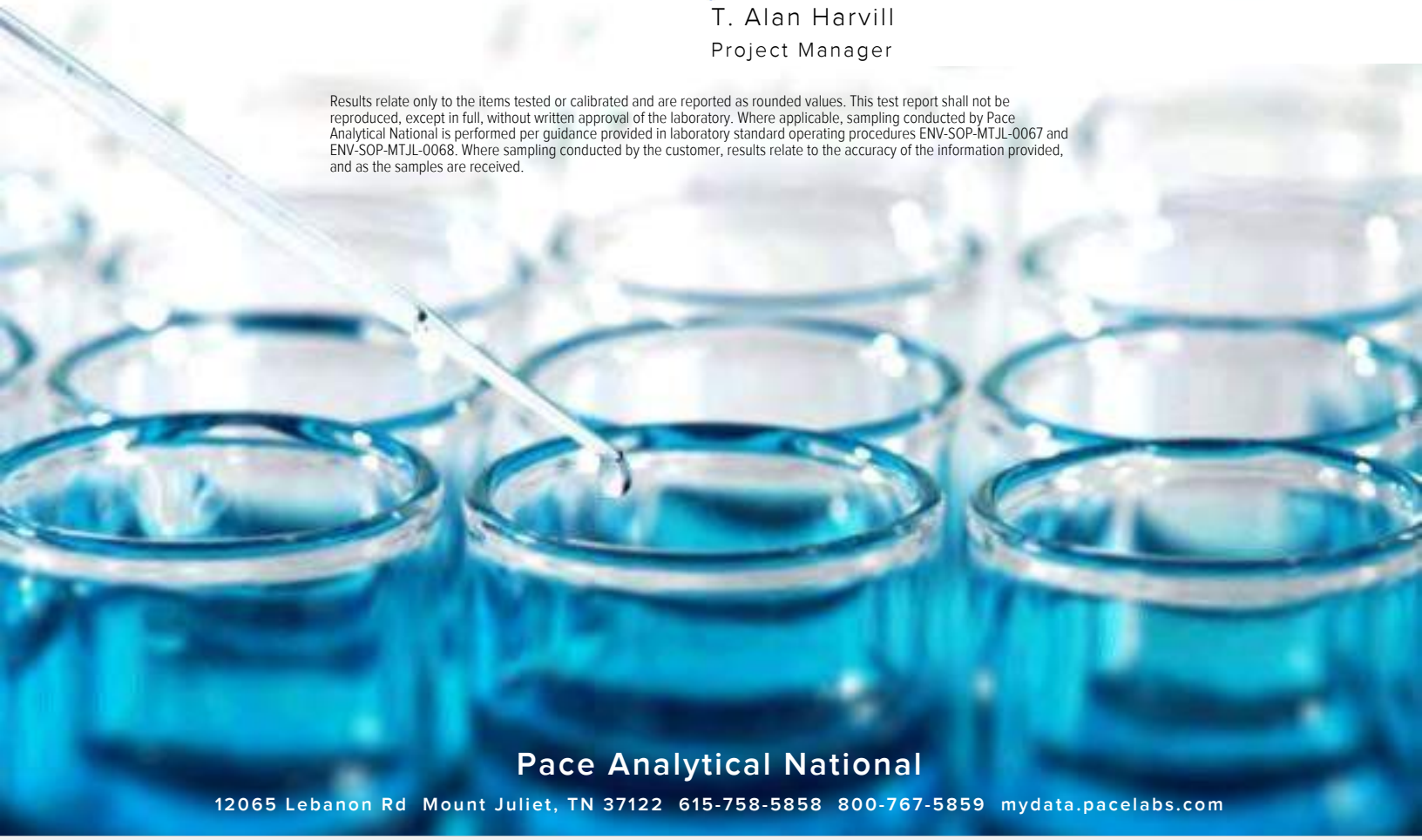
Elk River Landfill

Sample Delivery Group:	L1842913
Samples Received:	04/02/2025
Project Number:	500
Description:	Elk River QTRLY Leachate(1,4,7,10)
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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SAMPLE SUMMARY

SP-01_Leachate L1842913-01

Collected by: Kenneth Smith
Collected date/time: 04/01/25 13:20
Received date/time: 04/02/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 D-2011	WG2482974	1	04/03/25 23:28	04/06/25 15:01	AMG	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG2482824	1	04/03/25 16:51	04/03/25 16:51	ARD	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2482043	5	04/04/25 06:27	04/04/25 06:27	ZSA	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2482043	50	04/04/25 06:41	04/04/25 06:41	ZSA	Mt. Juliet, TN
Wet Chemistry by Method 335.4	WG2485966	1	04/09/25 10:10	04/09/25 19:09	AEC	Mt. Juliet, TN
Wet Chemistry by Method 410.4	WG2482470	25	04/03/25 12:17	04/03/25 16:07	JAS	Mt. Juliet, TN
Wet Chemistry by Method 4500H+ B-2011	WG2482289	1	04/03/25 11:45	04/03/25 11:45	BJM	Mt. Juliet, TN
Wet Chemistry by Method D93/1010A	WG2482653	1	04/03/25 16:00	04/03/25 16:00	DLS	Mt. Juliet, TN
Mercury by Method 245.1	WG2484815	10	04/08/25 13:37	04/08/25 20:08	NDL	Mt. Juliet, TN
Metals (ICP) by Method 200.7	WG2484529	5	04/08/25 17:23	04/09/25 03:12	BAG	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2487619	10	04/14/25 22:49	04/14/25 22:49	WHS	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2487790	10	04/10/25 23:40	04/10/25 23:40	KST	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2488192	10	04/11/25 18:08	04/11/25 18:08	DWR	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2490588	100	04/14/25 23:49	04/14/25 23:49	WHS	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2490955	50	04/15/25 17:25	04/15/25 17:25	KST	Mt. Juliet, TN
Pesticides (GC) by Method EPA 608.3	WG2484099	1.01	04/07/25 08:28	04/07/25 21:55	LTB	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method EPA-608.3	WG2484099	1.01	04/07/25 08:28	04/08/25 16:22	LTB	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 625.1	WG2482495	1.03	04/05/25 04:25	04/12/25 18:07	ADF	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 625.1	WG2490619	1.09	04/15/25 18:35	04/18/25 06:15	JCH	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Report Revision History

Level II Report - Version 1: 04/24/25 08:30

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory¿s PQL unless requested by the client.

Revised to include onsite data.

Sample Comments

L1842913-01	L1842913-01 -2-Propanol, 2-Chloroethylvinyl Ether, and Acrolein initially run within seven-day method hold time. The initial run had failing internal standards and surrogates due to a bad purge which was the result of the foamy matrix of this sample.

Sample Delivery Group (SDG) Narrative

pH outside of method requirement.

Batch	Method	Lab Sample ID
WG2487790	8260D	L1842913-01
WG2488192	8260D	L1842913-01
WG2490955	8260D	L1842913-01

Sample was prepared and/or analyzed past recommended holding time. Concentrations should be considered minimum values.

Batch	Method	Lab Sample ID
WG2487619	8260D	L1842913-01
WG2490588	8260D	L1842913-01
WG2490619	625.1	L1842913-01

The laboratory analysis was performed from an unpreserved, insufficiently or inadequately preserved sample.

Batch	Method	Lab Sample ID
WG2484529	200.7	L1842913-01
WG2484815	245.1	L1842913-01

The following samples were prepared and/or analyzed past recommended holding time. Concentrations should be considered minimum values.

Batch	Method	Lab Sample ID
WG2482289	4500H+ B-2011	L1842913-01

Analyzed from headspace vial.

Batch	Method	Lab Sample ID
WG2490955	8260D	L1842913-01

Gravimetric Analysis by Method 2540 D-2011

RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Batch	Lab Sample ID	Analytes
WG2482974	(DUP) R4195878-3	Suspended Solids

Wet Chemistry by Method 335.4

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2485966	(MS) R4197388-5, (MSD) R4197388-6	Cyanide

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG2485966	(MSD) R4197388-6	Cyanide

Metals (ICP) by Method 200.7

The sample concentration is too high to evaluate accurate spike recoveries.

Batch	Lab Sample ID	Analytes
WG2484529	(MS) R4196935-6, (MSD) R4196935-7	Sodium

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.

Batch	Lab Sample ID	Analytes
WG2487790	L1842913-01	2-Butanone (MEK)

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2487790	L1842913-01	4-Methyl-2-pentanone (MIBK), Acetone, Acrylonitrile, Chloromethane and Hexachloro-1,3-butadiene

The associated batch QC was above the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG2487619	(LCS) R4199482-1, (LCSD) R4199482-2, L1842913-01	Acrolein
WG2487790	(LCS) R4198196-1, L1842913-01	1,1,2-Trichloroethane, Bromomethane and Carbon tetrachloride

Pesticides (GC) by Method EPA 608.3

RPD between the primary and confirmatory analysis exceeded 40%

Batch	Lab Sample ID	Analytes
WG2484099	L1842913-01	Endosulfan I

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG2484099	Decachlorobiphenyl	L1842913-01
WG2484099	Tetrachloro-m-xylene	L1842913-01

Polychlorinated Biphenyls (GC) by Method EPA-608.3

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG2484099	Decachlorobiphenyl	L1842913-01

Semi Volatile Organic Compounds (GC/MS) by Method 625.1

Analyte reported using a calibration and validation based on Azobenzene (CAS 103-33-3). 1,2-Diphenylhydrazine decomposes into Azobenzene during the analysis.

Batch	Analyte	Lab Sample ID
WG2482495	1,2-Diphenylhydrazine	(BLANK) R4198313-3, (LCS) R4198313-1, (MS) R4199396-1, (MSD) R4199396-2, L1842913-01

Surrogate recovery limits have been exceeded; values are outside lower control limits.

Batch	Analyte	Lab Sample ID
WG2490619	p-Terphenyl-d14	L1842913-01

The associated batch QC was below the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG2482495	(LCS) R4198313-1, L1842913-01	1,2,4-Trichlorobenzene, 2-Chloronaphthalene, Fluorene and Hexachloroethane

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2482495	(MS) R4199396-1, (MSD) R4199396-2	11 analytes

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	8.27	su
Temperature (on-site)	14.19	Deg. C

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	93.1		4.00	1	04/06/2025 15:01	WG2482974

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	8470		20.0	1	04/03/2025 16:51	WG2482824

Sample Narrative:

L1842913-01 WG2482824: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	2800		2.60	50	04/04/2025 06:41	WG2482043
Sulfate	35.0		5.00	5	04/04/2025 06:27	WG2482043

Wet Chemistry by Method 335.4

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Cyanide	ND		0.0100	1	04/09/2025 19:09	WG2485966

Wet Chemistry by Method 410.4

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
COD	3180		75.0	25	04/03/2025 16:07	WG2482470

Wet Chemistry by Method 4500H+ B-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	SU			date / time	
pH	7.85	T8	1	04/03/2025 11:45	WG2482289

Sample Narrative:

L1842913-01 WG2482289: 7.85 at 20.4C

Wet Chemistry by Method D93/1010A

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	deg F			date / time	
Flashpoint	DNF at 170		1	04/03/2025 16:00	WG2482653

Mercury by Method 245.1

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Mercury	0.000753		0.000490	10	04/08/2025 20:08	WG2484815

Metals (ICP) by Method 200.7

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
Silver	ND		0.0135	5	04/09/2025 03:12	WG2484529
Arsenic	0.0938		0.0320	5	04/09/2025 03:12	WG2484529
Beryllium	ND		0.00350	5	04/09/2025 03:12	WG2484529
Boron	19.4		0.200	5	04/09/2025 03:12	WG2484529
Calcium	143		1.00	5	04/09/2025 03:12	WG2484529
Cadmium	ND		0.00350	5	04/09/2025 03:12	WG2484529
Chromium	0.341		0.0100	5	04/09/2025 03:12	WG2484529
Copper	ND		0.0350	5	04/09/2025 03:12	WG2484529
Potassium	774		1.00	5	04/09/2025 03:12	WG2484529
Magnesium	173		1.00	5	04/09/2025 03:12	WG2484529
Molybdenum	0.0110		0.0100	5	04/09/2025 03:12	WG2484529
Sodium	2420		1.00	5	04/09/2025 03:12	WG2484529
Nickel	0.298		0.0290	5	04/09/2025 03:12	WG2484529
Lead	ND		0.0100	5	04/09/2025 03:12	WG2484529
Antimony	ND		0.0385	5	04/09/2025 03:12	WG2484529
Selenium	ND		0.0380	5	04/09/2025 03:12	WG2484529
Thallium	ND		0.0335	5	04/09/2025 03:12	WG2484529
Zinc	0.204		0.0500	5	04/09/2025 03:12	WG2484529

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
1,1,1-Trichloroethane	ND		0.00100	10	04/10/2025 23:40	WG2487790
2-Propanol	1.05	Q	0.165	100	04/14/2025 23:49	WG2490588
1,1,2,2-Tetrachloroethane	ND		0.00100	10	04/10/2025 23:40	WG2487790
2-Chloroethyl vinyl ether	ND	Q	0.0500	10	04/14/2025 22:49	WG2487619
1,1,2-Trichloroethane	ND	J4	0.00100	10	04/10/2025 23:40	WG2487790
Acrolein	ND	J4 Q	0.0254	10	04/14/2025 22:49	WG2487619
1,1-Dichloroethane	ND		0.00100	10	04/10/2025 23:40	WG2487790
1,1-Dichloroethene	ND		0.00100	10	04/10/2025 23:40	WG2487790
1,2,4-Trichlorobenzene	ND		0.00176	10	04/10/2025 23:40	WG2487790
1,2-Dichloroethane	ND		0.00100	10	04/10/2025 23:40	WG2487790
1,2-Dichloropropane	ND		0.00100	10	04/10/2025 23:40	WG2487790
2-Butanone (MEK)	1.46	C5	0.0254	10	04/10/2025 23:40	WG2487790
4-Methyl-2-pentanone (MIBK)	0.0246	C3	0.00500	10	04/10/2025 23:40	WG2487790
Acetone	2.02	C3	0.0146	10	04/10/2025 23:40	WG2487790
Acrylonitrile	ND	C3	0.00500	10	04/10/2025 23:40	WG2487790
Benzene	0.00287		0.00100	10	04/10/2025 23:40	WG2487790
Bromodichloromethane	ND		0.00100	10	04/10/2025 23:40	WG2487790
Bromoform	ND		0.00100	10	04/10/2025 23:40	WG2487790
Bromomethane	ND	J4	0.00100	10	04/10/2025 23:40	WG2487790
Carbon tetrachloride	ND	J4	0.00100	10	04/10/2025 23:40	WG2487790
Chlorobenzene	ND		0.00100	10	04/10/2025 23:40	WG2487790
Chloroethane	ND		0.00100	10	04/11/2025 18:08	WG2488192
Chloroform	ND		0.00100	10	04/10/2025 23:40	WG2487790
Chloromethane	ND	C3	0.00174	10	04/10/2025 23:40	WG2487790
Dibromochloromethane	ND		0.00100	10	04/10/2025 23:40	WG2487790
Ethyl ether	0.0154		0.00100	10	04/10/2025 23:40	WG2487790
Ethylbenzene	0.0115		0.00100	10	04/10/2025 23:40	WG2487790
Hexachloro-1,3-butadiene	ND	C3	0.00200	10	04/10/2025 23:40	WG2487790
Methylene Chloride	ND		0.00266	10	04/10/2025 23:40	WG2487790
Naphthalene	0.00589		0.00195	10	04/10/2025 23:40	WG2487790
Tetrachloroethene	ND		0.00100	10	04/10/2025 23:40	WG2487790
Tetrahydrofuran	2.15		0.00704	50	04/15/2025 17:25	WG2490955
Toluene	0.0366		0.00100	10	04/10/2025 23:40	WG2487790
Total Xylene	0.0296		0.00200	10	04/10/2025 23:40	WG2487790

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
Trichloroethene	ND		0.00100	10	04/10/2025 23:40	WG2487790
Vinyl chloride	ND		0.00100	10	04/10/2025 23:40	WG2487790
cis-1,3-Dichloropropene	ND		0.00100	10	04/10/2025 23:40	WG2487790
m&p-Xylene	0.0196		0.00200	10	04/10/2025 23:40	WG2487790
o-Xylene	0.0100		0.00100	10	04/10/2025 23:40	WG2487790
trans-1,2-Dichloroethene	ND		0.00100	10	04/10/2025 23:40	WG2487790
trans-1,3-Dichloropropene	ND		0.00100	10	04/10/2025 23:40	WG2487790
(S) 4-Bromofluorobenzene	*97.2*			*67.0-138*	*04/10/2025 23:40*	WG2487790
(S) 4-Bromofluorobenzene	*102*			*67.0-138*	*04/11/2025 18:08*	WG2488192
(S) 4-Bromofluorobenzene	*101*			*67.0-138*	*04/15/2025 17:25*	WG2490955
(S) Toluene-d8	*109*			*75.0-131*	*04/10/2025 23:40*	WG2487790
(S) Toluene-d8	*103*			*75.0-131*	*04/11/2025 18:08*	WG2488192
(S) Toluene-d8	*98.6*			*75.0-131*	*04/15/2025 17:25*	WG2490955
(S) 1,2-Dichloroethane-d4	*98.8*			*70.0-130*	*04/10/2025 23:40*	WG2487790
(S) 1,2-Dichloroethane-d4	*101*			*70.0-130*	*04/11/2025 18:08*	WG2488192
(S) 1,2-Dichloroethane-d4	*99.9*			*70.0-130*	*04/15/2025 17:25*	WG2490955
(S) 1,2-Dichloroethane-d4	*92.9*			*70.0-130*	*04/14/2025 22:49*	WG2487619
(S) 1,2-Dichloroethane-d4	*92.4*			*70.0-130*	*04/14/2025 23:49*	WG2490588
(S) 4-Bromofluorobenzene	*95.7*			*77.0-126*	*04/14/2025 22:49*	WG2487619
(S) 4-Bromofluorobenzene	*95.4*			*77.0-126*	*04/14/2025 23:49*	WG2490588
(S) Toluene-d8	*118*			*80.0-120*	*04/14/2025 22:49*	WG2487619
(S) Toluene-d8	*115*			*80.0-120*	*04/14/2025 23:49*	WG2490588

Pesticides (GC) by Method EPA 608.3

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
4,4-DDD	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
4,4-DDE	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
4,4-DDT	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Aldrin	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Alpha BHC	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Beta BHC	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Chlordane	ND		0.000500	1.01	04/07/2025 21:55	WG2484099
Delta BHC	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Dieldrin	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Endosulfan I	0.000383	P	0.0000500	1.01	04/07/2025 21:55	WG2484099
Endosulfan II	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Endosulfan sulfate	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Endrin	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Endrin aldehyde	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Gamma BHC	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Heptachlor	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Heptachlor epoxide	ND		0.0000500	1.01	04/07/2025 21:55	WG2484099
Toxaphene	ND		0.000500	1.01	04/07/2025 21:55	WG2484099
(S) Tetrachloro-m-xylene	*2.13*	J2		*10.0-135*	*04/07/2025 21:55*	WG2484099
(S) Decachlorobiphenyl	*2.08*	J2		*10.0-144*	*04/07/2025 21:55*	WG2484099

Sample Narrative:

L1842913-01 WG2484099: Duplicate Analysis performed due to surrogate failure. Results confirm; reporting in hold data

Polychlorinated Biphenyls (GC) by Method EPA-608.3

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
PCB 1016	ND		0.000200	1.01	04/08/2025 16:22	WG2484099
PCB 1221	ND		0.000200	1.01	04/08/2025 16:22	WG2484099
PCB 1232	ND		0.000200	1.01	04/08/2025 16:22	WG2484099
PCB 1242	ND		0.000200	1.01	04/08/2025 16:22	WG2484099
PCB 1248	ND		0.000200	1.01	04/08/2025 16:22	WG2484099
PCB 1254	ND		0.000200	1.01	04/08/2025 16:22	WG2484099
PCB 1260	ND		0.000200	1.01	04/08/2025 16:22	WG2484099
(S) Tetrachloro-m-xylene	*26.8*			*10.0-135*	*04/08/2025 16:22*	WG2484099
(S) Decachlorobiphenyl	*1.85*	J2		*10.0-144*	*04/08/2025 16:22*	WG2484099

Sample Narrative:

L1842913-01 WG2484099: Duplicate Analysis performed due to surrogate failure. Results confirm; reporting in hold data

Semi Volatile Organic Compounds (GC/MS) by Method 625.1

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND	J4	0.0100	1.03	04/12/2025 18:07	WG2482495
1,2-Dichlorobenzene	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
1,2-Diphenylhydrazine	ND	N2	0.0100	1.03	04/12/2025 18:07	WG2482495
1,3-Dichlorobenzene	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
1,4-Dichlorobenzene	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
2,2-Oxybis(1-Chloropropane)	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
2,4,6-Trichlorophenol	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
2,4-Dichlorophenol	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
2,4-Dimethylphenol	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
2,4-Dinitrophenol	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
2,4-Dinitrotoluene	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
2,6-Dinitrotoluene	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
2-Chloronaphthalene	ND	J4	0.00500	1.03	04/12/2025 18:07	WG2482495
2-Chlorophenol	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
2-Nitrophenol	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
3,3-Dichlorobenzidine	ND		5.00	1.03	04/12/2025 18:07	WG2482495
4,6-Dinitro-2-methylphenol	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
4-Bromophenyl-phenylether	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
4-Chloro-3-methylphenol	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
4-Chlorophenyl-phenylether	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
4-Nitrophenol	ND		0.0150	1.03	04/12/2025 18:07	WG2482495
Acenaphthene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Acenaphthylene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Anthracene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Benzidine	ND		0.0800	1.03	04/12/2025 18:07	WG2482495
Benzo(A)Anthracene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Benzo(a)pyrene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Benzo(b)fluoranthene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Benzo(g,h,i)perylene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Benzo(k)fluoranthene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Benzylbutyl phthalate	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Bis(2-Ethylhexyl)phthalate	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
Bis(2-chlorethoxy)methane	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
Bis(2-chloroethyl)ether	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
Chrysene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Di-n-butyl phthalate	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Di-n-octyl phthalate	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Dibenz(a,h)anthracene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Diethyl phthalate	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Dimethyl phthalate	ND		0.00500	1.03	04/12/2025 18:07	WG2482495

Semi Volatile Organic Compounds (GC/MS) by Method 625.1

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
Fluoranthene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Fluorene	ND	J4	0.00500	1.03	04/12/2025 18:07	WG2482495
Hexachloro-1,3-butadiene	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
Hexachlorobenzene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Hexachlorocyclopentadiene	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
Hexachloroethane	ND	J4	0.0100	1.03	04/12/2025 18:07	WG2482495
Indeno(1,2,3-cd)pyrene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Isophorone	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
Naphthalene	ND		0.00100	1.03	04/12/2025 18:07	WG2482495
Nitrobenzene	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
Pentachlorophenol	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
Phenanthrene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
Phenol	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
Phenol	0.220	Q	0.0100	1.09	04/18/2025 06:15	WG2490619
Pyrene	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
n-Nitrosodi-n-propylamine	ND		0.00500	1.03	04/12/2025 18:07	WG2482495
n-Nitrosodimethylamine	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
n-Nitrosodiphenylamine	ND		0.0100	1.03	04/12/2025 18:07	WG2482495
(S) Phenol-d5	*23.1*			*8.00-424*	*04/12/2025 18:07*	WG2482495
(S) Phenol-d5	*48.8*			*8.00-424*	*04/18/2025 06:15*	WG2490619
(S) Nitrobenzene-d5	*59.5*			*15.0-314*	*04/12/2025 18:07*	WG2482495
(S) Nitrobenzene-d5	*70.1*			*15.0-314*	*04/18/2025 06:15*	WG2490619
(S) 2,4,6-Tribromophenol	*45.7*			*10.0-153*	*04/12/2025 18:07*	WG2482495
(S) 2,4,6-Tribromophenol	*76.5*			*10.0-153*	*04/18/2025 06:15*	WG2490619
(S) p-Terphenyl-d14	*51.9*			*29.0-141*	*04/12/2025 18:07*	WG2482495
(S) p-Terphenyl-d14	*21.4*	J2		*29.0-141*	*04/18/2025 06:15*	WG2490619
(S) 2-Fluorophenol	*32.6*			*10.0-120*	*04/12/2025 18:07*	WG2482495
(S) 2-Fluorophenol	*34.8*			*10.0-120*	*04/18/2025 06:15*	WG2490619
(S) 2-Fluorobiphenyl	*47.7*			*22.0-127*	*04/12/2025 18:07*	WG2482495
(S) 2-Fluorobiphenyl	*39.8*			*22.0-127*	*04/18/2025 06:15*	WG2490619

Sample Narrative:

L1842913-01 WG2482495, WG2490619: Duplicate Analysis performed due to QC failure. Results don't confirm; both analyses reported.

Method Blank (MB)

(MB) R4195878-1 04/06/25 15:01

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Suspended Solids	ND		0.350	2.50

L1842900-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1842900-01 04/06/25 15:01 • (DUP) R4195878-3 04/06/25 15:01

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	95.6	85.6	1	11.0	P1	10

L1842934-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1842934-02 04/06/25 15:01 • (DUP) R4195878-4 04/06/25 15:01

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	52.4	52.0	1	0.766		10

Laboratory Control Sample (LCS)

(LCS) R4195878-2 04/06/25 15:01

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Suspended Solids	773	776	100	85.0-115	

Method Blank (MB)

(MB) R4196344-2 04/03/25 16:22

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	ND		2.71	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1843195-08 Original Sample (OS) • Duplicate (DUP)

(OS) L1843195-08 04/03/25 16:29 • (DUP) R4196344-3 04/03/25 16:37

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	250	249	1	0.358		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1843195-13 Original Sample (OS) • Duplicate (DUP)

(OS) L1843195-13 04/03/25 21:03 • (DUP) R4196344-4 04/03/25 21:08

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	417	428	1	2.64		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R4196344-1 04/03/25 16:15

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	92.6	92.6	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R4195175-1 04/04/25 00:53

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloride	0.524		0.0519	1.00
Sulfate	0.514		0.0774	5.00

L1841529-13 Original Sample (OS) • Duplicate (DUP)

(OS) L1841529-13 04/04/25 01:19 • (DUP) R4195175-3 04/04/25 01:32

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	11.5	11.5	1	0.480		15
Sulfate	9.75	9.44	1	3.24		15

L1842699-08 Original Sample (OS) • Duplicate (DUP)

(OS) L1842699-08 04/04/25 03:33 • (DUP) R4195175-5 04/04/25 03:46

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	9.13	8.96	1	1.79		15
Sulfate	20.7	20.8	1	0.471		15

Laboratory Control Sample (LCS)

(LCS) R4195175-2 04/04/25 01:06

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40.0	41.7	104	90.0-110	
Sulfate	40.0	42.2	106	90.0-110	

L1841529-13 Original Sample (OS) • Matrix Spike (MS)

(OS) L1841529-13 04/04/25 01:19 • (MS) R4195175-4 04/04/25 01:46

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	40.0	11.5	51.1	99.0	1	90.0-110	
Sulfate	40.0	9.75	50.7	102	1	90.0-110	

L1842699-08 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1842699-08 04/04/25 03:33 • (MS) R4195175-6 04/04/25 04:00 • (MSD) R4195175-7 04/04/25 04:13

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	40.0	9.13	48.7	47.7	98.9	96.6	1	90.0-110			1.98	15
Sulfate	40.0	20.7	58.5	57.2	94.5	91.2	1	90.0-110			2.26	15

Method Blank (MB)

(MB) R4197388-1 04/09/25 18:42

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Cyanide	ND		0.00180	0.00500

L1842709-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1842709-02 04/09/25 18:53 • (DUP) R4197388-4 04/09/25 18:55

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Cyanide	ND	ND	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R4197388-2 04/09/25 18:43

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Cyanide	0.100	0.0880	88.0	87.1-120	

L1843921-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1843921-01 04/09/25 19:21 • (MS) R4197388-5 04/09/25 19:22 • (MSD) R4197388-6 04/09/25 19:24

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Cyanide	0.100	ND	0.0881	0.0701	88.1	70.1	1	90.0-110	J6	J3 J6	22.8	20

Method Blank (MB)

(MB) R4194858-1 04/03/25 16:01

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
COD	ND		3.00	10.0

L1842709-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1842709-04 04/03/25 16:05 • (DUP) R4194858-5 04/03/25 16:05

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	15.0	15.0	1	0.220		20

L1842913-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1842913-01 04/03/25 16:07 • (DUP) R4194858-6 04/03/25 16:07

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	3180	3420	25	7.35		20

Laboratory Control Sample (LCS)

(LCS) R4194858-2 04/03/25 16:01

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
COD	500	495	99.0	90.0-110	

L1842678-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1842678-01 04/03/25 16:02 • (MS) R4194858-3 04/03/25 16:02 • (MSD) R4194858-4 04/03/25 16:02

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
COD	500	ND	484	492	96.7	98.3	1	90.0-110			1.65	20

L1840370-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1840370-01 04/03/25 11:45 • (DUP) R4194677-2 04/03/25 11:45

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	1.75	1.75	1	0.000		1

Sample Narrative:

OS: 1.75 at 20.5C

DUP: 1.75 at 20.7C

L1842926-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1842926-01 04/03/25 11:45 • (DUP) R4194677-3 04/03/25 11:45

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	SU	su		%		%
pH	7.88	7.89	1	0.127		1

Sample Narrative:

OS: 7.88 at 20.4C

DUP: 7.89 at 20.4C

Laboratory Control Sample (LCS)

(LCS) R4194677-1 04/03/25 11:45

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	su	su	%	%	
pH	10.0	10.0	100	99.0-101	

Sample Narrative:

LCS: 10.01 at 20.8C

L1843260-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1843260-01 04/03/25 16:00 • (DUP) R4194916-3 04/03/25 16:00

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	deg F	deg F		%		%
Flashpoint	107	107	1	0.280		10

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4194916-1 04/03/25 16:00 • (LCSD) R4194916-2 04/03/25 16:00

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	deg F	deg F	deg F	%	%	%			%	%
Flashpoint	126	127	126	101	100	96.5-103			0.790	10

Method Blank (MB)

(MB) R4196838-1 04/08/25 19:36

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Mercury	0.0000568		0.0000490	0.000200

Laboratory Control Sample (LCS)

(LCS) R4196838-2 04/08/25 19:44

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Mercury	0.00300	0.00281	93.8	85.0-115	

L1844128-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1844128-06 04/08/25 19:47 • (MS) R4196838-4 04/08/25 19:52 • (MSD) R4196838-5 04/08/25 19:55

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	ND	0.00300	0.00299	100	99.6	1	70.0-130			0.559	20

L1844290-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1844290-01 04/08/25 19:58 • (MS) R4196838-6 04/08/25 20:00 • (MSD) R4196838-7 04/08/25 20:03

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	ND	0.00275	0.00276	91.7	92.2	1	70.0-130			0.479	20

Method Blank (MB)

(MB) R4196935-1 04/09/25 02:20

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Silver	ND		0.00270	0.00500
Arsenic	ND		0.00640	0.0100
Beryllium	ND		0.000700	0.00200
Boron	ND		0.0159	0.200
Calcium	ND		0.100	1.00
Cadmium	ND		0.000700	0.00200
Chromium	ND	J	0.00180	0.0100
Copper	ND		0.00700	0.0100
Potassium	0.134	J	0.107	1.00
Magnesium	ND		0.0168	1.00
Molybdenum	ND		0.00170	0.00500
Sodium	0.320	J	0.0939	1.00
Nickel	ND		0.00580	0.0100
Lead	ND		0.00200	0.00500
Antimony	ND		0.00770	0.0100
Selenium	ND		0.00760	0.0100
Thallium	ND		0.00670	0.0100
Zinc	ND		0.00340	0.0500

Laboratory Control Sample (LCS)

(LCS) R4196935-2 04/09/25 02:22

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Silver	0.200	0.191	95.6	85.0-115	
Arsenic	1.00	1.03	103	85.0-115	
Beryllium	1.00	1.04	104	85.0-115	
Boron	1.00	0.991	99.1	85.0-115	
Calcium	10.0	9.89	98.9	85.0-115	
Cadmium	1.00	1.03	103	85.0-115	
Chromium	1.00	1.05	105	85.0-115	
Copper	1.00	1.03	103	85.0-115	
Potassium	10.0	10.1	101	85.0-115	
Magnesium	10.0	9.79	97.9	85.0-115	
Molybdenum	1.00	1.04	104	85.0-115	
Sodium	10.0	10.5	105	85.0-115	
Nickel	1.00	0.980	98.0	85.0-115	
Lead	1.00	1.00	100	85.0-115	
Antimony	1.00	1.01	101	85.0-115	

Laboratory Control Sample (LCS)

(LCS) R4196935-2 04/09/25 02:22

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Selenium	1.00	1.02	102	85.0-115	
Thallium	1.00	1.04	104	85.0-115	
Zinc	1.00	1.04	104	85.0-115	

L1842041-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1842041-01 04/09/25 02:24 • (MS) R4196935-4 04/09/25 02:28 • (MSD) R4196935-5 04/09/25 02:30

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Silver	0.200	ND	0.191	0.194	94.7	96.3	1	70.0-130			1.68	20
Arsenic	1.00	ND	1.04	1.06	104	106	1	70.0-130			1.41	20
Beryllium	1.00	ND	1.05	1.06	105	106	1	70.0-130			1.54	20
Boron	1.00	0.212	1.20	1.22	98.8	101	1	70.0-130			1.64	20
Calcium	10.0	14.5	24.3	23.9	98.0	93.3	1	70.0-130			1.94	20
Cadmium	1.00	ND	1.03	1.03	103	103	1	70.0-130			0.525	20
Chromium	1.00	ND	1.04	1.05	104	105	1	70.0-130			0.668	20
Copper	1.00	ND	1.04	1.05	103	104	1	70.0-130			0.887	20
Potassium	10.0	10.3	20.6	20.4	103	101	1	70.0-130			0.862	20
Magnesium	10.0	4.06	13.9	13.9	98.8	97.9	1	70.0-130			0.663	20
Molybdenum	1.00	ND	1.03	1.04	103	104	1	70.0-130			1.21	20
Sodium	10.0	47.1	57.7	56.8	106	96.5	1	70.0-130			1.63	20
Nickel	1.00	ND	1.00	1.01	100	101	1	70.0-130			0.684	20
Lead	1.00	ND	1.02	1.03	102	103	1	70.0-130			0.930	20
Antimony	1.00	ND	1.01	1.01	101	101	1	70.0-130			0.268	20
Selenium	1.00	ND	1.02	1.03	102	103	1	70.0-130			1.04	20
Thallium	1.00	ND	1.04	1.05	104	105	1	70.0-130			1.31	20
Zinc	1.00	ND	1.07	1.07	104	104	1	70.0-130			0.571	20

L1842834-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1842834-03 04/09/25 02:32 • (MS) R4196935-6 04/09/25 02:34 • (MSD) R4196935-7 04/09/25 02:35

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Silver	0.200	ND	0.196	0.196	98.1	97.8	1	70.0-130			0.329	20
Arsenic	1.00	ND	1.08	1.08	108	108	1	70.0-130			0.592	20
Beryllium	1.00	ND	1.06	1.05	106	105	1	70.0-130			1.12	20
Boron	1.00	ND	1.15	1.14	100	99.6	1	70.0-130			0.758	20
Calcium	10.0	38.2	47.1	46.9	88.5	86.9	1	70.0-130			0.339	20
Cadmium	1.00	ND	1.05	1.04	105	104	1	70.0-130			0.645	20

L1842834-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1842834-03 04/09/25 02:32 • (MS) R4196935-6 04/09/25 02:34 • (MSD) R4196935-7 04/09/25 02:35

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chromium	1.00	ND	1.06	1.05	106	105	1	70.0-130			0.928	20
Copper	1.00	ND	1.06	1.05	106	105	1	70.0-130			0.924	20
Potassium	10.0	12.7	23.0	22.7	102	99.6	1	70.0-130			1.11	20
Magnesium	10.0	8.08	17.7	17.7	96.4	95.9	1	70.0-130			0.320	20
Molybdenum	1.00	ND	1.05	1.05	105	105	1	70.0-130			0.375	20
Sodium	10.0	268	274	270	57.7	22.6	1	70.0-130	V	V	1.29	20
Nickel	1.00	ND	1.03	1.02	103	102	1	70.0-130			0.669	20
Lead	1.00	ND	1.03	1.03	103	103	1	70.0-130			0.394	20
Antimony	1.00	ND	1.03	1.03	103	103	1	70.0-130			0.269	20
Selenium	1.00	ND	1.07	1.07	107	107	1	70.0-130			0.479	20
Thallium	1.00	ND	1.04	1.03	104	103	1	70.0-130			0.234	20
Zinc	1.00	0.292	1.34	1.33	105	104	1	70.0-130			0.699	20

Method Blank (MB)

(MB) R4199482-4 04/14/25 21:57

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
2-Chloroethyl vinyl ether	ND		0.000575	0.0500
Acrolein	ND		0.00254	0.0500
(S) 1,2-Dichloroethane-d4	*93.7*			*70.0-130*
(S) 4-Bromofluorobenzene	*93.6*			*77.0-126*
(S) Toluene-d8	*116*			*80.0-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4199482-1 04/14/25 20:17 • (LCSD) R4199482-2 04/14/25 20:37

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
2-Chloroethyl vinyl ether	0.0250	0.0199	0.0179	79.6	71.6	51.0-160	J	J	10.6	20
Acrolein	0.0250	0.0530	0.0448	212	179	10.0-160	J4	J J4	16.8	26
(S) 1,2-Dichloroethane-d4				*96.7*	*95.6*	*70.0-130*				
(S) 4-Bromofluorobenzene				*92.7*	*93.4*	*77.0-126*				
(S) Toluene-d8				*114*	*115*	*80.0-120*				

Method Blank (MB)

(MB) R4198196-3 04/10/25 20:35

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
1,1,1-Trichloroethane	ND		0.0000369	0.000100
1,1,2,2-Tetrachloroethane	ND		0.0000278	0.000100
1,1,2-Trichloroethane	ND		0.0000239	0.000100
1,1-Dichloroethane	ND		0.0000196	0.000100
1,1-Dichloroethene	ND		0.0000242	0.000100
1,2,4-Trichlorobenzene	ND		0.000176	0.000500
1,2-Dichloroethane	ND		0.0000260	0.000100
1,2-Dichloropropane	ND		0.0000568	0.000200
2-Butanone (MEK)	ND		0.00254	0.00400
4-Methyl-2-pentanone (MIBK)	ND		0.0000912	0.00100
Acetone	ND		0.00146	0.00200
Acrylonitrile	ND		0.000144	0.000500
Benzene	ND		0.0000187	0.0000400
Bromodichloromethane	ND		0.0000290	0.000100
Bromoform	ND		0.0000468	0.00100
Bromomethane	ND		0.0000788	0.000500
Carbon tetrachloride	ND		0.0000359	0.000200
Chlorobenzene	ND		0.00000840	0.000100
Chloroform	0.0000660	J	0.0000412	0.000100
Chloromethane	ND		0.000174	0.000500
Dibromochloromethane	ND		0.0000245	0.000100
Ethyl ether	ND		0.0000356	0.000100
Ethylbenzene	ND		0.0000295	0.000100
Hexachloro-1,3-butadiene	ND		0.0000485	0.00100
Methylene Chloride	ND		0.000266	0.00100
Naphthalene	ND		0.000195	0.000500
Tetrachloroethene	ND		0.0000358	0.000100
Toluene	ND		0.0000520	0.000200
Total Xylene	ND		0.0000352	0.000260
Trichloroethene	ND		0.0000234	0.0000400
Vinyl chloride	ND		0.0000462	0.0000500
cis-1,3-Dichloropropene	ND		0.0000303	0.000100
m&p-Xylene	ND		0.0000760	0.000160
o-Xylene	ND		0.0000352	0.000100
trans-1,2-Dichloroethene	ND		0.0000416	0.000200
trans-1,3-Dichloropropene	ND		0.0000456	0.000200
(S) 4-Bromofluorobenzene	*98.2*			*67.0-138*
(S) Toluene-d8	*110*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*96.3*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4198196-1 04/10/25 18:23 • (LCSD) R4198196-2 04/10/25 19:57

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1-Trichloroethane	0.00500	0.00618	0.00552	124	110	69.0-126			11.3	20
1,1,2,2-Tetrachloroethane	0.00500	0.00511	0.00522	102	104	68.0-128			2.13	20
1,1,2-Trichloroethane	0.00500	0.00619	0.00577	124	115	78.0-123	J4		7.02	20
1,1-Dichloroethane	0.00500	0.00456	0.00416	91.2	83.2	70.0-127			9.17	20
1,1-Dichloroethene	0.00500	0.00487	0.00444	97.4	88.8	65.0-131			9.24	20
1,2,4-Trichlorobenzene	0.00500	0.00443	0.00409	88.6	81.8	62.0-137			7.98	20
1,2-Dichloroethane	0.00500	0.00513	0.00500	103	100	65.0-131			2.57	20
1,2-Dichloropropane	0.00500	0.00477	0.00421	95.4	84.2	74.0-125			12.5	20
2-Butanone (MEK)	0.0250	0.0304	0.0289	122	116	30.0-160			5.06	24
4-Methyl-2-pentanone (MIBK)	0.0250	0.0194	0.0180	77.6	72.0	56.0-143			7.49	20
Acetone	0.0250	0.0166	0.0157	66.4	62.8	10.0-160			5.57	31
Acrylonitrile	0.0250	0.0180	0.0166	72.0	66.4	45.0-153			8.09	22
Benzene	0.00500	0.00532	0.00483	106	96.6	70.0-123			9.66	20
Bromodichloromethane	0.00500	0.00582	0.00541	116	108	73.0-121			7.30	20
Bromoform	0.00500	0.00538	0.00527	108	105	64.0-132			2.07	20
Bromomethane	0.00500	0.00750	0.00701	150	140	56.0-147	J4		6.75	20
Carbon tetrachloride	0.00500	0.00648	0.00585	130	117	66.0-128	J4		10.2	20
Chlorobenzene	0.00500	0.00564	0.00506	113	101	76.0-128			10.8	20
Chloroform	0.00500	0.00526	0.00479	105	95.8	72.0-123			9.35	20
Chloromethane	0.00500	0.00339	0.00333	67.8	66.6	51.0-138			1.79	20
Dibromochloromethane	0.00500	0.00617	0.00594	123	119	74.0-127			3.80	20
Ethyl ether	0.00500	0.00437	0.00400	87.4	80.0	64.0-137			8.84	20
Ethylbenzene	0.00500	0.00553	0.00509	111	102	74.0-126			8.29	20
Hexachloro-1,3-butadiene	0.00500	0.00385	0.00408	77.0	81.6	57.0-150			5.80	20
Methylene Chloride	0.00500	0.00505	0.00463	101	92.6	68.0-123			8.68	20
Naphthalene	0.00500	0.00492	0.00471	98.4	94.2	59.0-130			4.36	20
Tetrachloroethene	0.00500	0.00665	0.00605	133	121	70.0-136			9.45	20
Toluene	0.00500	0.00570	0.00533	114	107	75.0-121			6.71	20
Total Xylene	0.0150	0.0163	0.0143	109	95.3	72.0-127			13.1	20
Trichloroethene	0.00500	0.00623	0.00570	125	114	76.0-126			8.89	20
Vinyl chloride	0.00500	0.00514	0.00451	103	90.2	63.0-134			13.1	20
cis-1,3-Dichloropropene	0.00500	0.00551	0.00529	110	106	76.0-127			4.07	20
m&p-Xylene	0.0100	0.0111	0.00981	111	98.1	76.0-126			12.3	20
o-Xylene	0.00500	0.00520	0.00451	104	90.2	79.0-124			14.2	20
trans-1,2-Dichloroethene	0.00500	0.00531	0.00498	106	99.6	71.0-125			6.41	20
trans-1,3-Dichloropropene	0.00500	0.00602	0.00571	120	114	73.0-127			5.29	20
(S) 4-Bromofluorobenzene				*97.2*	*95.9*	*67.0-138*				
(S) Toluene-d8				*107*	*107*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*96.8*	*96.4*	*70.0-130*				

Method Blank (MB)

(MB) R4198627-3 04/11/25 15:03

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloroethane	ND		0.0000680	0.000200
(S) 4-Bromofluorobenzene	*101*			*67.0-138*
(S) Toluene-d8	*103*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*102*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4198627-1 04/11/25 13:46 • (LCSD) R4198627-2 04/11/25 14:05

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Chloroethane	0.00500	0.00429	0.00439	85.8	87.8	61.0-134			2.30	20
(S) 4-Bromofluorobenzene				*103*	*102*	*67.0-138*				
(S) Toluene-d8				*103*	*102*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*101*	*102*	*70.0-130*				

Method Blank (MB)

(MB) R4199510-4 04/14/25 21:57

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
2-Propanol	ND		0.00165	0.00500
(S) 1,2-Dichloroethane-d4	*93.7*			*70.0-130*
(S) 4-Bromofluorobenzene	*93.6*			*77.0-126*
(S) Toluene-d8	*116*			*80.0-120*

Laboratory Control Sample (LCS)

(LCS) R4199510-3 04/14/25 20:57

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
2-Propanol	0.0500	0.0437	87.4	10.0-160	
(S) 1,2-Dichloroethane-d4			*103*	*70.0-130*	
(S) 4-Bromofluorobenzene			*91.8*	*77.0-126*	
(S) Toluene-d8			*116*	*80.0-120*	

Method Blank (MB)

(MB) R4200241-3 04/15/25 10:05

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Tetrahydrofuran	ND		0.000141	0.000500
(S) 4-Bromofluorobenzene	*103*			*67.0-138*
(S) Toluene-d8	*100*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*89.9*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4200241-1 04/15/25 08:29 • (LCSD) R4200241-2 04/15/25 08:48

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Tetrahydrofuran	0.00500	0.00480	0.00536	96.0	107	37.0-146			11.0	24
(S) 4-Bromofluorobenzene				*104*	*104*	*67.0-138*				
(S) Toluene-d8				*100*	*101*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*100*	*98.4*	*70.0-130*				

Method Blank (MB)

(MB) R4196625-1 04/07/25 18:20

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
4,4-DDD	ND		0.0000170	0.0000500
4,4-DDE	ND		0.0000164	0.0000500
4,4-DDT	ND		0.0000177	0.0000500
Aldrin	ND		0.00000813	0.0000500
Alpha BHC	ND		0.0000166	0.0000500
Beta BHC	ND		0.0000184	0.0000500
Chlordane	ND		0.0000977	0.000500
Delta BHC	ND		0.0000197	0.0000500
Dieldrin	ND		0.00000751	0.0000500
Endosulfan I	ND		0.0000179	0.0000500
Endosulfan II	ND		0.0000176	0.0000500
Endosulfan sulfate	ND		0.0000196	0.0000500
Endrin	ND		0.0000189	0.0000500
Endrin aldehyde	ND		0.0000142	0.0000500
Gamma BHC	ND		0.0000176	0.0000500
Heptachlor	ND		0.0000108	0.0000500
Heptachlor epoxide	ND		0.0000175	0.0000500
Toxaphene	ND		0.000168	0.000500
(S) Tetrachloro-m-xylene	*84.3*			*10.0-135*
(S) Decachlorobiphenyl	*10.1*			*10.0-144*

Laboratory Control Sample (LCS)

(LCS) R4196625-5 04/07/25 18:30

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
4,4-DDD	0.00100	0.000644	64.4	31.0-141	
4,4-DDE	0.00100	0.000626	62.6	30.0-145	
4,4-DDT	0.00100	0.000660	66.0	25.0-160	
Aldrin	0.00100	0.000600	60.0	42.0-140	
Alpha BHC	0.00100	0.000588	58.8	37.0-140	
Beta BHC	0.00100	0.000594	59.4	17.0-147	
Delta BHC	0.00100	0.000574	57.4	19.0-140	
Dieldrin	0.00100	0.000644	64.4	36.0-146	
Endosulfan I	0.00100	0.000614	61.4	45.0-153	
Endosulfan II	0.00100	0.000633	63.3	1.00-202	
Endosulfan sulfate	0.00100	0.000595	59.5	26.0-144	
Endrin	0.00100	0.000653	65.3	30.0-147	
Endrin aldehyde	0.00100	0.000596	59.6	56.0-128	

Laboratory Control Sample (LCS)

(LCS) R4196625-5 04/07/25 18:30

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Gamma BHC	0.00100	0.000602	60.2	32.0-140	
Heptachlor	0.00100	0.000607	60.7	34.0-140	
Heptachlor epoxide	0.00100	0.000611	61.1	37.0-142	
(S) Tetrachloro-m-xylene			*53.8*	*10.0-135*	
(S) Decachlorobiphenyl			*48.4*	*10.0-144*	

L1843693-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1843693-01 04/07/25 19:08 • (MS) R4196625-6 04/07/25 19:17 • (MSD) R4196625-7 04/07/25 19:26

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
4,4-DDD	0.00100	ND	0.00101	0.00102	101	102	1	31.0-141			0.985	39
4,4-DDE	0.00100	ND	0.000966	0.000978	96.6	97.8	1	30.0-145			1.23	35
4,4-DDT	0.00100	ND	0.00101	0.00101	101	101	1	25.0-160			0.000	42
Aldrin	0.00100	ND	0.000983	0.000987	98.3	98.7	1	42.0-140			0.406	35
Alpha BHC	0.00100	ND	0.00101	0.00100	101	100	1	37.0-140			0.995	36
Beta BHC	0.00100	ND	0.00101	0.000977	101	97.7	1	17.0-147			3.32	44
Delta BHC	0.00100	ND	0.000980	0.000962	98.0	96.2	1	19.0-140			1.85	52
Dieldrin	0.00100	ND	0.00105	0.00104	105	104	1	36.0-146			0.957	49
Endosulfan I	0.00100	ND	0.000986	0.000990	98.6	99.0	1	45.0-153			0.405	28
Endosulfan II	0.00100	ND	0.00101	0.00101	101	101	1	1.00-202			0.000	53
Endosulfan sulfate	0.00100	ND	0.000952	0.000968	95.2	96.8	1	26.0-144			1.67	38
Endrin	0.00100	ND	0.00106	0.00106	106	106	1	30.0-147			0.000	48
Endrin aldehyde	0.00100	ND	0.000951	0.000949	95.1	94.9	1	56.0-128			0.211	20
Gamma BHC	0.00100	ND	0.00103	0.00101	103	101	1	32.0-140			1.96	39
Heptachlor	0.00100	ND	0.00102	0.00101	102	101	1	34.0-140			0.985	43
Heptachlor epoxide	0.00100	ND	0.000994	0.000987	99.4	98.7	1	37.0-142			0.707	26
(S) Tetrachloro-m-xylene					*93.1*	*88.3*		*10.0-135*				
(S) Decachlorobiphenyl					*80.3*	*72.3*		*10.0-144*				

Method Blank (MB)

(MB) R4196625-1 04/07/25 18:20

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
PCB 1016	ND		0.000100	0.000200
PCB 1221	ND		0.0000730	0.000200
PCB 1232	ND		0.0000420	0.000200
PCB 1242	ND		0.0000470	0.000200
PCB 1248	ND		0.0000860	0.000200
PCB 1254	ND		0.0000470	0.000200
PCB 1260	ND		0.000120	0.000200
(S) Tetrachloro-m-xylene	*83.9*			*10.0-135*
(S) Decachlorobiphenyl	*10.0*			*10.0-144*

Laboratory Control Sample (LCS)

(LCS) R4196625-2 04/07/25 18:39

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
PCB 1016	0.00250	0.00216	86.4	50.0-140	
PCB 1260	0.00250	0.00219	87.6	8.00-140	
(S) Tetrachloro-m-xylene			*85.9*	*10.0-135*	
(S) Decachlorobiphenyl			*63.6*	*10.0-144*	

L1843693-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1843693-01 04/07/25 19:08 • (MS) R4196625-3 04/07/25 19:36 • (MSD) R4196625-4 04/07/25 19:45

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
PCB 1016	0.00250	ND	0.00209	0.00155	83.6	62.0	1	50.0-140			29.7	36
PCB 1260	0.00250	ND	0.00205	0.00196	82.0	78.4	1	8.00-140			4.49	38
(S) Tetrachloro-m-xylene					*90.0*	*82.2*		*10.0-135*				
(S) Decachlorobiphenyl					*70.7*	*60.9*		*10.0-144*				

Method Blank (MB)

(MB) R4198313-3 04/10/25 18:34

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
1,2,4-Trichlorobenzene	ND		0.000355	0.0100
1,2-Dichlorobenzene	ND		0.0000713	0.0100
1,2-Diphenylhydrazine	ND	N2	0.000318	0.0100
1,3-Dichlorobenzene	ND		0.000132	0.0100
1,4-Dichlorobenzene	ND		0.0000942	0.0100
2,2-Oxybis(1-Chloropropane)	ND		0.000445	0.0100
2,4,6-Trichlorophenol	ND		0.000297	0.0100
2,4-Dichlorophenol	ND		0.000284	0.0100
2,4-Dimethylphenol	ND		0.000624	0.0100
2,4-Dinitrophenol	ND		0.00325	0.0100
2,4-Dinitrotoluene	ND		0.00165	0.0100
2,6-Dinitrotoluene	ND		0.000279	0.0100
2-Chloronaphthalene	ND		0.000330	0.00100
2-Chlorophenol	ND		0.000283	0.0100
2-Nitrophenol	ND		0.000320	0.0100
3,3-Dichlorobenzidine	ND		0.00202	0.0100
4,6-Dinitro-2-methylphenol	ND		0.00263	0.0100
4-Bromophenyl-phenylether	ND		0.000335	0.0100
4-Chloro-3-methylphenol	ND		0.000263	0.0100
4-Chlorophenyl-phenylether	ND		0.000303	0.0100
4-Nitrophenol	ND		0.00201	0.0100
Acenaphthene	ND		0.000316	0.00100
Acenaphthylene	ND		0.000309	0.00100
Anthracene	ND		0.000291	0.00100
Benzidine	ND		0.00432	0.0100
Benzo(A)Anthracene	ND		0.0000975	0.00100
Benzo(a)pyrene	ND		0.000340	0.00100
Benzo(b)fluoranthene	ND		0.0000896	0.00100
Benzo(g,h,i)perylene	ND		0.000161	0.00100
Benzo(k)fluoranthene	ND		0.000355	0.00100
Benzylbutyl phthalate	ND		0.000275	0.00300
Bis(2-Ethylhexyl)phthalate	ND		0.000709	0.00300
Bis(2-chlorethoxy)methane	ND		0.000329	0.0100
Bis(2-chloroethyl)ether	ND		0.00162	0.0100
Chrysene	ND		0.000332	0.00100
Di-n-butyl phthalate	ND		0.000266	0.00300
Di-n-octyl phthalate	0.000302		0.000278	0.00300
Dibenz(a,h)anthracene	ND		0.000279	0.00100
Diethyl phthalate	ND		0.000282	0.00300
Dimethyl phthalate	ND		0.000283	0.00300

Method Blank (MB)

(MB) R4198313-3 04/10/25 18:34

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Fluoranthene	ND		0.000310	0.00100
Fluorene	ND		0.000323	0.00100
Hexachloro-1,3-butadiene	ND		0.000329	0.0100
Hexachlorobenzene	ND		0.000341	0.00100
Hexachlorocyclopentadiene	ND		0.00233	0.0100
Hexachloroethane	ND		0.000365	0.0100
Indeno(1,2,3-cd)pyrene	ND		0.000279	0.00100
Isophorone	ND		0.000272	0.0100
Naphthalene	ND		0.000372	0.00100
Nitrobenzene	ND		0.000367	0.0100
Pentachlorophenol	ND		0.000313	0.0100
Phenanthrene	ND		0.000366	0.00100
Phenol	ND		0.000334	0.0100
Pyrene	ND		0.000330	0.00100
n-Nitrosodi-n-propylamine	ND		0.000403	0.0100
n-Nitrosodimethylamine	ND		0.00126	0.0100
n-Nitrosodiphenylamine	ND		0.00119	0.0100
(S) Phenol-d5	*26.5*			*8.00-424*
(S) Nitrobenzene-d5	*57.3*			*15.0-314*
(S) 2,4,6-Tribromophenol	*52.0*			*10.0-153*
(S) p-Terphenyl-d14	*67.0*			*29.0-141*
(S) 2-Fluorophenol	*37.0*			*10.0-120*
(S) 2-Fluorobiphenyl	*62.3*			*22.0-127*

Laboratory Control Sample (LCS)

(LCS) R4198313-1 04/10/25 17:51

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
1,2,4-Trichlorobenzene	0.0500	0.0214	42.8	44.0-142	J4
1,2-Dichlorobenzene	0.0500	0.0189	37.8	27.0-120	
1,2-Diphenylhydrazine	0.0500	0.0266	53.2	37.0-125	N2
1,3-Dichlorobenzene	0.0500	0.0189	37.8	26.0-120	
1,4-Dichlorobenzene	0.0500	0.0192	38.4	26.0-120	
2,2-Oxybis(1-Chloropropane)	0.0500	0.0206	41.2	36.0-166	
2,4,6-Trichlorophenol	0.0500	0.0290	58.0	37.0-144	
2,4-Dichlorophenol	0.0500	0.0233	46.6	39.0-135	
2,4-Dimethylphenol	0.0500	0.0180	36.0	32.0-120	
2,4-Dinitrophenol	0.0500	0.0269	53.8	1.00-191	

Laboratory Control Sample (LCS)

(LCS) R4198313-1 04/10/25 17:51

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
2,4-Dinitrotoluene	0.0500	0.0316	63.2	39.0-139	
2,6-Dinitrotoluene	0.0500	0.0299	59.8	50.0-158	
2-Chloronaphthalene	0.0500	0.0242	48.4	60.0-120	J4
2-Chlorophenol	0.0500	0.0177	35.4	23.0-134	
2-Nitrophenol	0.0500	0.0236	47.2	29.0-182	
3,3-Dichlorobenzidine	0.100	0.0625	62.5	1.00-262	
4,6-Dinitro-2-methylphenol	0.0500	0.0353	70.6	1.00-181	
4-Bromophenyl-phenylether	0.0500	0.0314	62.8	53.0-127	
4-Chloro-3-methylphenol	0.0500	0.0254	50.8	22.0-147	
4-Chlorophenyl-phenylether	0.0500	0.0294	58.8	25.0-158	
4-Nitrophenol	0.0500	0.0117	23.4	1.00-132	
Acenaphthene	0.0500	0.0265	53.0	47.0-145	
Acenaphthylene	0.0500	0.0280	56.0	33.0-145	
Anthracene	0.0500	0.0270	54.0	27.0-133	
Benzidine	0.100	0.00802	8.02	1.00-120	J
Benzo(A)Anthracene	0.0500	0.0310	62.0	33.0-143	
Benzo(a)pyrene	0.0500	0.0284	56.8	17.0-163	
Benzo(b)fluoranthene	0.0500	0.0286	57.2	24.0-159	
Benzo(g,h,i)perylene	0.0500	0.0317	63.4	1.00-219	
Benzo(k)fluoranthene	0.0500	0.0290	58.0	11.0-162	
Benzylbutyl phthalate	0.0500	0.0280	56.0	1.00-152	
Bis(2-Ethylhexyl)phthalate	0.0500	0.0262	52.4	8.00-158	
Bis(2-chlorethoxy)methane	0.0500	0.0208	41.6	1.00-219	
Bis(2-chloroethyl)ether	0.0500	0.0190	38.0	33.0-185	
Chrysene	0.0500	0.0288	57.6	17.0-168	
Di-n-butyl phthalate	0.0500	0.0296	59.2	1.00-120	
Di-n-octyl phthalate	0.0500	0.0276	55.2	4.00-146	
Dibenz(a,h)anthracene	0.0500	0.0332	66.4	1.00-227	
Diethyl phthalate	0.0500	0.0291	58.2	1.00-120	
Dimethyl phthalate	0.0500	0.0302	60.4	1.00-120	
Fluoranthene	0.0500	0.0327	65.4	26.0-137	
Fluorene	0.0500	0.0271	54.2	59.0-121	J4
Hexachloro-1,3-butadiene	0.0500	0.0203	40.6	24.0-120	
Hexachlorobenzene	0.0500	0.0298	59.6	1.00-152	
Hexachlorocyclopentadiene	0.0500	0.0158	31.6	10.0-120	
Hexachloroethane	0.0500	0.0185	37.0	40.0-120	J4
Indeno(1,2,3-cd)pyrene	0.0500	0.0321	64.2	1.00-171	
Isophorone	0.0500	0.0226	45.2	21.0-196	
Naphthalene	0.0500	0.0202	40.4	21.0-133	
Nitrobenzene	0.0500	0.0203	40.6	35.0-180	

Laboratory Control Sample (LCS)

(LCS) R4198313-1 04/10/25 17:51

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Pentachlorophenol	0.0500	0.0169	33.8	14.0-176	
Phenanthrene	0.0500	0.0278	55.6	54.0-120	
Phenol	0.0500	0.0101	20.2	5.00-120	
Pyrene	0.0500	0.0274	54.8	52.0-120	
n-Nitrosodi-n-propylamine	0.0500	0.0224	44.8	1.00-230	
n-Nitrosodimethylamine	0.0500	0.0188	37.6	10.0-120	
n-Nitrosodiphenylamine	0.0500	0.0277	55.4	44.0-120	
(S) Phenol-d5			*21.3*	*8.00-424*	
(S) Nitrobenzene-d5			*41.9*	*15.0-314*	
(S) 2,4,6-Tribromophenol			*62.5*	*10.0-153*	
(S) p-Terphenyl-d14			*59.6*	*29.0-141*	
(S) 2-Fluorophenol			*30.5*	*10.0-120*	
(S) 2-Fluorobiphenyl			*58.0*	*22.0-127*	

L1843004-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1843004-01 04/12/25 18:50 • (MS) R4199396-1 04/12/25 19:12 • (MSD) R4199396-2 04/12/25 19:33

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
1,2,4-Trichlorobenzene	0.0500	ND	0.0172	0.0169	34.4	33.8	1	44.0-142	J6	J6	1.76	50
1,2-Dichlorobenzene	0.0500	ND	0.0126	0.0132	25.2	26.4	1	14.0-125			4.65	24
1,2-Diphenylhydrazine	0.0500	ND	0.0236	0.0207	47.2	41.4	1	18.0-156	N2	N2	13.1	34
1,3-Dichlorobenzene	0.0500	ND	0.0122	0.0131	24.4	26.2	1	12.0-123			7.11	22
1,4-Dichlorobenzene	0.0500	ND	0.0123	0.0133	24.6	26.6	1	12.0-125			7.81	23
2,2-Oxybis(1-Chloropropane)	0.0500	ND	0.0118	0.0125	23.6	25.0	1	36.0-166	J6	J6	5.76	76
2,4,6-Trichlorophenol	0.0500	ND	0.0291	0.0245	58.2	49.0	1	37.0-144			17.2	58
2,4-Dichlorophenol	0.0500	ND	0.0238	0.0220	47.6	44.0	1	39.0-135			7.86	50
2,4-Dimethylphenol	0.0500	ND	0.0220	0.0210	44.0	42.0	1	32.0-120			4.65	58
2,4-Dinitrophenol	0.0500	ND	0.0242	0.0196	48.4	39.2	1	1.00-191			21.0	132
2,4-Dinitrotoluene	0.0500	ND	0.0283	0.0233	56.6	46.6	1	39.0-139			19.4	42
2,6-Dinitrotoluene	0.0500	ND	0.0275	0.0234	55.0	46.8	1	50.0-158		J6	16.1	48
2-Chloronaphthalene	0.0500	ND	0.0198	0.0188	39.6	37.6	1	60.0-120	J6	J6	5.18	24
2-Chlorophenol	0.0500	ND	0.0124	0.0129	24.8	25.8	1	23.0-134			3.95	61
2-Nitrophenol	0.0500	ND	0.0197	0.0186	39.4	37.2	1	29.0-182			5.74	55
3,3-Dichlorobenzidine	0.100	ND	ND	ND	51.3	44.7	1	1.00-262			13.8	108
4,6-Dinitro-2-methylphenol	0.0500	ND	0.0260	0.0224	52.0	44.8	1	1.00-181			14.9	203
4-Bromophenyl-phenylether	0.0500	ND	0.0244	0.0199	48.8	39.8	1	53.0-127	J6	J6	20.3	43
4-Chloro-3-methylphenol	0.0500	ND	0.0249	0.0217	49.8	43.4	1	22.0-147			13.7	73
4-Chlorophenyl-phenylether	0.0500	ND	0.0248	0.0220	49.6	44.0	1	25.0-158			12.0	61

L1843004-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1843004-01 04/12/25 18:50 • (MS) R4199396-1 04/12/25 19:12 • (MSD) R4199396-2 04/12/25 19:33

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
4-Nitrophenol	0.0500	ND	ND	ND	20.0	16.9	1	1.00-132			17.0	131
Acenaphthene	0.0500	ND	0.0207	0.0189	41.4	37.8	1	47.0-145	J6	J6	9.09	48
Acenaphthylene	0.0500	ND	0.0237	0.0208	47.4	41.6	1	33.0-145			13.0	74
Anthracene	0.0500	ND	0.0230	0.0199	46.0	39.8	1	27.0-133			14.5	66
Benzidine	0.100	ND	ND	ND	8.64	8.95	1	1.00-120			3.52	40
Benzo(A)Anthracene	0.0500	ND	0.0236	0.0199	47.2	39.8	1	33.0-143			17.0	53
Benzo(a)pyrene	0.0500	ND	0.0218	0.0187	43.6	37.4	1	17.0-163			15.3	72
Benzo(b)fluoranthene	0.0500	ND	0.0214	0.0180	42.8	36.0	1	24.0-159			17.3	71
Benzo(g,h,i)perylene	0.0500	ND	0.0263	0.0225	52.6	45.0	1	1.00-219			15.6	97
Benzo(k)fluoranthene	0.0500	ND	0.0199	0.0172	39.8	34.4	1	11.0-162			14.6	63
Benzylbutyl phthalate	0.0500	ND	0.0243	0.0205	48.6	41.0	1	1.00-152			17.0	60
Bis(2-Ethylhexyl)phthalate	0.0500	ND	0.0200	0.0158	40.0	31.6	1	8.00-158			23.5	82
Bis(2-chlorethoxy)methane	0.0500	ND	0.0202	0.0189	40.4	37.8	1	33.0-184			6.65	54
Bis(2-chloroethyl)ether	0.0500	ND	0.0146	0.0150	29.2	30.0	1	12.0-158			2.70	108
Chrysene	0.0500	ND	0.0209	0.0170	41.8	34.0	1	17.0-168			20.6	87
Di-n-butyl phthalate	0.0500	ND	0.0278	0.0222	55.6	44.4	1	1.00-120			22.4	47
Di-n-octyl phthalate	0.0500	ND	0.0211	0.0165	42.2	33.0	1	4.00-146			24.5	69
Dibenz(a,h)anthracene	0.0500	ND	0.0277	0.0237	55.4	47.4	1	1.00-227			15.6	126
Diethyl phthalate	0.0500	ND	0.0282	0.0235	56.4	47.0	1	1.00-120			18.2	100
Dimethyl phthalate	0.0500	ND	0.0279	0.0232	55.8	46.4	1	1.00-120			18.4	183
Fluoranthene	0.0500	ND	0.0323	0.0269	64.6	53.8	1	26.0-137			18.2	66
Fluorene	0.0500	ND	0.0237	0.0201	47.4	40.2	1	59.0-121	J6	J6	16.4	38
Hexachloro-1,3-butadiene	0.0500	ND	0.0146	0.0151	29.2	30.2	1	24.0-120			3.37	62
Hexachlorobenzene	0.0500	ND	0.0222	0.0182	44.4	36.4	1	1.00-152			19.8	55
Hexachlorocyclopentadiene	0.0500	ND	ND	ND	8.02	6.80	1	10.0-146	J6	J6	16.5	34
Hexachloroethane	0.0500	ND	0.0116	0.0127	23.2	25.4	1	40.0-120	J6	J6	9.05	52
Indeno(1,2,3-cd)pyrene	0.0500	ND	0.0278	0.0238	55.6	47.6	1	1.00-171			15.5	99
Isophorone	0.0500	ND	0.0207	0.0201	41.4	40.2	1	21.0-196			2.94	93
Naphthalene	0.0500	ND	0.0158	0.0160	31.6	32.0	1	21.0-133			1.26	65
Nitrobenzene	0.0500	ND	0.0217	0.0206	43.4	41.2	1	35.0-180			5.20	62
Pentachlorophenol	0.0500	ND	0.0207	0.0173	41.4	34.6	1	14.0-176			17.9	86
Phenanthrene	0.0500	ND	0.0227	0.0193	45.4	38.6	1	54.0-120	J6	J6	16.2	39
Phenol	0.0500	ND	ND	ND	18.4	17.7	1	5.00-120			4.21	64
Pyrene	0.0500	ND	0.0238	0.0198	47.6	39.6	1	52.0-120	J6	J6	18.3	49
n-Nitrosodi-n-propylamine	0.0500	ND	0.0191	0.0198	38.2	39.6	1	1.00-230			3.60	87
n-Nitrosodimethylamine	0.0500	ND	0.0152	0.0170	30.4	34.0	1	10.0-120			11.2	40
n-Nitrosodiphenylamine	0.0500	ND	0.0255	0.0206	51.0	41.2	1	16.0-160			21.3	28
(S) Phenol-d5					*19.6*	*16.9*		*8.00-424*				
(S) Nitrobenzene-d5					*51.7*	*48.2*		*15.0-314*				
(S) 2,4,6-Tribromophenol					*48.5*	*40.7*		*10.0-153*				

L1843004-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1843004-01 04/12/25 18:50 • (MS) R4199396-1 04/12/25 19:12 • (MSD) R4199396-2 04/12/25 19:33

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
(S) p-Terphenyl-d14					*48.1*	*37.8*		*29.0-141*				
(S) 2-Fluorophenol					*20.8*	*20.3*		*10.0-120*				
(S) 2-Fluorobiphenyl					*44.7*	*41.6*		*22.0-127*				

Method Blank (MB)

(MB) R4201321-3 04/17/25 01:33

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Phenol	ND		0.000334	0.0100
(S) Phenol-d5	*24.0*			*8.00-424*
(S) Nitrobenzene-d5	*96.6*			*15.0-314*
(S) 2,4,6-Tribromophenol	*73.5*			*10.0-153*
(S) p-Terphenyl-d14	*72.2*			*29.0-141*
(S) 2-Fluorophenol	*34.7*			*10.0-120*
(S) 2-Fluorobiphenyl	*70.0*			*22.0-127*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4201321-1 04/17/25 00:51 • (LCSD) R4201321-2 04/17/25 01:12

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Phenol	0.0500	0.0137	0.0135	27.4	27.0	5.00-120			1.47	64
(S) Phenol-d5				*26.0*	*27.0*	*8.00-424*				
(S) Nitrobenzene-d5				*96.1*	*97.8*	*15.0-314*				
(S) 2,4,6-Tribromophenol				*94.0*	*86.5*	*10.0-153*				
(S) p-Terphenyl-d14				*79.7*	*77.5*	*29.0-141*				
(S) 2-Fluorophenol				*36.2*	*40.3*	*10.0-120*				
(S) 2-Fluorobiphenyl				*82.4*	*78.8*	*22.0-127*				

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
C5	The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
N2	Analyte reported using a calibration and validation based on Azobenzene (CAS 103-33-3). 1,2-Diphenylhydrazine decomposes into Azobenzene during the analysis.
P	RPD between the primary and confirmatory analysis exceeded 40%.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.

GLOSSARY OF TERMS

Qualifier	Description
Q	Sample was prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com,datamgt@barr.com,jeide

Project Description:
Elk River QTRLY Leachate(1,4,7,10)

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program(DOD,RCRA,DW,etc):

Client Project #
500

Lab Project #
WMELKRIVMN-00003

Collected by (print):
Kenneth Snyder

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	608.3 100ml Amb-NoPres	625.1 100ml Amb-NaTio	Alk, Cl,SO4,pH 500mlHDPE-NoPres	CN 250mlHDPEAmb-NaOH	COD 250mlHDPE-H2SO4	FLASH 250mlAmb-NoPres	Metals 250mlHDPE-HNO3	TSS 1L-HDPE NoPres	V8260LLAP5NP 40mlAmb-HCl	V8260ULLC 40mlAmb HCl	Remarks	Sample # (lab only)
SP-01_Leachate	G	GW		4/1/25	1320	16	X	X	X	X	X	X	X	X	X	X		-01

Analyses / Container / Preservative

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

12065 Lebanon Rd Mount Juliet, TN 37122
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # 1842913
B124

Acctnum: WMELKRIVMN
Template: T170179
Prelogin: P1137531
PM: 364 - T. Alan Harvill
PB: 3-17-25

Shipped Via: FedEX Ground

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 4439 2444 2492

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR
	4/1/25	1500		
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 1.9°C Bottles Received: 3.5, 1.4, 3.9 16
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature) Alyssa Mitchell	Date: 4/2/25 Time: 0900

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

FIELD INFORMATION FORM

Surface Water, Stormwater and Leachate

WM WASTE MANAGEMENT

Laboratory Use Only / Lab I.D.: L1842913

Site Name: ERL

Sample I.D.: SR-01

Sampling Method & Equipment

Purge and Sample Equipment:

Sampling Method: [D] D - Direct, I - Indirect, V - Visual

Sampling Equipment: [O] D - Dipper, T - Transfer Vessel, S - Sample Bottle, O - Other: Nozzle

Sample Type: [ ] (Grab) / Composite (circle one)

Field Measurements

Sample Date MM/DD/YYYY	Sample Time 24 Hr. Clock	pH (std. Units)	CONDUCTIVITY (umhos/cm @ 25°C)	Temp °C	TURBIDITY (NTUs)	DO mg/L - ppm	eH/ORP (std. Units)
04/01/2025	1380	8.27	1744	14.19			

Record final stabilized field readings.

Field Observations

Sample Appearance: Odor: Moderate Color: Black Other:

Sheen Present [Y] or [N] Foam Present: [Y] or [N] Floating Solids: [Y] or [N]

Weather Conditions: (required daily, or as conditions change):

Direction/Speed: Precipitation: [Y] or [N]

Specific Comments:

Date	Name	Signature	Company
4/1/25	Kenneth Smith		Alliance

ANALYTICAL REPORT

April 23, 2025

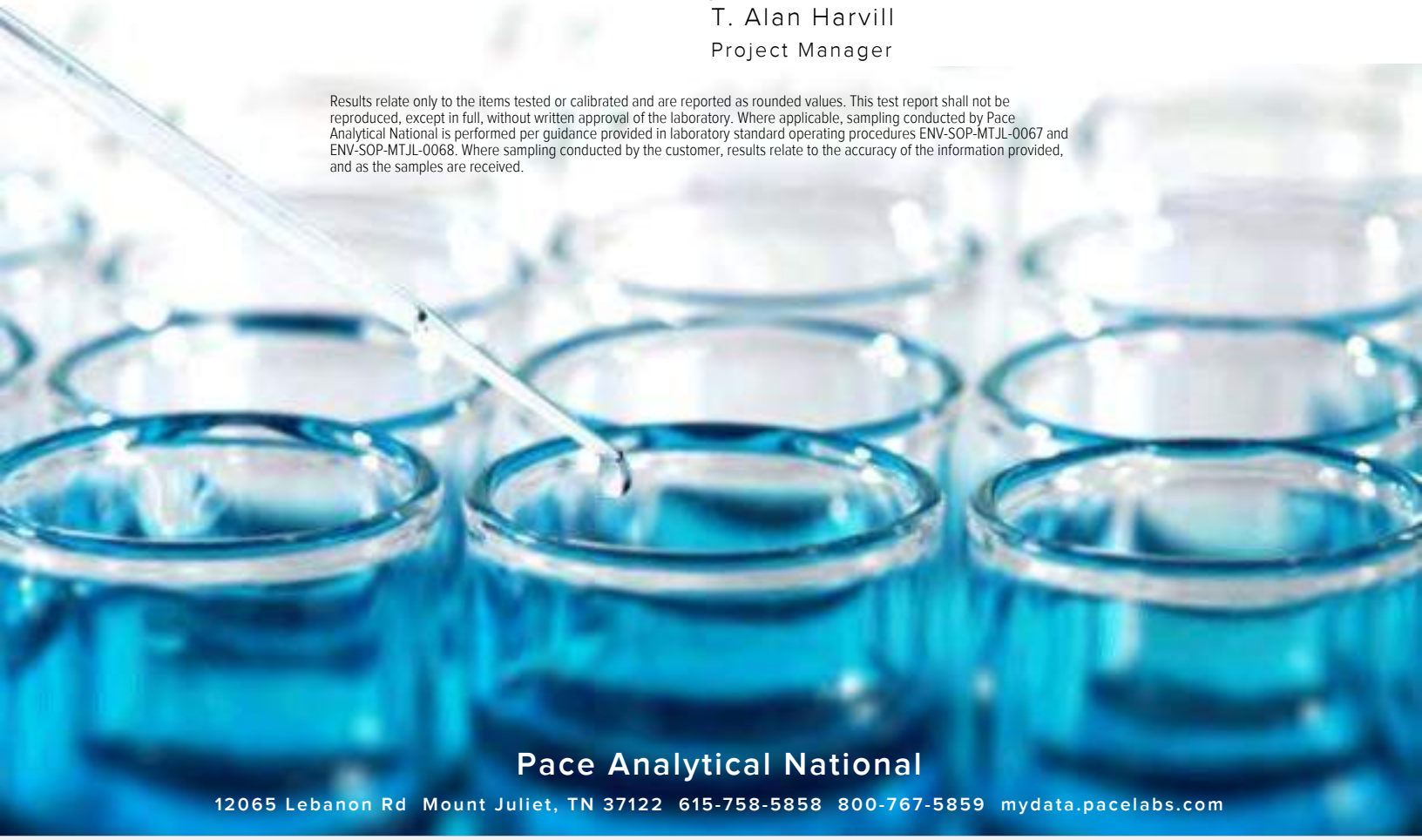
Elk River Landfill

Sample Delivery Group:	L1848209
Samples Received:	04/16/2025
Project Number:	200
Description:	MNA Parameters
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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TB L1848209-01 GW

Collected by: Mike Hamer | Collected date/time: 04/15/25 00:00 | Received date/time: 04/16/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2493546	1	04/17/25 22:39	04/17/25 22:39	JAH	Mt. Juliet, TN

P-321L L1848209-02 GW

Collected by: Mike Hamer | Collected date/time: 04/15/25 12:45 | Received date/time: 04/16/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG2495877	1	04/21/25 11:22	04/21/25 11:22	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2491881	1	04/16/25 22:40	04/16/25 22:40	DLH	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2495741	1	04/22/25 16:36	04/22/25 16:36	CAT	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2492884	1	04/17/25 14:33	04/17/25 14:33	AF	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2492340	1	04/16/25 22:52	04/16/25 22:52	KHM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2493546	1	04/18/25 00:34	04/18/25 00:34	JAH	Mt. Juliet, TN

P-323L L1848209-03 GW

Collected by: Mike Hamer | Collected date/time: 04/15/25 12:05 | Received date/time: 04/16/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG2495877	1	04/21/25 11:36	04/21/25 11:36	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2491881	1	04/16/25 22:53	04/16/25 22:53	DLH	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2491881	5	04/17/25 00:31	04/17/25 00:31	DLH	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2495741	1	04/22/25 16:38	04/22/25 16:38	CAT	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2492884	1	04/17/25 14:54	04/17/25 14:54	AF	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2492340	1	04/16/25 22:58	04/16/25 22:58	KHM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2493546	1	04/18/25 00:53	04/18/25 00:53	JAH	Mt. Juliet, TN

P-325L L1848209-04 GW

Collected by: Mike Hamer | Collected date/time: 04/15/25 10:15 | Received date/time: 04/16/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG2495877	1	04/21/25 11:40	04/21/25 11:40	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2491881	1	04/16/25 23:07	04/16/25 23:07	DLH	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2491881	5	04/17/25 00:44	04/17/25 00:44	DLH	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2495741	1	04/22/25 16:40	04/22/25 16:40	CAT	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2492884	1	04/17/25 15:15	04/17/25 15:15	AF	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2492340	1	04/16/25 23:09	04/16/25 23:09	KHM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2493546	1	04/18/25 01:12	04/18/25 01:12	JAH	Mt. Juliet, TN

P-326L L1848209-05 GW

Collected by: Mike Hamer | Collected date/time: 04/15/25 10:50 | Received date/time: 04/16/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG2495877	1	04/21/25 11:43	04/21/25 11:43	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2491881	1	04/16/25 23:24	04/16/25 23:24	DLH	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2495741	1	04/22/25 16:42	04/22/25 16:42	CAT	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2492884	1	04/17/25 15:35	04/17/25 15:35	AF	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2492340	1	04/16/25 23:16	04/16/25 23:16	KHM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2493546	1	04/18/25 01:31	04/18/25 01:31	JAH	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Wet Chemistry by Method 300.0

The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).

Batch	Lab Sample ID	Analytes
WG2491881	(MS) R4201140-4	Nitrate
WG2491881	(MSD) R4201140-5	Nitrate

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2491881	(MS) R4201140-4, (MSD) R4201140-5	Chloride, Nitrate and Sulfate

Wet Chemistry by Method 9060A

RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Batch	Lab Sample ID	Analytes
WG2492884	(DUP) R4201318-8	TOC

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2493546	L1848209-01	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, 2,2-Dichloropropane, 2-Butanone (MEK), Acetone, Bromoform, Chloroethane, Naphthalene and Tetrahydrofuran
WG2493546	L1848209-02	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, 2,2-Dichloropropane, 2-Butanone (MEK), Acetone, Bromoform, Chloroethane, Naphthalene and Tetrahydrofuran
WG2493546	L1848209-03	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, 2,2-Dichloropropane, 2-Butanone (MEK), Acetone, Bromoform, Chloroethane, Naphthalene and Tetrahydrofuran
WG2493546	L1848209-04	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, 2,2-Dichloropropane, 2-Butanone (MEK), Acetone, Bromoform, Chloroethane, Naphthalene and Tetrahydrofuran

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2493546	L1848209-05	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, 2,2-Dichloropropane, 2-Butanone (MEK), Acetone, Bromoform, Chloroethane, Naphthalene and Tetrahydrofuran

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG2493546	(MSD) R4202903-5	1,1,2-Trichloro-1,2,2-trifluoroethane, Chloromethane, Dichlorodifluoromethane and Dichlorofluoromethane

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/17/2025 22:39	WG2493546
1,1,1-Trichloroethane	ND		1.00	1	04/17/2025 22:39	WG2493546
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/17/2025 22:39	WG2493546
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/17/2025 22:39	WG2493546
1,1,2-Trichloroethane	ND		0.750	1	04/17/2025 22:39	WG2493546
1,1-Dichloroethane	ND		1.00	1	04/17/2025 22:39	WG2493546
1,1-Dichloroethene	ND		1.00	1	04/17/2025 22:39	WG2493546
1,1-Dichloropropene	ND		1.00	1	04/17/2025 22:39	WG2493546
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/17/2025 22:39	WG2493546
1,2,3-Trichloropropane	ND		1.00	1	04/17/2025 22:39	WG2493546
1,2,4-Trichlorobenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
1,2,4-Trimethylbenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/17/2025 22:39	WG2493546
1,2-Dibromoethane	ND		1.00	1	04/17/2025 22:39	WG2493546
1,2-Dichlorobenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
1,2-Dichloroethane	ND		0.250	1	04/17/2025 22:39	WG2493546
1,2-Dichloropropane	ND		1.00	1	04/17/2025 22:39	WG2493546
1,3,5-Trimethylbenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
1,3-Dichlorobenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
1,3-Dichloropropane	ND		1.00	1	04/17/2025 22:39	WG2493546
1,4-Dichlorobenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
2,2-Dichloropropane	ND	C3	1.00	1	04/17/2025 22:39	WG2493546
2-Butanone (MEK)	ND	C3	10.0	1	04/17/2025 22:39	WG2493546
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/17/2025 22:39	WG2493546
Acetone	ND	C3	10.0	1	04/17/2025 22:39	WG2493546
Allyl chloride	ND		1.00	1	04/17/2025 22:39	WG2493546
Benzene	ND		0.500	1	04/17/2025 22:39	WG2493546
Bromobenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
Bromochloromethane	ND		1.00	1	04/17/2025 22:39	WG2493546
Bromodichloromethane	ND		1.00	1	04/17/2025 22:39	WG2493546
Bromoform	ND	C3	1.00	1	04/17/2025 22:39	WG2493546
Bromomethane	ND		1.00	1	04/17/2025 22:39	WG2493546
Carbon tetrachloride	ND		0.250	1	04/17/2025 22:39	WG2493546
Chlorobenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
Chloroethane	ND	C3	1.00	1	04/17/2025 22:39	WG2493546
Chloroform	ND		1.00	1	04/17/2025 22:39	WG2493546
Chloromethane	ND		1.00	1	04/17/2025 22:39	WG2493546
Dibromochloromethane	ND		1.00	1	04/17/2025 22:39	WG2493546
Dibromomethane	ND		1.00	1	04/17/2025 22:39	WG2493546
Dichlorodifluoromethane	ND		1.00	1	04/17/2025 22:39	WG2493546
Dichlorofluoromethane	ND		1.00	1	04/17/2025 22:39	WG2493546
Ethyl ether	ND		1.00	1	04/17/2025 22:39	WG2493546
Ethylbenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
Hexachloro-1,3-butadiene	ND		0.250	1	04/17/2025 22:39	WG2493546
Isopropylbenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
Methyl tert-butyl ether	ND		1.00	1	04/17/2025 22:39	WG2493546
Methylene Chloride	ND		1.00	1	04/17/2025 22:39	WG2493546
Naphthalene	ND	C3	1.00	1	04/17/2025 22:39	WG2493546
Styrene	ND		1.00	1	04/17/2025 22:39	WG2493546
Tetrachloroethene	ND		1.00	1	04/17/2025 22:39	WG2493546
Tetrahydrofuran	ND	C3	5.00	1	04/17/2025 22:39	WG2493546
Toluene	ND		1.00	1	04/17/2025 22:39	WG2493546
Trichloroethene	ND		0.100	1	04/17/2025 22:39	WG2493546
Trichlorofluoromethane	ND		1.00	1	04/17/2025 22:39	WG2493546
Vinyl chloride	ND		0.0500	1	04/17/2025 22:39	WG2493546

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
Xylenes, Total	ND		2.00	1	04/17/2025 22:39	WG2493546
cis-1,2-Dichloroethene	ND		0.100	1	04/17/2025 22:39	WG2493546
cis-1,3-Dichloropropene	ND		0.500	1	04/17/2025 22:39	WG2493546
n-Butylbenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
n-Propylbenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
o-Chlorotoluene	ND		1.00	1	04/17/2025 22:39	WG2493546
p-Chlorotoluene	ND		1.00	1	04/17/2025 22:39	WG2493546
p-Isopropyltoluene	ND		1.00	1	04/17/2025 22:39	WG2493546
sec-Butylbenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
tert-Butylbenzene	ND		1.00	1	04/17/2025 22:39	WG2493546
trans-1,2-Dichloroethene	ND		1.00	1	04/17/2025 22:39	WG2493546
trans-1,3-Dichloropropene	ND		1.00	1	04/17/2025 22:39	WG2493546
(S) 1,2-Dichloroethane-d4	*96.1*			*70.0-130*	*04/17/2025 22:39*	WG2493546
(S) Toluene-d8	*105*			*75.0-131*	*04/17/2025 22:39*	WG2493546
(S) 4-Bromofluorobenzene	*99.0*			*67.0-138*	*04/17/2025 22:39*	WG2493546

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	7.13	su
Specific Conductance (on site)	932	umhos/cm
Temperature (on-site)	11.6	Deg. C
Turbidity (on-site)	2.1	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-106	mV

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	414		20.0	1	04/21/2025 11:22	WG2495877

Sample Narrative:

L1848209-02 WG2495877: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	43.7		1.00	1	04/16/2025 22:40	WG2491881
Nitrate	ND		1.00	1	04/16/2025 22:40	WG2491881
Sulfate	29.8		5.00	1	04/16/2025 22:40	WG2491881

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/22/2025 16:36	WG2495741

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
TOC	1.25		1.00	1	04/17/2025 14:33	WG2492884

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ethane	ND		0.00120	1	04/16/2025 22:52	WG2492340
Ethene	ND		0.00120	1	04/16/2025 22:52	WG2492340
Methane	0.277		0.000678	1	04/16/2025 22:52	WG2492340

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/18/2025 00:34	WG2493546
1,1,1-Trichloroethane	ND		1.00	1	04/18/2025 00:34	WG2493546
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/18/2025 00:34	WG2493546
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/18/2025 00:34	WG2493546
1,1,2-Trichloroethane	ND		0.750	1	04/18/2025 00:34	WG2493546
1,1-Dichloroethane	2.74		1.00	1	04/18/2025 00:34	WG2493546
1,1-Dichloroethene	ND		1.00	1	04/18/2025 00:34	WG2493546
1,1-Dichloropropene	ND		1.00	1	04/18/2025 00:34	WG2493546
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/18/2025 00:34	WG2493546
1,2,3-Trichloropropane	ND		1.00	1	04/18/2025 00:34	WG2493546

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
1,2,4-Trimethylbenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/18/2025 00:34	WG2493546
1,2-Dibromoethane	ND		1.00	1	04/18/2025 00:34	WG2493546
1,2-Dichlorobenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
1,2-Dichloroethane	ND		0.250	1	04/18/2025 00:34	WG2493546
1,2-Dichloropropane	ND		1.00	1	04/18/2025 00:34	WG2493546
1,3,5-Trimethylbenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
1,3-Dichlorobenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
1,3-Dichloropropane	ND		1.00	1	04/18/2025 00:34	WG2493546
1,4-Dichlorobenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
2,2-Dichloropropane	ND	C3	1.00	1	04/18/2025 00:34	WG2493546
2-Butanone (MEK)	ND	C3	10.0	1	04/18/2025 00:34	WG2493546
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/18/2025 00:34	WG2493546
Acetone	ND	C3	10.0	1	04/18/2025 00:34	WG2493546
Allyl chloride	ND		1.00	1	04/18/2025 00:34	WG2493546
Benzene	ND		0.500	1	04/18/2025 00:34	WG2493546
Bromobenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
Bromochloromethane	ND		1.00	1	04/18/2025 00:34	WG2493546
Bromodichloromethane	ND		1.00	1	04/18/2025 00:34	WG2493546
Bromoform	ND	C3	1.00	1	04/18/2025 00:34	WG2493546
Bromomethane	ND		1.00	1	04/18/2025 00:34	WG2493546
Carbon tetrachloride	ND		0.250	1	04/18/2025 00:34	WG2493546
Chlorobenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
Chloroethane	ND	C3	1.00	1	04/18/2025 00:34	WG2493546
Chloroform	ND		1.00	1	04/18/2025 00:34	WG2493546
Chloromethane	ND		1.00	1	04/18/2025 00:34	WG2493546
Dibromochloromethane	ND		1.00	1	04/18/2025 00:34	WG2493546
Dibromomethane	ND		1.00	1	04/18/2025 00:34	WG2493546
Dichlorodifluoromethane	ND		1.00	1	04/18/2025 00:34	WG2493546
Dichlorofluoromethane	3.25		1.00	1	04/18/2025 00:34	WG2493546
Ethyl ether	7.20		1.00	1	04/18/2025 00:34	WG2493546
Ethylbenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
Hexachloro-1,3-butadiene	ND		0.250	1	04/18/2025 00:34	WG2493546
Isopropylbenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
Methyl tert-butyl ether	ND		1.00	1	04/18/2025 00:34	WG2493546
Methylene Chloride	ND		1.00	1	04/18/2025 00:34	WG2493546
Naphthalene	ND	C3	1.00	1	04/18/2025 00:34	WG2493546
Styrene	ND		1.00	1	04/18/2025 00:34	WG2493546
Tetrachloroethene	ND		1.00	1	04/18/2025 00:34	WG2493546
Tetrahydrofuran	ND	C3	5.00	1	04/18/2025 00:34	WG2493546
Toluene	ND		1.00	1	04/18/2025 00:34	WG2493546
Trichloroethene	ND		0.100	1	04/18/2025 00:34	WG2493546
Trichlorofluoromethane	ND		1.00	1	04/18/2025 00:34	WG2493546
Vinyl chloride	0.414		0.0500	1	04/18/2025 00:34	WG2493546
Xylenes, Total	ND		2.00	1	04/18/2025 00:34	WG2493546
cis-1,2-Dichloroethene	0.335		0.100	1	04/18/2025 00:34	WG2493546
cis-1,3-Dichloropropene	ND		0.500	1	04/18/2025 00:34	WG2493546
n-Butylbenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
n-Propylbenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
o-Chlorotoluene	ND		1.00	1	04/18/2025 00:34	WG2493546
p-Chlorotoluene	ND		1.00	1	04/18/2025 00:34	WG2493546
p-Isopropyltoluene	ND		1.00	1	04/18/2025 00:34	WG2493546
sec-Butylbenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
tert-Butylbenzene	ND		1.00	1	04/18/2025 00:34	WG2493546
trans-1,2-Dichloroethene	ND		1.00	1	04/18/2025 00:34	WG2493546

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
trans-1,3-Dichloropropene	ND		1.00	1	04/18/2025 00:34	WG2493546
(S) 1,2-Dichloroethane-d4	*97.3*			*70.0-130*	*04/18/2025 00:34*	WG2493546
(S) Toluene-d8	*104*			*75.0-131*	*04/18/2025 00:34*	WG2493546
(S) 4-Bromofluorobenzene	*95.2*			*67.0-138*	*04/18/2025 00:34*	WG2493546

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	6.76	su
Specific Conductance (on site)	1656	umhos/cm
Temperature (on-site)	9.7	Deg. C
Turbidity (on-site)	70	NTU
Dissolved Oxygen (on-site)	0.1	mg/l
eH/ORP (On Site)	-120	mV

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	689		20.0	1	04/21/2025 11:36	WG2495877

Sample Narrative:

L1848209-03 WG2495877: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	135		1.00	5	04/17/2025 00:31	WG2491881
Nitrate	ND		1.00	1	04/16/2025 22:53	WG2491881
Sulfate	20.5		5.00	1	04/16/2025 22:53	WG2491881

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/22/2025 16:38	WG2495741

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
TOC	6.79		1.00	1	04/17/2025 14:54	WG2492884

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ethane	0.00137		0.00120	1	04/16/2025 22:58	WG2492340
Ethene	ND		0.00120	1	04/16/2025 22:58	WG2492340
Methane	0.115		0.000678	1	04/16/2025 22:58	WG2492340

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/18/2025 00:53	WG2493546
1,1,1-Trichloroethane	ND		1.00	1	04/18/2025 00:53	WG2493546
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/18/2025 00:53	WG2493546
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/18/2025 00:53	WG2493546
1,1,2-Trichloroethane	ND		0.750	1	04/18/2025 00:53	WG2493546
1,1-Dichloroethane	5.76		1.00	1	04/18/2025 00:53	WG2493546
1,1-Dichloroethene	ND		1.00	1	04/18/2025 00:53	WG2493546
1,1-Dichloropropene	ND		1.00	1	04/18/2025 00:53	WG2493546
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/18/2025 00:53	WG2493546
1,2,3-Trichloropropane	ND		1.00	1	04/18/2025 00:53	WG2493546

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
1,2,4-Trimethylbenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/18/2025 00:53	WG2493546
1,2-Dibromoethane	ND		1.00	1	04/18/2025 00:53	WG2493546
1,2-Dichlorobenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
1,2-Dichloroethane	0.288		0.250	1	04/18/2025 00:53	WG2493546
1,2-Dichloropropane	ND		1.00	1	04/18/2025 00:53	WG2493546
1,3,5-Trimethylbenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
1,3-Dichlorobenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
1,3-Dichloropropane	ND		1.00	1	04/18/2025 00:53	WG2493546
1,4-Dichlorobenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
2,2-Dichloropropane	ND	C3	1.00	1	04/18/2025 00:53	WG2493546
2-Butanone (MEK)	ND	C3	10.0	1	04/18/2025 00:53	WG2493546
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/18/2025 00:53	WG2493546
Acetone	ND	C3	10.0	1	04/18/2025 00:53	WG2493546
Allyl chloride	ND		1.00	1	04/18/2025 00:53	WG2493546
Benzene	ND		0.500	1	04/18/2025 00:53	WG2493546
Bromobenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
Bromochloromethane	ND		1.00	1	04/18/2025 00:53	WG2493546
Bromodichloromethane	ND		1.00	1	04/18/2025 00:53	WG2493546
Bromoform	ND	C3	1.00	1	04/18/2025 00:53	WG2493546
Bromomethane	ND		1.00	1	04/18/2025 00:53	WG2493546
Carbon tetrachloride	ND		0.250	1	04/18/2025 00:53	WG2493546
Chlorobenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
Chloroethane	ND	C3	1.00	1	04/18/2025 00:53	WG2493546
Chloroform	ND		1.00	1	04/18/2025 00:53	WG2493546
Chloromethane	ND		1.00	1	04/18/2025 00:53	WG2493546
Dibromochloromethane	ND		1.00	1	04/18/2025 00:53	WG2493546
Dibromomethane	ND		1.00	1	04/18/2025 00:53	WG2493546
Dichlorodifluoromethane	ND		1.00	1	04/18/2025 00:53	WG2493546
Dichlorofluoromethane	3.37		1.00	1	04/18/2025 00:53	WG2493546
Ethyl ether	19.7		1.00	1	04/18/2025 00:53	WG2493546
Ethylbenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
Hexachloro-1,3-butadiene	ND		0.250	1	04/18/2025 00:53	WG2493546
Isopropylbenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
Methyl tert-butyl ether	ND		1.00	1	04/18/2025 00:53	WG2493546
Methylene Chloride	ND		1.00	1	04/18/2025 00:53	WG2493546
Naphthalene	ND	C3	1.00	1	04/18/2025 00:53	WG2493546
Styrene	ND		1.00	1	04/18/2025 00:53	WG2493546
Tetrachloroethene	ND		1.00	1	04/18/2025 00:53	WG2493546
Tetrahydrofuran	11.3	C3	5.00	1	04/18/2025 00:53	WG2493546
Toluene	ND		1.00	1	04/18/2025 00:53	WG2493546
Trichloroethene	0.758		0.100	1	04/18/2025 00:53	WG2493546
Trichlorofluoromethane	ND		1.00	1	04/18/2025 00:53	WG2493546
Vinyl chloride	0.244		0.0500	1	04/18/2025 00:53	WG2493546
Xylenes, Total	ND		2.00	1	04/18/2025 00:53	WG2493546
cis-1,2-Dichloroethene	2.13		0.100	1	04/18/2025 00:53	WG2493546
cis-1,3-Dichloropropene	ND		0.500	1	04/18/2025 00:53	WG2493546
n-Butylbenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
n-Propylbenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
o-Chlorotoluene	ND		1.00	1	04/18/2025 00:53	WG2493546
p-Chlorotoluene	ND		1.00	1	04/18/2025 00:53	WG2493546
p-Isopropyltoluene	ND		1.00	1	04/18/2025 00:53	WG2493546
sec-Butylbenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
tert-Butylbenzene	ND		1.00	1	04/18/2025 00:53	WG2493546
trans-1,2-Dichloroethene	ND		1.00	1	04/18/2025 00:53	WG2493546

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
trans-1,3-Dichloropropene	ND		1.00	1	04/18/2025 00:53	WG2493546
(S) 1,2-Dichloroethane-d4	*94.1*			*70.0-130*	*04/18/2025 00:53*	WG2493546
(S) Toluene-d8	*103*			*75.0-131*	*04/18/2025 00:53*	WG2493546
(S) 4-Bromofluorobenzene	*92.3*			*67.0-138*	*04/18/2025 00:53*	WG2493546

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	6.74	su
Specific Conductance (on site)	1450	umhos/cm
Temperature (on-site)	8	Deg. C
Turbidity (on-site)	0.3	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-122	mV

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	619		20.0	1	04/21/2025 11:40	WG2495877

Sample Narrative:

L1848209-04 WG2495877: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	103		1.00	5	04/17/2025 00:44	WG2491881
Nitrate	ND		1.00	1	04/16/2025 23:07	WG2491881
Sulfate	24.9		5.00	1	04/16/2025 23:07	WG2491881

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/22/2025 16:40	WG2495741

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
TOC	8.17		1.00	1	04/17/2025 15:15	WG2492884

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ethane	ND		0.00120	1	04/16/2025 23:09	WG2492340
Ethene	ND		0.00120	1	04/16/2025 23:09	WG2492340
Methane	0.932		0.000678	1	04/16/2025 23:09	WG2492340

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/18/2025 01:12	WG2493546
1,1,1-Trichloroethane	ND		1.00	1	04/18/2025 01:12	WG2493546
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/18/2025 01:12	WG2493546
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/18/2025 01:12	WG2493546
1,1,2-Trichloroethane	ND		0.750	1	04/18/2025 01:12	WG2493546
1,1-Dichloroethane	6.93		1.00	1	04/18/2025 01:12	WG2493546
1,1-Dichloroethene	ND		1.00	1	04/18/2025 01:12	WG2493546
1,1-Dichloropropene	ND		1.00	1	04/18/2025 01:12	WG2493546
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/18/2025 01:12	WG2493546
1,2,3-Trichloropropane	ND		1.00	1	04/18/2025 01:12	WG2493546

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
1,2,4-Trimethylbenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/18/2025 01:12	WG2493546
1,2-Dibromoethane	ND		1.00	1	04/18/2025 01:12	WG2493546
1,2-Dichlorobenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
1,2-Dichloroethane	ND		0.250	1	04/18/2025 01:12	WG2493546
1,2-Dichloropropane	ND		1.00	1	04/18/2025 01:12	WG2493546
1,3,5-Trimethylbenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
1,3-Dichlorobenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
1,3-Dichloropropane	ND		1.00	1	04/18/2025 01:12	WG2493546
1,4-Dichlorobenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
2,2-Dichloropropane	ND	C3	1.00	1	04/18/2025 01:12	WG2493546
2-Butanone (MEK)	ND	C3	10.0	1	04/18/2025 01:12	WG2493546
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/18/2025 01:12	WG2493546
Acetone	ND	C3	10.0	1	04/18/2025 01:12	WG2493546
Allyl chloride	ND		1.00	1	04/18/2025 01:12	WG2493546
Benzene	ND		0.500	1	04/18/2025 01:12	WG2493546
Bromobenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
Bromochloromethane	ND		1.00	1	04/18/2025 01:12	WG2493546
Bromodichloromethane	ND		1.00	1	04/18/2025 01:12	WG2493546
Bromoform	ND	C3	1.00	1	04/18/2025 01:12	WG2493546
Bromomethane	ND		1.00	1	04/18/2025 01:12	WG2493546
Carbon tetrachloride	ND		0.250	1	04/18/2025 01:12	WG2493546
Chlorobenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
Chloroethane	ND	C3	1.00	1	04/18/2025 01:12	WG2493546
Chloroform	ND		1.00	1	04/18/2025 01:12	WG2493546
Chloromethane	ND		1.00	1	04/18/2025 01:12	WG2493546
Dibromochloromethane	ND		1.00	1	04/18/2025 01:12	WG2493546
Dibromomethane	ND		1.00	1	04/18/2025 01:12	WG2493546
Dichlorodifluoromethane	1.02		1.00	1	04/18/2025 01:12	WG2493546
Dichlorofluoromethane	8.52		1.00	1	04/18/2025 01:12	WG2493546
Ethyl ether	24.1		1.00	1	04/18/2025 01:12	WG2493546
Ethylbenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
Hexachloro-1,3-butadiene	ND		0.250	1	04/18/2025 01:12	WG2493546
Isopropylbenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
Methyl tert-butyl ether	ND		1.00	1	04/18/2025 01:12	WG2493546
Methylene Chloride	ND		1.00	1	04/18/2025 01:12	WG2493546
Naphthalene	ND	C3	1.00	1	04/18/2025 01:12	WG2493546
Styrene	ND		1.00	1	04/18/2025 01:12	WG2493546
Tetrachloroethene	ND		1.00	1	04/18/2025 01:12	WG2493546
Tetrahydrofuran	ND	C3	5.00	1	04/18/2025 01:12	WG2493546
Toluene	ND		1.00	1	04/18/2025 01:12	WG2493546
Trichloroethene	ND		0.100	1	04/18/2025 01:12	WG2493546
Trichlorofluoromethane	ND		1.00	1	04/18/2025 01:12	WG2493546
Vinyl chloride	0.707		0.0500	1	04/18/2025 01:12	WG2493546
Xylenes, Total	ND		2.00	1	04/18/2025 01:12	WG2493546
cis-1,2-Dichloroethene	1.59		0.100	1	04/18/2025 01:12	WG2493546
cis-1,3-Dichloropropene	ND		0.500	1	04/18/2025 01:12	WG2493546
n-Butylbenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
n-Propylbenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
o-Chlorotoluene	ND		1.00	1	04/18/2025 01:12	WG2493546
p-Chlorotoluene	ND		1.00	1	04/18/2025 01:12	WG2493546
p-Isopropyltoluene	ND		1.00	1	04/18/2025 01:12	WG2493546
sec-Butylbenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
tert-Butylbenzene	ND		1.00	1	04/18/2025 01:12	WG2493546
trans-1,2-Dichloroethene	ND		1.00	1	04/18/2025 01:12	WG2493546

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
trans-1,3-Dichloropropene	ND		1.00	1	04/18/2025 01:12	WG2493546
(S) 1,2-Dichloroethane-d4	*93.9*			*70.0-130*	*04/18/2025 01:12*	WG2493546
(S) Toluene-d8	*105*			*75.0-131*	*04/18/2025 01:12*	WG2493546
(S) 4-Bromofluorobenzene	*95.8*			*67.0-138*	*04/18/2025 01:12*	WG2493546

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	6.76	su
Specific Conductance (on site)	1275	umhos/cm
Temperature (on-site)	7.6	Deg. C
Turbidity (on-site)	1	NTU
Dissolved Oxygen (on-site)	0.2	mg/l
eH/ORP (On Site)	-136	mV

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	653		20.0	1	04/21/2025 11:43	WG2495877

Sample Narrative:

L1848209-05 WG2495877: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	61.5		1.00	1	04/16/2025 23:24	WG2491881
Nitrate	ND		1.00	1	04/16/2025 23:24	WG2491881
Sulfate	19.0		5.00	1	04/16/2025 23:24	WG2491881

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/22/2025 16:42	WG2495741

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
TOC	2.83		1.00	1	04/17/2025 15:35	WG2492884

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ethane	ND		0.00120	1	04/16/2025 23:16	WG2492340
Ethene	ND		0.00120	1	04/16/2025 23:16	WG2492340
Methane	0.237		0.000678	1	04/16/2025 23:16	WG2492340

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/18/2025 01:31	WG2493546
1,1,1-Trichloroethane	ND		1.00	1	04/18/2025 01:31	WG2493546
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/18/2025 01:31	WG2493546
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/18/2025 01:31	WG2493546
1,1,2-Trichloroethane	ND		0.750	1	04/18/2025 01:31	WG2493546
1,1-Dichloroethane	3.83		1.00	1	04/18/2025 01:31	WG2493546
1,1-Dichloroethene	ND		1.00	1	04/18/2025 01:31	WG2493546
1,1-Dichloropropene	ND		1.00	1	04/18/2025 01:31	WG2493546
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/18/2025 01:31	WG2493546
1,2,3-Trichloropropane	ND		1.00	1	04/18/2025 01:31	WG2493546

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
1,2,4-Trimethylbenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/18/2025 01:31	WG2493546
1,2-Dibromoethane	ND		1.00	1	04/18/2025 01:31	WG2493546
1,2-Dichlorobenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
1,2-Dichloroethane	ND		0.250	1	04/18/2025 01:31	WG2493546
1,2-Dichloropropane	ND		1.00	1	04/18/2025 01:31	WG2493546
1,3,5-Trimethylbenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
1,3-Dichlorobenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
1,3-Dichloropropane	ND		1.00	1	04/18/2025 01:31	WG2493546
1,4-Dichlorobenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
2,2-Dichloropropane	ND	C3	1.00	1	04/18/2025 01:31	WG2493546
2-Butanone (MEK)	ND	C3	10.0	1	04/18/2025 01:31	WG2493546
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/18/2025 01:31	WG2493546
Acetone	ND	C3	10.0	1	04/18/2025 01:31	WG2493546
Allyl chloride	ND		1.00	1	04/18/2025 01:31	WG2493546
Benzene	ND		0.500	1	04/18/2025 01:31	WG2493546
Bromobenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
Bromochloromethane	ND		1.00	1	04/18/2025 01:31	WG2493546
Bromodichloromethane	ND		1.00	1	04/18/2025 01:31	WG2493546
Bromoform	ND	C3	1.00	1	04/18/2025 01:31	WG2493546
Bromomethane	ND		1.00	1	04/18/2025 01:31	WG2493546
Carbon tetrachloride	ND		0.250	1	04/18/2025 01:31	WG2493546
Chlorobenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
Chloroethane	ND	C3	1.00	1	04/18/2025 01:31	WG2493546
Chloroform	ND		1.00	1	04/18/2025 01:31	WG2493546
Chloromethane	ND		1.00	1	04/18/2025 01:31	WG2493546
Dibromochloromethane	ND		1.00	1	04/18/2025 01:31	WG2493546
Dibromomethane	ND		1.00	1	04/18/2025 01:31	WG2493546
Dichlorodifluoromethane	ND		1.00	1	04/18/2025 01:31	WG2493546
Dichlorofluoromethane	3.68		1.00	1	04/18/2025 01:31	WG2493546
Ethyl ether	12.3		1.00	1	04/18/2025 01:31	WG2493546
Ethylbenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
Hexachloro-1,3-butadiene	ND		0.250	1	04/18/2025 01:31	WG2493546
Isopropylbenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
Methyl tert-butyl ether	ND		1.00	1	04/18/2025 01:31	WG2493546
Methylene Chloride	ND		1.00	1	04/18/2025 01:31	WG2493546
Naphthalene	ND	C3	1.00	1	04/18/2025 01:31	WG2493546
Styrene	ND		1.00	1	04/18/2025 01:31	WG2493546
Tetrachloroethene	ND		1.00	1	04/18/2025 01:31	WG2493546
Tetrahydrofuran	9.26	C3	5.00	1	04/18/2025 01:31	WG2493546
Toluene	ND		1.00	1	04/18/2025 01:31	WG2493546
Trichloroethene	0.100		0.100	1	04/18/2025 01:31	WG2493546
Trichlorofluoromethane	ND		1.00	1	04/18/2025 01:31	WG2493546
Vinyl chloride	0.0920		0.0500	1	04/18/2025 01:31	WG2493546
Xylenes, Total	ND		2.00	1	04/18/2025 01:31	WG2493546
cis-1,2-Dichloroethene	1.42		0.100	1	04/18/2025 01:31	WG2493546
cis-1,3-Dichloropropene	ND		0.500	1	04/18/2025 01:31	WG2493546
n-Butylbenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
n-Propylbenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
o-Chlorotoluene	ND		1.00	1	04/18/2025 01:31	WG2493546
p-Chlorotoluene	ND		1.00	1	04/18/2025 01:31	WG2493546
p-Isopropyltoluene	ND		1.00	1	04/18/2025 01:31	WG2493546
sec-Butylbenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
tert-Butylbenzene	ND		1.00	1	04/18/2025 01:31	WG2493546
trans-1,2-Dichloroethene	ND		1.00	1	04/18/2025 01:31	WG2493546

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
trans-1,3-Dichloropropene	ND		1.00	1	04/18/2025 01:31	WG2493546
(S) 1,2-Dichloroethane-d4	*93.1*			*70.0-130*	*04/18/2025 01:31*	WG2493546
(S) Toluene-d8	*104*			*75.0-131*	*04/18/2025 01:31*	WG2493546
(S) 4-Bromofluorobenzene	*94.4*			*67.0-138*	*04/18/2025 01:31*	WG2493546

Method Blank (MB)

(MB) R4202839-2 04/21/25 10:30

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	ND		2.71	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1848758-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1848758-01 04/21/25 10:55 • (DUP) R4202839-3 04/21/25 10:59

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	241	243	1	1.13		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1848768-06 Original Sample (OS) • Duplicate (DUP)

(OS) L1848768-06 04/21/25 12:23 • (DUP) R4202839-4 04/21/25 12:27

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	203	203	1	0.163		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R4202839-1 04/21/25 10:26

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	97.4	97.4	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R4201140-1 04/16/25 18:39

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloride	ND		0.0519	1.00
Nitrate	ND		0.0227	0.100
Sulfate	0.103		0.0774	5.00

L1848157-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1848157-01 04/16/25 19:05 • (DUP) R4201140-3 04/17/25 01:24

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	36.2	35.8	1	1.11		15
Nitrate	4.27	4.20	1	1.55		15
Sulfate	21.0	20.9	1	0.579		15

L1848157-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1848157-02 04/16/25 19:19 • (DUP) R4201140-6 04/17/25 02:04

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	8.03	8.09	1	0.697		15
Nitrate	ND	ND	1	1.80		15
Sulfate	6.68	6.68	1	0.00150		15

Laboratory Control Sample (LCS)

(LCS) R4201140-2 04/16/25 18:52

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40.0	38.3	95.8	90.0-110	
Nitrate	8.00	8.41	105	90.0-110	
Sulfate	40.0	42.5	106	90.0-110	

L1848157-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848157-01 04/16/25 19:05 • (MS) R4201140-4 04/17/25 01:38 • (MSD) R4201140-5 04/17/25 01:51

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	40.0	36.2	64.8	65.5	71.5	73.3	1	90.0-110	J6	J6	1.09	15
Nitrate	8.00	4.27	11.3	11.5	88.3	90.4	1	90.0-110	E J6	E	1.44	15
Sulfate	40.0	21.0	54.6	57.5	84.0	91.1	1	90.0-110	J6		5.07	15

L1848157-02 Original Sample (OS) • Matrix Spike (MS)

(OS) L1848157-02 04/16/25 19:19 • (MS) R4201140-7 04/17/25 02:18

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	40.0	8.03	44.1	90.2	1	90.0-110	
Nitrate	8.00	ND	8.90	101	1	90.0-110	
Sulfate	40.0	6.68	46.9	101	1	90.0-110	

Method Blank (MB)

(MB) R4203521-1 04/22/25 16:00

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Nitrate-Nitrite	ND		0.0197	0.100

Laboratory Control Sample (LCS)

(LCS) R4203521-2 04/22/25 16:03

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Nitrate-Nitrite	2.50	2.63	105	90.0-110	

L1848129-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848129-06 04/22/25 16:07 • (MS) R4203521-3 04/22/25 16:10 • (MSD) R4203521-4 04/22/25 16:12

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.75	2.77	107	108	1	90.0-110			0.690	20

L1848129-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848129-07 04/22/25 16:14 • (MS) R4203521-5 04/22/25 16:17 • (MSD) R4203521-6 04/22/25 16:19

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.78	2.80	108	109	1	90.0-110			0.825	20

QUALITY CONTROL SUMMARY

L1848209-02,03,04,05

Method Blank (MB)

(MB) R4201318-2 04/17/25 11:00

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TOC	0.187		0.102	1.00

L1848207-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1848207-05 04/17/25 13:01 • (DUP) R4201318-5 04/17/25 13:18

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC	ND	ND	1	6.28		20

L1848259-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1848259-04 04/17/25 18:01 • (DUP) R4201318-8 04/17/25 18:18

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC	ND	ND	1	200	P1	20

Laboratory Control Sample (LCS)

(LCS) R4201318-1 04/17/25 10:37

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TOC	25.0	25.7	103	85.0-115	

L1848207-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848207-04 04/17/25 11:59 • (MS) R4201318-3 04/17/25 12:21 • (MSD) R4201318-4 04/17/25 12:44

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TOC	25.0	ND	25.6	25.4	103	102	1	85.0-115			0.783	20

L1848259-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848259-02 04/17/25 16:55 • (MS) R4201318-6 04/17/25 17:17 • (MSD) R4201318-7 04/17/25 17:39

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TOC	25.0	ND	25.7	25.8	101	101	1	85.0-115			0.194	20

Method Blank (MB)

(MB) R4200785-2 04/16/25 18:50

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Ethane	ND		0.000296	0.00129
Ethene	ND		0.000422	0.00127
Methane	ND		0.000287	0.000678

L1848173-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1848173-01 04/16/25 20:05 • (DUP) R4200785-3 04/16/25 22:16

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ethane	ND	ND	1	0.000		20
Ethene	ND	ND	1	0.000		20
Methane	ND	ND	1	0.000		20

L1848247-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1848247-01 04/16/25 23:32 • (DUP) R4200785-4 04/17/25 00:10

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ethane	ND	ND	1	0.000		20
Ethene	ND	ND	1	0.000		20
Methane	ND	ND	1	0.000		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4200785-1 04/16/25 18:39 • (LCSD) R4200785-7 04/17/25 00:31

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Ethane	0.129	0.123	0.122	95.3	94.6	85.0-115			0.816	20
Ethene	0.127	0.125	0.123	98.4	96.9	85.0-115			1.61	20
Methane	0.0678	0.0664	0.0641	97.9	94.5	85.0-115			3.52	20

L1848247-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848247-01 04/16/25 23:32 • (MS) R4200785-5 04/17/25 00:14 • (MSD) R4200785-6 04/17/25 00:23

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ethane	0.129	ND	0.131	0.129	102	100	1	85.0-115			1.54	20
Ethene	0.127	ND	0.130	0.129	102	102	1	85.0-115			0.772	20
Methane	0.0678	ND	0.0684	0.0673	101	99.3	1	85.0-115			1.62	20

Method Blank (MB)

(MB) R4202903-3 04/17/25 21:16

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0302	0.100
1,1,2-Trichloroethane	ND		0.0239	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND	J	0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	0.0280		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	0.0250		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	0.0350		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	0.500
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromochloromethane	ND		0.0245	0.100
Dibromomethane	ND		0.0300	0.200

Method Blank (MB)

(MB) R4202903-3 04/17/25 21:16

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorodifluoromethane	ND		0.0644	0.200
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	0.250
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Vinyl chloride	ND		0.0462	0.0500
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
o-Chlorotoluene	ND		0.0346	0.100
p-Chlorotoluene	ND		0.0180	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 1,2-Dichloroethane-d4	*91.6*			*70.0-130*
(S) Toluene-d8	*105*			*75.0-131*
(S) 4-Bromofluorobenzene	*95.7*			*67.0-138*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4202903-1 04/17/25 19:41 • (LCSD) R4202903-2 04/17/25 20:00

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	4.59	4.40	91.8	88.0	74.0-129			4.23	20
1,1,1-Trichloroethane	5.00	4.63	4.75	92.6	95.0	69.0-126			2.56	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4202903-1 04/17/25 19:41 • (LCSD) R4202903-2 04/17/25 20:00

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,2,2-Tetrachloroethane	5.00	4.49	4.32	89.8	86.4	68.0-128			3.86	20
1,1,2-Trichloro-1,2,2-trifluoroethane	5.00	4.72	4.78	94.4	95.6	61.0-139			1.26	20
1,1,2-Trichloroethane	5.00	4.67	4.49	93.4	89.8	78.0-123			3.93	20
1,1-Dichloroethane	5.00	4.70	4.60	94.0	92.0	70.0-127			2.15	20
1,1-Dichloroethene	5.00	4.54	4.48	90.8	89.6	65.0-131			1.33	20
1,1-Dichloropropene	5.00	4.67	4.65	93.4	93.0	73.0-125			0.429	20
1,2,3-Trichlorobenzene	5.00	3.86	3.88	77.2	77.6	59.0-139			0.517	20
1,2,3-Trichloropropane	5.00	5.09	4.87	102	97.4	67.0-129			4.42	20
1,2,4-Trichlorobenzene	5.00	4.73	4.69	94.6	93.8	62.0-137			0.849	20
1,2,4-Trimethylbenzene	5.00	4.80	4.60	96.0	92.0	70.0-126			4.26	20
1,2-Dibromo-3-Chloropropane	5.00	3.50	3.40	70.0	68.0	59.0-130			2.90	20
1,2-Dibromoethane	5.00	5.01	4.68	100	93.6	74.0-128			6.81	20
1,2-Dichlorobenzene	5.00	5.02	4.92	100	98.4	76.0-124			2.01	20
1,2-Dichloroethane	5.00	4.11	3.90	82.2	78.0	65.0-131			5.24	20
1,2-Dichloropropane	5.00	4.47	4.37	89.4	87.4	74.0-125			2.26	20
1,3,5-Trimethylbenzene	5.00	4.61	4.55	92.2	91.0	73.0-127			1.31	20
1,3-Dichlorobenzene	5.00	5.03	4.90	101	98.0	76.0-125			2.62	20
1,3-Dichloropropane	5.00	4.99	4.53	99.8	90.6	80.0-125			9.66	20
1,4-Dichlorobenzene	5.00	5.13	5.11	103	102	77.0-121			0.391	20
2,2-Dichloropropane	5.00	3.97	3.98	79.4	79.6	59.0-135			0.252	20
2-Butanone (MEK)	25.0	17.4	18.3	69.6	73.2	30.0-160			5.04	24
4-Methyl-2-pentanone (MIBK)	25.0	22.8	22.1	91.2	88.4	56.0-143			3.12	20
Acetone	25.0	11.2	12.1	44.8	48.4	10.0-160			7.73	31
Allyl chloride	25.0	22.6	22.0	90.4	88.0	70.0-131			2.69	20
Benzene	5.00	4.28	4.32	85.6	86.4	70.0-123			0.930	20
Bromobenzene	5.00	5.24	5.04	105	101	73.0-121			3.89	20
Bromochloromethane	5.00	4.56	4.52	91.2	90.4	77.0-128			0.881	20
Bromodichloromethane	5.00	4.15	4.22	83.0	84.4	73.0-121			1.67	20
Bromoform	5.00	3.93	3.64	78.6	72.8	64.0-132			7.66	20
Bromomethane	5.00	4.66	4.57	93.2	91.4	56.0-147			1.95	20
Carbon tetrachloride	5.00	4.58	4.67	91.6	93.4	66.0-128			1.95	20
Chlorobenzene	5.00	4.83	4.67	96.6	93.4	76.0-128			3.37	20
Chloroethane	5.00	3.98	4.47	79.6	89.4	61.0-134			11.6	20
Chloroform	5.00	4.58	4.67	91.6	93.4	72.0-123			1.95	20
Chloromethane	5.00	4.37	4.33	87.4	86.6	51.0-138			0.920	20
Dibromochloromethane	5.00	4.37	4.13	87.4	82.6	74.0-127			5.65	20
Dibromomethane	5.00	4.32	4.17	86.4	83.4	75.0-122			3.53	20
Dichlorodifluoromethane	5.00	4.44	4.53	88.8	90.6	43.0-156			2.01	20
Dichlorofluoromethane	5.00	4.69	5.12	93.8	102	65.0-137			8.77	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4202903-1 04/17/25 19:41 • (LCSD) R4202903-2 04/17/25 20:00

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Ethyl ether	5.00	5.05	5.18	101	104	64.0-137			2.54	20
Ethylbenzene	5.00	4.96	4.97	99.2	99.4	74.0-126			0.201	20
Hexachloro-1,3-butadiene	5.00	5.46	5.20	109	104	57.0-150			4.88	20
Isopropylbenzene	5.00	4.76	4.68	95.2	93.6	72.0-127			1.69	20
Methyl tert-butyl ether	5.00	4.23	4.13	84.6	82.6	66.0-132			2.39	20
Methylene Chloride	5.00	5.14	4.92	103	98.4	68.0-123			4.37	20
Naphthalene	5.00	3.17	3.30	63.4	66.0	59.0-130			4.02	20
Styrene	5.00	4.70	4.62	94.0	92.4	72.0-127			1.72	20
Tetrachloroethene	5.00	4.80	4.99	96.0	99.8	70.0-136			3.88	20
Tetrahydrofuran	5.00	2.68	2.96	53.6	59.2	37.0-146			9.93	24
Toluene	5.00	4.66	4.56	93.2	91.2	75.0-121			2.17	20
Trichloroethene	5.00	4.85	4.79	97.0	95.8	76.0-126			1.24	20
Trichlorofluoromethane	5.00	4.84	4.87	96.8	97.4	61.0-142			0.618	20
Vinyl chloride	5.00	4.58	4.68	91.6	93.6	63.0-134			2.16	20
Xylenes, Total	15.0	15.3	14.7	102	98.0	72.0-127			4.00	20
cis-1,2-Dichloroethene	5.00	4.31	4.34	86.2	86.8	73.0-125			0.694	20
cis-1,3-Dichloropropene	5.00	4.15	4.25	83.0	85.0	76.0-127			2.38	20
n-Butylbenzene	5.00	4.71	4.51	94.2	90.2	68.0-135			4.34	20
n-Propylbenzene	5.00	4.81	4.68	96.2	93.6	74.0-126			2.74	20
o-Chlorotoluene	5.00	5.32	5.15	106	103	75.0-124			3.25	20
p-Chlorotoluene	5.00	4.74	4.70	94.8	94.0	75.0-124			0.847	20
p-Isopropyltoluene	5.00	5.00	4.84	100	96.8	72.0-133			3.25	20
sec-Butylbenzene	5.00	4.93	4.82	98.6	96.4	74.0-130			2.26	20
tert-Butylbenzene	5.00	4.80	4.66	96.0	93.2	75.0-127			2.96	20
trans-1,2-Dichloroethene	5.00	4.38	4.40	87.6	88.0	71.0-125			0.456	20
trans-1,3-Dichloropropene	5.00	4.56	4.53	91.2	90.6	73.0-127			0.660	20
(S) 1,2-Dichloroethane-d4				*95.6*	*93.6*	*70.0-130*				
(S) Toluene-d8				*105*	*105*	*75.0-131*				
(S) 4-Bromofluorobenzene				*95.8*	*94.5*	*67.0-138*				

L1846594-22 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1846594-22 04/17/25 22:58 • (MS) R4202903-4 04/18/25 05:01 • (MSD) R4202903-5 04/18/25 05:20

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	ND	4.98	4.37	99.6	87.4	1	10.0-149			13.0	39
1,1,1-Trichloroethane	5.00	ND	5.63	4.81	113	96.2	1	10.0-144			15.7	35
1,1,2,2-Tetrachloroethane	5.00	ND	5.59	4.89	112	97.8	1	10.0-160			13.4	35
1,1,2-Trichloro-1,2,2-trifluoroethane	5.00	ND	7.26	5.01	145	100	1	10.0-160		J3	36.7	36

L1846594-22 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1846594-22 04/17/25 22:58 • (MS) R4202903-4 04/18/25 05:01 • (MSD) R4202903-5 04/18/25 05:20

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
1,1,2-Trichloroethane	5.00	ND	5.38	4.87	108	97.4	1	10.0-160			9.95	35
1,1-Dichloroethane	5.00	ND	5.66	4.67	113	93.4	1	10.0-147			19.2	37
1,1-Dichloroethene	5.00	ND	6.00	4.84	120	96.8	1	10.0-155			21.4	37
1,1-Dichloropropene	5.00	ND	5.54	4.54	111	90.8	1	10.0-153			19.8	35
1,2,3-Trichlorobenzene	5.00	ND	4.35	4.37	87.0	87.4	1	10.0-160			0.459	40
1,2,3-Trichloropropane	5.00	ND	5.78	5.21	116	104	1	10.0-156			10.4	35
1,2,4-Trichlorobenzene	5.00	ND	5.24	4.75	105	95.0	1	10.0-160			9.81	40
1,2,4-Trimethylbenzene	5.00	ND	5.27	4.81	105	96.2	1	10.0-160			9.13	36
1,2-Dibromo-3-Chloropropane	5.00	ND	4.12	3.92	82.4	78.4	1	10.0-151			4.98	39
1,2-Dibromoethane	5.00	ND	5.71	5.07	114	101	1	10.0-148			11.9	34
1,2-Dichlorobenzene	5.00	ND	5.94	5.20	119	104	1	10.0-155			13.3	37
1,2-Dichloroethane	5.00	ND	5.97	4.50	119	90.0	1	10.0-148			28.1	35
1,2-Dichloropropane	5.00	ND	6.42	4.51	128	90.2	1	10.0-148			34.9	37
1,3,5-Trimethylbenzene	5.00	ND	5.02	4.46	100	89.2	1	10.0-160			11.8	38
1,3-Dichlorobenzene	5.00	ND	5.89	5.17	118	103	1	10.0-153			13.0	38
1,3-Dichloropropane	5.00	ND	5.54	5.01	111	100	1	10.0-154			10.0	35
1,4-Dichlorobenzene	5.00	ND	6.01	5.29	120	106	1	10.0-151			12.7	38
2,2-Dichloropropane	5.00	ND	5.02	4.08	100	81.6	1	10.0-138			20.7	36
2-Butanone (MEK)	25.0	ND	22.8	19.2	91.2	76.8	1	10.0-160			17.1	40
4-Methyl-2-pentanone (MIBK)	25.0	ND	27.8	25.2	111	101	1	10.0-160			9.81	35
Acetone	25.0	ND	14.4	10.9	57.6	43.6	1	10.0-160			27.7	40
Allyl chloride	25.0	ND	25.4	22.2	102	88.8	1	10.0-160			13.4	30
Benzene	5.00	ND	5.20	4.58	104	91.6	1	10.0-149			12.7	37
Bromobenzene	5.00	ND	6.14	5.38	123	108	1	10.0-156			13.2	38
Bromochloromethane	5.00	ND	5.98	4.76	120	95.2	1	10.0-155			22.7	33
Bromodichloromethane	5.00	ND	6.16	4.47	123	89.4	1	10.0-143			31.8	37
Bromoform	5.00	ND	4.41	4.20	88.2	84.0	1	10.0-146			4.88	36
Bromomethane	5.00	ND	7.08	4.93	142	98.6	1	10.0-149			35.8	38
Carbon tetrachloride	5.00	ND	5.30	4.37	106	87.4	1	10.0-145			19.2	37
Chlorobenzene	5.00	ND	5.73	5.04	115	101	1	10.0-152			12.8	39
Chloroethane	5.00	ND	6.98	4.72	140	94.4	1	10.0-146			38.6	40
Chloroform	5.00	ND	5.88	4.79	118	95.8	1	10.0-146			20.4	37
Chloromethane	5.00	ND	6.81	4.65	136	93.0	1	10.0-159		J3	37.7	37
Dibromochloromethane	5.00	ND	4.89	4.41	97.8	88.2	1	10.0-146			10.3	37
Dibromomethane	5.00	ND	6.63	4.69	133	93.8	1	10.0-147			34.3	35
Dichlorodifluoromethane	5.00	ND	7.29	4.87	146	97.4	1	10.0-160		J3	39.8	35
Dichlorofluoromethane	5.00	ND	7.95	5.41	159	108	1	10.0-160		J3	38.0	34
Ethyl ether	5.00	ND	5.36	4.34	107	86.8	1	10.0-160			21.0	31
Ethylbenzene	5.00	ND	5.71	4.90	114	98.0	1	10.0-160			15.3	38
Hexachloro-1,3-butadiene	5.00	ND	6.09	5.50	122	110	1	10.0-160			10.2	40

L1846594-22 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1846594-22 04/17/25 22:58 • (MS) R4202903-4 04/18/25 05:01 • (MSD) R4202903-5 04/18/25 05:20

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Isopropylbenzene	5.00	ND	5.15	4.56	103	91.2	1	10.0-155			12.2	38
Methyl tert-butyl ether	5.00	ND	5.25	4.04	105	80.8	1	11.0-147			26.0	35
Methylene Chloride	5.00	ND	5.55	4.42	111	88.4	1	10.0-141			22.7	37
Naphthalene	5.00	ND	3.58	3.66	71.6	73.2	1	10.0-160			2.21	36
Styrene	5.00	ND	5.56	4.86	111	97.2	1	10.0-160			13.4	40
Tetrachloroethene	5.00	ND	6.03	5.10	121	102	1	10.0-156			16.7	39
Tetrahydrofuran	5.00	ND	ND	ND	99.2	84.8	1	10.0-158			15.7	33
Toluene	5.00	ND	5.34	4.66	107	93.2	1	10.0-156			13.6	38
Trichloroethene	5.00	ND	5.22	4.42	104	88.4	1	10.0-156			16.6	38
Trichlorofluoromethane	5.00	ND	7.31	5.46	146	109	1	10.0-160			29.0	40
Vinyl chloride	5.00	ND	7.49	5.25	150	105	1	10.0-160			35.2	37
Xylenes, Total	15.0	ND	17.6	15.0	117	100	1	10.0-160			16.0	38
cis-1,2-Dichloroethene	5.00	ND	5.48	4.46	110	89.2	1	10.0-149			20.5	37
cis-1,3-Dichloropropene	5.00	ND	5.71	4.49	114	89.8	1	10.0-151			23.9	37
n-Butylbenzene	5.00	ND	5.31	4.59	106	91.8	1	10.0-160			14.5	40
n-Propylbenzene	5.00	ND	4.98	4.40	99.6	88.0	1	10.0-158			12.4	38
o-Chlorotoluene	5.00	ND	6.18	5.42	124	108	1	10.0-159			13.1	38
p-Chlorotoluene	5.00	ND	5.62	4.78	112	95.6	1	10.0-155			16.2	39
p-Isopropyltoluene	5.00	ND	5.47	4.70	109	94.0	1	10.0-160			15.1	40
sec-Butylbenzene	5.00	ND	5.33	4.77	107	95.4	1	10.0-159			11.1	39
tert-Butylbenzene	5.00	ND	5.32	4.54	106	90.8	1	10.0-156			15.8	39
trans-1,2-Dichloroethene	5.00	ND	5.38	4.46	108	89.2	1	10.0-150			18.7	37
trans-1,3-Dichloropropene	5.00	ND	5.09	4.71	102	94.2	1	10.0-148			7.76	37
(S) 1,2-Dichloroethane-d4					*112*	*97.8*		*70.0-130*				
(S) Toluene-d8					*102*	*103*		*75.0-131*				
(S) 4-Bromofluorobenzene					*94.9*	*94.3*		*67.0-138*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
J3	The associated batch QC was outside the established quality control range for precision.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
MNA Parameters

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program(DOD,RCRA,DW,etc):

Client Project #
200

Lab Project #
WMELKRIVMN-00023

Collected by (print):
Mike Trimbo

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	NO2,SO4,Cl,Alk 125mlHDPE-NoPres	NO2NO3 HOLD 250mlHDPE-H2SO4	RSK175LL 40mlAmb-HCl	TOC 250mlAmb-HCl	V8260ULLC 40mlAmb-HCl	V8260ULLC 40mlAmb-HCl-Blk						
TB		GW				1						X						-01
~~P-302C~~		GW				9	X	X	X	X	X							
~~P-304C~~		GW				9	X	X	X	X	X							
~~P-312C~~		GW				9	X	X	X	X	X							
P-321L	G	GW		4/15/25	1245	9	X	X	X	X	X							-02
P-323L	G	GW		4/15/25	1205	9	X	X	X	X	X							-03
P-325L	G	GW		4/15/25	1015	9	X	X	X	X	X							-04
P-326L	G	GW		4/15/25	1050	9	X	X	X	X	X							-05
~~P-334C~~		GW				9	X	X	X	X	X							
~~P-336C~~		GW				9	X	X	X	X	X							

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

12065 Lebanon Rd Mount Juliet, TN 37122
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1648209
A234

Acctnum: WMELKRIVMN
Template:T261646
Prelogin: P1144758
PM: 364 - T. Alan Harvill
PB: 4/11/25 BK
Shipped Via: FedEX Priority

Remarks | Sample # (lab only)

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 449359344904

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N
RAD Screen <0.5 mR/hr:		Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: (Yes) No / HCL / MeoH / TBR	Date/Time
	4/15/25	1730	FedEx	1	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 7.1/9.4°C Bottles Received: 38	
				7.1/0.4.25	
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 4.16.25 Time: 0900	Hold: Condition: NCF / OK
			Deyan G		

PM - 30BCN2631
TRC - 322?A??3

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | | Sample Point: P 3 2 1 L (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: LB48209

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:mn)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 15 25	12:25				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Filter Device: Y or (N) 0.45 µ or _____ µ (circle or fill in)

Purging Device: C
Sampling Device: C
X-Other: _____

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Filter Type: _____

A-In-line Disposable, B-Pressure, C-Vacuum, X-Other _____

Sample Tube Type: _____

A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: _____

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)
972.56 (ft/msl)	23.10 (ft)	949.56 (ft/msl)

Total Well Depth (from TOC): _____ (ft)
Stick Up (from ground elevation): _____ (ft)
Casing ID: _____ (in)
Casing Material: _____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit: LPM	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
12:30	0.4 1st	7.18 1st	940	11.1		0.2		
12:35	2nd	7.15 2nd	935	11.3		0.1		
12:40	3rd	7.14 3rd	934	11.6		0.0		
12:45	4th	7.13 4th	932	11.6	2.1	0.0	-106	
Suggested range for 3 consec. readings or note Permit/State requirements:		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: _____ Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings, before sampling for all field parameters required by State/Permit/Site).*

FIELD COMMENTS

Sample Appearance: _____ Odor: None Color: None Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4 15 25	Mike H		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: Elk River Landfill

Site No.: | | | | | Sample Point: P 3 2 3 L (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: L6H5209

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hrs:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 15 25	11:45				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes; record field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Purging Device: C — A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device: C — A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

X-Other:

Filter Device: Y or (N) — 0.45 µ or ____ µ (circle or fill in)

Filter Type: ____ — A-In-line Disposable, B-Pressure, C-Vacuum, X-Other ____

Sample Tube Type: ____ — A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: ____

WELL DATA

Well Elevation (at TOC) (ft/msl)	Depth to Water (DTW) (from TOC) (ft)	Groundwater Elevation (site datum, from TOC) (ft/msl)
967.20	18.07	949.13

Total Well Depth (from TOC) (ft)	Stick Up (from ground elevation) (ft)	Casing ID (in)	Casing Material

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit (GPM)	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
11:50	0.4	6.82	1650	10.0		0.2		
11:55		6.75	1655	9.8		0.0		
12:00		6.75	1653	9.7		0.0		
12:05		6.76	1656	9.7	70	0.1	-120	
Suggested range for 3 consec. readings or acc Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ Units ____

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling) for all field parameters required by State/Permit/Site.*

FIELD COMMENTS

Sample Appearance: ____ Odor: N-a Color: N-a Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign)

Date	Name	Signature	Company
4/15/25	Mike Hoar		Allen

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.:

Sample Point: P325L (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: L648209

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 15 25	09:55	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Filter Device: Y or (N) 0.45 µ or ____ µ (circle or fill in)

Purging Device: Y — A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device: Y

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other ____

X-Other: Drop tube

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: ____

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)
(ft/msl)	(ft)	(ft/msl)

Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
(ft)	(ft)	(in)	

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit LPM	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1000	0.2 1st	6.43 1st	1435	7.8		02		
1005	2nd	6.61 2nd	1454	7.9		01		
1010	3rd	6.68 3rd	1457	7.9		01		
1015	4th	6.74 4th	1460	8.0	0.3	0.0 -	122	
Suggested range for 3 consec. readings or site/Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required for State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ Units ____

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling) for all field parameters required by State/Permit/Site.*

Sample Appearance: ____ Odor: None Color: None Other: ____

Weather Conditions (record daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/15/25	Mike Hom		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | | Sample Point: P 3 2 6 L (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: 1404209

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 15 25	1030				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment .... Dedicated: (Y) or N

Purging Device: Y — A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device: Y

X-Other: Disp tube

Filter Device: Y or (N) — 0.45 µ or ____ µ (circle or fill in)

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other ____

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: ____

WELL DATA

Well Elevation (at TOC) ____ (ft/msl) — Depth to Water (DTW) (from TOC) ____ (ft) — Groundwater Elevation (site datum, from TOC) ____ (ft/msl)

Total Well Depth (from TOC) ____ (ft) — Stick Up (from ground elevation) ____ (ft) — Casing ID ____ (in) — Casing Material ____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit LPM	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1035	0.1	6.89	1224	7.1		0.8		
1040		6.83	1250	7.4		0.7		
1045		6.80	1268	7.5		0.3		
1050		6.76	1275	7.6	1.0	0.2	-136	

Suggested range for 3 consec. readings or note Permit/State requirements: +/- 0.2 | +/- 3% | ~ | ~ | +/- 10% | +/- 25 mV | Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling) for all field parameters required by State/Permit/Site.*

FIELD COMMENTS

Sample Appearance: ____ Odor: None Color: None Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4 15 25	Mike Hamm		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

ANALYTICAL REPORT

May 07, 2025

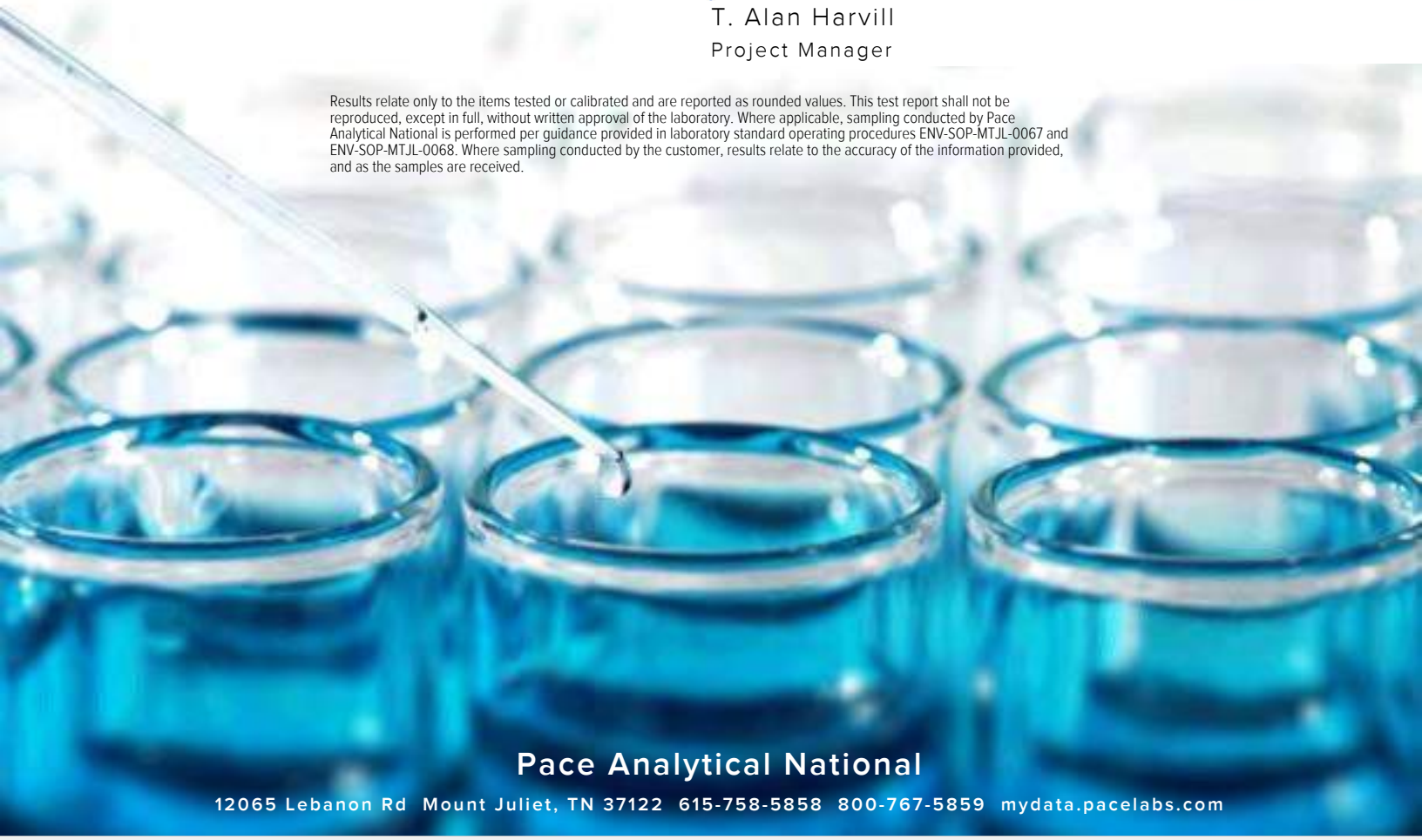
Elk River Landfill

Sample Delivery Group:	L1848860
Samples Received:	04/17/2025
Project Number:	200
Description:	MNA Parameters
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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TB L1848860-01 GW

Collected by: Mike Hamer | Collected date/time: 04/16/25 00:00 | Received date/time: 04/17/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498825	1	04/24/25 14:49	04/24/25 14:49	KST	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2499929	1	04/26/25 09:34	04/26/25 09:34	AV	Mt. Juliet, TN

P-302C L1848860-02 GW

Collected by: Mike Hamer | Collected date/time: 04/16/25 14:15 | Received date/time: 04/17/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG2495882	1	04/21/25 11:09	04/21/25 11:09	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2493080	1	04/18/25 00:11	04/18/25 00:11	ZSA	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2493080	1	04/22/25 02:15	04/22/25 02:15	DLH	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2493080	5	04/18/25 02:52	04/18/25 02:52	ZSA	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2495742	1	04/27/25 00:53	04/27/25 00:53	CAT	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2493859	1	04/18/25 14:28	04/18/25 14:28	KAM	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2495726	1	04/22/25 10:30	04/22/25 10:30	CCM	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2497196	10	04/22/25 15:15	04/22/25 15:15	CCM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498825	1	04/24/25 15:51	04/24/25 15:51	GLN	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2499929	1	04/26/25 09:54	04/26/25 09:54	AV	Mt. Juliet, TN

P-334L L1848860-03 GW

Collected by: Mike Hamer | Collected date/time: 04/16/25 11:15 | Received date/time: 04/17/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG2495882	1	04/21/25 11:16	04/21/25 11:16	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2493080	1	04/18/25 00:24	04/18/25 00:24	ZSA	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2493080	1	04/22/25 02:28	04/22/25 02:28	DLH	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2495771	1	04/21/25 03:14	04/21/25 03:14	CAT	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2493859	1	04/18/25 15:31	04/18/25 15:31	KAM	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2495726	1	04/22/25 10:36	04/22/25 10:36	CCM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498825	1	04/24/25 16:38	04/24/25 16:38	KST	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2499929	1	04/26/25 10:14	04/26/25 10:14	AV	Mt. Juliet, TN

P-338L L1848860-04 GW

Collected by: Mike Hamer | Collected date/time: 04/16/25 10:30 | Received date/time: 04/17/25 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG2495882	1	04/21/25 11:24	04/21/25 11:24	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2493080	1	04/18/25 00:38	04/18/25 00:38	ZSA	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2493080	1	04/22/25 02:41	04/22/25 02:41	DLH	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2495771	1	04/21/25 03:21	04/21/25 03:21	CAT	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2493859	1	04/18/25 16:12	04/18/25 16:12	KAM	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2495726	1	04/22/25 10:45	04/22/25 10:45	CCM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498825	1	04/24/25 16:59	04/24/25 16:59	KST	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2499929	1	04/26/25 10:34	04/26/25 10:34	AV	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Sample Delivery Group (SDG) Narrative

Analyzed from headspace vial.

Batch	Method	Lab Sample ID
WG2499929	8260D	L1848860-01

Wet Chemistry by Method 300.0

The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).

Batch	Lab Sample ID	Analytes
WG2493080	(MS) R4201978-6	Nitrate and Sulfate
WG2493080	(MSD) R4201978-7	Nitrate and Sulfate

RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Batch	Lab Sample ID	Analytes
WG2493080	(DUP) R4201978-3	Sulfate

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2493080	(MS) R4201978-4, (MS) R4201978-6, (MSD) R4201978-7	Sulfate

Volatile Organic Compounds (GC/MS) by Method 8260D

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2498825	L1848860-01	1,1,2,2-Tetrachloroethane, 2,2-Dichloropropane, 2-Butanone (MEK) and Chloromethane
WG2498825	L1848860-02	1,1,2,2-Tetrachloroethane, 2,2-Dichloropropane, 2-Butanone (MEK) and Chloromethane
WG2498825	L1848860-03	1,1,2,2-Tetrachloroethane, 2,2-Dichloropropane, 2-Butanone (MEK) and Chloromethane
WG2498825	L1848860-04	1,1,2,2-Tetrachloroethane, 2,2-Dichloropropane, 2-Butanone (MEK) and Chloromethane
WG2499929	L1848860-01	Tetrahydrofuran
WG2499929	L1848860-02	Tetrahydrofuran
WG2499929	L1848860-03	Tetrahydrofuran
WG2499929	L1848860-04	Tetrahydrofuran

The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).

Batch	Lab Sample ID	Analytes
WG2498825	L1848860-02	Ethyl ether

The associated batch QC was below the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG2498825	(LCS) R4205005-1, L1848860-01, 02, 03, 04	2,2-Dichloropropane

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG2498825	(LCSD) R4205005-2, L1848860-01, 02, 03, 04	1,1-Dichloroethene, 2,2-Dichloropropane, Bromomethane, Chloroethane, Chloromethane, Dichlorodifluoromethane, Isopropylbenzene, Trichloroethene and Vinyl chloride

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/24/2025 14:49	WG2498825
1,1,1-Trichloroethane	ND		1.00	1	04/24/2025 14:49	WG2498825
1,1,2,2-Tetrachloroethane	ND	C3	0.500	1	04/24/2025 14:49	WG2498825
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/24/2025 14:49	WG2498825
1,1,2-Trichloroethane	ND		0.750	1	04/24/2025 14:49	WG2498825
1,1-Dichloroethane	ND		1.00	1	04/24/2025 14:49	WG2498825
1,1-Dichloroethene	ND	J3	1.00	1	04/24/2025 14:49	WG2498825
1,1-Dichloropropene	ND		1.00	1	04/24/2025 14:49	WG2498825
1,2,3-Trichlorobenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
1,2,3-Trichloropropane	ND		1.00	1	04/24/2025 14:49	WG2498825
1,2,4-Trichlorobenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
1,2,4-Trimethylbenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/24/2025 14:49	WG2498825
1,2-Dibromoethane	ND		1.00	1	04/24/2025 14:49	WG2498825
1,2-Dichlorobenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
1,2-Dichloroethane	ND		0.250	1	04/24/2025 14:49	WG2498825
1,2-Dichloropropane	ND		1.00	1	04/24/2025 14:49	WG2498825
1,3,5-Trimethylbenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
1,3-Dichlorobenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
1,3-Dichloropropane	ND		1.00	1	04/24/2025 14:49	WG2498825
1,4-Dichlorobenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
2,2-Dichloropropane	ND	C3 J3 J4	1.00	1	04/24/2025 14:49	WG2498825
2-Butanone (MEK)	ND	C3	10.0	1	04/24/2025 14:49	WG2498825
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/24/2025 14:49	WG2498825
Acetone	ND		10.0	1	04/24/2025 14:49	WG2498825
Allyl chloride	ND		1.00	1	04/24/2025 14:49	WG2498825
Benzene	ND		0.500	1	04/24/2025 14:49	WG2498825
Bromobenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
Bromochloromethane	ND		1.00	1	04/24/2025 14:49	WG2498825
Bromodichloromethane	ND		1.00	1	04/24/2025 14:49	WG2498825
Bromoform	ND		1.00	1	04/24/2025 14:49	WG2498825
Bromomethane	ND	J3	1.00	1	04/24/2025 14:49	WG2498825
Carbon tetrachloride	ND		0.250	1	04/24/2025 14:49	WG2498825
Chlorobenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
Chloroethane	ND	J3	1.00	1	04/24/2025 14:49	WG2498825
Chloroform	ND		1.00	1	04/24/2025 14:49	WG2498825
Chloromethane	ND	C3 J3	1.00	1	04/24/2025 14:49	WG2498825
Dibromochloromethane	ND		1.00	1	04/24/2025 14:49	WG2498825
Dibromomethane	ND		1.00	1	04/24/2025 14:49	WG2498825
Dichlorodifluoromethane	ND	J3	1.00	1	04/24/2025 14:49	WG2498825
Dichlorofluoromethane	ND		1.00	1	04/24/2025 14:49	WG2498825
Ethyl ether	ND		1.00	1	04/24/2025 14:49	WG2498825
Ethylbenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
Hexachloro-1,3-butadiene	ND		0.250	1	04/24/2025 14:49	WG2498825
Isopropylbenzene	ND	J3	1.00	1	04/24/2025 14:49	WG2498825
Methyl tert-butyl ether	ND		1.00	1	04/24/2025 14:49	WG2498825
Methylene Chloride	ND		1.00	1	04/24/2025 14:49	WG2498825
Naphthalene	ND		1.00	1	04/24/2025 14:49	WG2498825
Styrene	ND		1.00	1	04/24/2025 14:49	WG2498825
Tetrachloroethene	ND		1.00	1	04/24/2025 14:49	WG2498825
Tetrahydrofuran	ND	C3	5.00	1	04/26/2025 09:34	WG2499929
Toluene	ND		1.00	1	04/24/2025 14:49	WG2498825
Trichloroethene	ND	J3	0.100	1	04/24/2025 14:49	WG2498825
Trichlorofluoromethane	ND		1.00	1	04/24/2025 14:49	WG2498825
Vinyl chloride	ND	J3	0.0500	1	04/24/2025 14:49	WG2498825

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Xylenes, Total	ND		2.00	1	04/24/2025 14:49	WG2498825
cis-1,2-Dichloroethene	ND		0.100	1	04/24/2025 14:49	WG2498825
cis-1,3-Dichloropropene	ND		0.500	1	04/24/2025 14:49	WG2498825
n-Butylbenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
n-Propylbenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
o-Chlorotoluene	ND		1.00	1	04/24/2025 14:49	WG2498825
p-Chlorotoluene	ND		1.00	1	04/24/2025 14:49	WG2498825
p-Isopropyltoluene	ND		1.00	1	04/24/2025 14:49	WG2498825
sec-Butylbenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
tert-Butylbenzene	ND		1.00	1	04/24/2025 14:49	WG2498825
trans-1,2-Dichloroethene	ND		1.00	1	04/24/2025 14:49	WG2498825
trans-1,3-Dichloropropene	ND		1.00	1	04/24/2025 14:49	WG2498825
(S) 1,2-Dichloroethane-d4	*107*			*70.0-130*	*04/24/2025 14:49*	WG2498825
(S) 1,2-Dichloroethane-d4	*84.5*			*70.0-130*	*04/26/2025 09:34*	WG2499929
(S) Toluene-d8	*99.7*			*75.0-131*	*04/24/2025 14:49*	WG2498825
(S) Toluene-d8	*112*			*75.0-131*	*04/26/2025 09:34*	WG2499929
(S) 4-Bromofluorobenzene	*99.6*			*67.0-138*	*04/24/2025 14:49*	WG2498825
(S) 4-Bromofluorobenzene	*96.8*			*67.0-138*	*04/26/2025 09:34*	WG2499929

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	7.12	su
Specific Conductance (on site)	1.893	mmhos/cm
Temperature (on-site)	13.3	Deg. C
Turbidity (on-site)	25.1	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-186	mV

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	757		20.0	1	04/21/2025 11:09	WG2495882

Sample Narrative:

L1848860-02 WG2495882: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	176		1.00	5	04/18/2025 02:52	WG2493080
Nitrate	ND		1.00	1	04/18/2025 00:11	WG2493080
Sulfate	25.3		5.00	1	04/22/2025 02:15	WG2493080

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/27/2025 00:53	WG2495742

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
TOC	17.0		1.00	1	04/18/2025 14:28	WG2493859

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ethane	ND		0.00120	1	04/22/2025 10:30	WG2495726
Ethene	ND		0.00120	1	04/22/2025 10:30	WG2495726
Methane	32.3		0.00287	10	04/22/2025 15:15	WG2497196

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/24/2025 15:51	WG2498825
1,1,1-Trichloroethane	ND		1.00	1	04/24/2025 15:51	WG2498825
1,1,2,2-Tetrachloroethane	ND	C3	0.500	1	04/24/2025 15:51	WG2498825
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/24/2025 15:51	WG2498825
1,1,2-Trichloroethane	ND		0.750	1	04/24/2025 15:51	WG2498825
1,1-Dichloroethane	ND		1.00	1	04/24/2025 15:51	WG2498825
1,1-Dichloroethene	ND	J3	1.00	1	04/24/2025 15:51	WG2498825
1,1-Dichloropropene	ND		1.00	1	04/24/2025 15:51	WG2498825
1,2,3-Trichlorobenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
1,2,3-Trichloropropane	ND		1.00	1	04/24/2025 15:51	WG2498825

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
1,2,4-Trimethylbenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/24/2025 15:51	WG2498825
1,2-Dibromoethane	ND		1.00	1	04/24/2025 15:51	WG2498825
1,2-Dichlorobenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
1,2-Dichloroethane	0.615		0.250	1	04/24/2025 15:51	WG2498825
1,2-Dichloropropane	ND		1.00	1	04/24/2025 15:51	WG2498825
1,3,5-Trimethylbenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
1,3-Dichlorobenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
1,3-Dichloropropane	ND		1.00	1	04/24/2025 15:51	WG2498825
1,4-Dichlorobenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
2,2-Dichloropropane	ND	C3 J3 J4	1.00	1	04/24/2025 15:51	WG2498825
2-Butanone (MEK)	ND	C3	10.0	1	04/24/2025 15:51	WG2498825
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/24/2025 15:51	WG2498825
Acetone	ND		10.0	1	04/24/2025 15:51	WG2498825
Allyl chloride	ND		1.00	1	04/24/2025 15:51	WG2498825
Benzene	ND		0.500	1	04/24/2025 15:51	WG2498825
Bromobenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
Bromochloromethane	ND		1.00	1	04/24/2025 15:51	WG2498825
Bromodichloromethane	ND		1.00	1	04/24/2025 15:51	WG2498825
Bromoform	ND		1.00	1	04/24/2025 15:51	WG2498825
Bromomethane	ND	J3	1.00	1	04/24/2025 15:51	WG2498825
Carbon tetrachloride	ND		0.250	1	04/24/2025 15:51	WG2498825
Chlorobenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
Chloroethane	ND	J3	1.00	1	04/24/2025 15:51	WG2498825
Chloroform	ND		1.00	1	04/24/2025 15:51	WG2498825
Chloromethane	ND	C3 J3	1.00	1	04/24/2025 15:51	WG2498825
Dibromochloromethane	ND		1.00	1	04/24/2025 15:51	WG2498825
Dibromomethane	ND		1.00	1	04/24/2025 15:51	WG2498825
Dichlorodifluoromethane	ND	J3	1.00	1	04/24/2025 15:51	WG2498825
Dichlorofluoromethane	5.08		1.00	1	04/24/2025 15:51	WG2498825
Ethyl ether	30.0	E	1.00	1	04/24/2025 15:51	WG2498825
Ethylbenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
Hexachloro-1,3-butadiene	ND		0.250	1	04/24/2025 15:51	WG2498825
Isopropylbenzene	ND	J3	1.00	1	04/24/2025 15:51	WG2498825
Methyl tert-butyl ether	ND		1.00	1	04/24/2025 15:51	WG2498825
Methylene Chloride	ND		1.00	1	04/24/2025 15:51	WG2498825
Naphthalene	ND		1.00	1	04/24/2025 15:51	WG2498825
Styrene	ND		1.00	1	04/24/2025 15:51	WG2498825
Tetrachloroethene	ND		1.00	1	04/24/2025 15:51	WG2498825
Tetrahydrofuran	ND	C3	5.00	1	04/26/2025 09:54	WG2499929
Toluene	ND		1.00	1	04/24/2025 15:51	WG2498825
Trichloroethene	ND	J3	0.100	1	04/24/2025 15:51	WG2498825
Trichlorofluoromethane	ND		1.00	1	04/24/2025 15:51	WG2498825
Vinyl chloride	0.513	J3	0.0500	1	04/24/2025 15:51	WG2498825
Xylenes, Total	ND		2.00	1	04/24/2025 15:51	WG2498825
cis-1,2-Dichloroethene	ND		0.100	1	04/24/2025 15:51	WG2498825
cis-1,3-Dichloropropene	ND		0.500	1	04/24/2025 15:51	WG2498825
n-Butylbenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
n-Propylbenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
o-Chlorotoluene	ND		1.00	1	04/24/2025 15:51	WG2498825
p-Chlorotoluene	ND		1.00	1	04/24/2025 15:51	WG2498825
p-Isopropyltoluene	ND		1.00	1	04/24/2025 15:51	WG2498825
sec-Butylbenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
tert-Butylbenzene	ND		1.00	1	04/24/2025 15:51	WG2498825
trans-1,2-Dichloroethene	ND		1.00	1	04/24/2025 15:51	WG2498825

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
trans-1,3-Dichloropropene	ND		1.00	1	04/24/2025 15:51	WG2498825
(S) 1,2-Dichloroethane-d4	*113*			*70.0-130*	*04/24/2025 15:51*	WG2498825
(S) 1,2-Dichloroethane-d4	*84.2*			*70.0-130*	*04/26/2025 09:54*	WG2499929
(S) Toluene-d8	*101*			*75.0-131*	*04/24/2025 15:51*	WG2498825
(S) Toluene-d8	*112*			*75.0-131*	*04/26/2025 09:54*	WG2499929
(S) 4-Bromofluorobenzene	*99.4*			*67.0-138*	*04/24/2025 15:51*	WG2498825
(S) 4-Bromofluorobenzene	*96.9*			*67.0-138*	*04/26/2025 09:54*	WG2499929

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	7.43	su
Specific Conductance (on site)	0.638	mmhos/cm
Temperature (on-site)	9.1	Deg. C
Turbidity (on-site)	23	NTU
Dissolved Oxygen (on-site)	0.1	mg/l
eH/ORP (On Site)	-132	mV

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	249		20.0	1	04/21/2025 11:16	WG2495882

Sample Narrative:

L1848860-03 WG2495882: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	21.1		1.00	1	04/18/2025 00:24	WG2493080
Nitrate	ND		1.00	1	04/18/2025 00:24	WG2493080
Sulfate	16.9		5.00	1	04/22/2025 02:28	WG2493080

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/21/2025 03:14	WG2495771

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
TOC	1.20		1.00	1	04/18/2025 15:31	WG2493859

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ethane	ND		0.00120	1	04/22/2025 10:36	WG2495726
Ethene	ND		0.00120	1	04/22/2025 10:36	WG2495726
Methane	1.82		0.000678	1	04/22/2025 10:36	WG2495726

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/24/2025 16:38	WG2498825
1,1,1-Trichloroethane	ND		1.00	1	04/24/2025 16:38	WG2498825
1,1,2,2-Tetrachloroethane	ND	C3	0.500	1	04/24/2025 16:38	WG2498825
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/24/2025 16:38	WG2498825
1,1,2-Trichloroethane	ND		0.750	1	04/24/2025 16:38	WG2498825
1,1-Dichloroethane	4.59		1.00	1	04/24/2025 16:38	WG2498825
1,1-Dichloroethene	ND	J3	1.00	1	04/24/2025 16:38	WG2498825
1,1-Dichloropropene	ND		1.00	1	04/24/2025 16:38	WG2498825
1,2,3-Trichlorobenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
1,2,3-Trichloropropane	ND		1.00	1	04/24/2025 16:38	WG2498825

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
1,2,4-Trimethylbenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/24/2025 16:38	WG2498825
1,2-Dibromoethane	ND		1.00	1	04/24/2025 16:38	WG2498825
1,2-Dichlorobenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
1,2-Dichloroethane	ND		0.250	1	04/24/2025 16:38	WG2498825
1,2-Dichloropropane	ND		1.00	1	04/24/2025 16:38	WG2498825
1,3,5-Trimethylbenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
1,3-Dichlorobenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
1,3-Dichloropropane	ND		1.00	1	04/24/2025 16:38	WG2498825
1,4-Dichlorobenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
2,2-Dichloropropane	ND	C3 J3 J4	1.00	1	04/24/2025 16:38	WG2498825
2-Butanone (MEK)	ND	C3	10.0	1	04/24/2025 16:38	WG2498825
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/24/2025 16:38	WG2498825
Acetone	ND		10.0	1	04/24/2025 16:38	WG2498825
Allyl chloride	ND		1.00	1	04/24/2025 16:38	WG2498825
Benzene	ND		0.500	1	04/24/2025 16:38	WG2498825
Bromobenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
Bromochloromethane	ND		1.00	1	04/24/2025 16:38	WG2498825
Bromodichloromethane	ND		1.00	1	04/24/2025 16:38	WG2498825
Bromoform	ND		1.00	1	04/24/2025 16:38	WG2498825
Bromomethane	ND	J3	1.00	1	04/24/2025 16:38	WG2498825
Carbon tetrachloride	ND		0.250	1	04/24/2025 16:38	WG2498825
Chlorobenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
Chloroethane	ND	J3	1.00	1	04/24/2025 16:38	WG2498825
Chloroform	ND		1.00	1	04/24/2025 16:38	WG2498825
Chloromethane	ND	C3 J3	1.00	1	04/24/2025 16:38	WG2498825
Dibromochloromethane	ND		1.00	1	04/24/2025 16:38	WG2498825
Dibromomethane	ND		1.00	1	04/24/2025 16:38	WG2498825
Dichlorodifluoromethane	9.26	J3	1.00	1	04/24/2025 16:38	WG2498825
Dichlorofluoromethane	21.9		1.00	1	04/24/2025 16:38	WG2498825
Ethyl ether	20.5		1.00	1	04/24/2025 16:38	WG2498825
Ethylbenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
Hexachloro-1,3-butadiene	ND		0.250	1	04/24/2025 16:38	WG2498825
Isopropylbenzene	ND	J3	1.00	1	04/24/2025 16:38	WG2498825
Methyl tert-butyl ether	1.11		1.00	1	04/24/2025 16:38	WG2498825
Methylene Chloride	ND		1.00	1	04/24/2025 16:38	WG2498825
Naphthalene	ND		1.00	1	04/24/2025 16:38	WG2498825
Styrene	ND		1.00	1	04/24/2025 16:38	WG2498825
Tetrachloroethene	ND		1.00	1	04/24/2025 16:38	WG2498825
Tetrahydrofuran	6.23	C3	5.00	1	04/26/2025 10:14	WG2499929
Toluene	ND		1.00	1	04/24/2025 16:38	WG2498825
Trichloroethene	ND	J3	0.100	1	04/24/2025 16:38	WG2498825
Trichlorofluoromethane	ND		1.00	1	04/24/2025 16:38	WG2498825
Vinyl chloride	ND	J3	0.0500	1	04/24/2025 16:38	WG2498825
Xylenes, Total	ND		2.00	1	04/24/2025 16:38	WG2498825
cis-1,2-Dichloroethene	ND		0.100	1	04/24/2025 16:38	WG2498825
cis-1,3-Dichloropropene	ND		0.500	1	04/24/2025 16:38	WG2498825
n-Butylbenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
n-Propylbenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
o-Chlorotoluene	ND		1.00	1	04/24/2025 16:38	WG2498825
p-Chlorotoluene	ND		1.00	1	04/24/2025 16:38	WG2498825
p-Isopropyltoluene	ND		1.00	1	04/24/2025 16:38	WG2498825
sec-Butylbenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
tert-Butylbenzene	ND		1.00	1	04/24/2025 16:38	WG2498825
trans-1,2-Dichloroethene	ND		1.00	1	04/24/2025 16:38	WG2498825

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
trans-1,3-Dichloropropene	ND		1.00	1	04/24/2025 16:38	WG2498825
(S) 1,2-Dichloroethane-d4	*126*			*70.0-130*	*04/24/2025 16:38*	WG2498825
(S) 1,2-Dichloroethane-d4	*83.9*			*70.0-130*	*04/26/2025 10:14*	WG2499929
(S) Toluene-d8	*96.9*			*75.0-131*	*04/24/2025 16:38*	WG2498825
(S) Toluene-d8	*112*			*75.0-131*	*04/26/2025 10:14*	WG2499929
(S) 4-Bromofluorobenzene	*97.0*			*67.0-138*	*04/24/2025 16:38*	WG2498825
(S) 4-Bromofluorobenzene	*95.7*			*67.0-138*	*04/26/2025 10:14*	WG2499929

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	7.34	su
Specific Conductance (on site)	0.937	mmhos/cm
Temperature (on-site)	9.2	Deg. C
Turbidity (on-site)	0.2	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-174	mV

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	415		20.0	1	04/21/2025 11:24	WG2495882

Sample Narrative:

L1848860-04 WG2495882: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	45.0		1.00	1	04/18/2025 00:38	WG2493080
Nitrate	ND		1.00	1	04/18/2025 00:38	WG2493080
Sulfate	18.0		5.00	1	04/22/2025 02:41	WG2493080

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/21/2025 03:21	WG2495771

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
TOC	2.11		1.00	1	04/18/2025 16:12	WG2493859

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ethane	ND		0.00120	1	04/22/2025 10:45	WG2495726
Ethene	ND		0.00120	1	04/22/2025 10:45	WG2495726
Methane	2.41		0.000678	1	04/22/2025 10:45	WG2495726

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/24/2025 16:59	WG2498825
1,1,1-Trichloroethane	ND		1.00	1	04/24/2025 16:59	WG2498825
1,1,2,2-Tetrachloroethane	ND	C3	0.500	1	04/24/2025 16:59	WG2498825
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/24/2025 16:59	WG2498825
1,1,2-Trichloroethane	ND		0.750	1	04/24/2025 16:59	WG2498825
1,1-Dichloroethane	8.70		1.00	1	04/24/2025 16:59	WG2498825
1,1-Dichloroethene	ND	J3	1.00	1	04/24/2025 16:59	WG2498825
1,1-Dichloropropene	ND		1.00	1	04/24/2025 16:59	WG2498825
1,2,3-Trichlorobenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
1,2,3-Trichloropropane	ND		1.00	1	04/24/2025 16:59	WG2498825

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
1,2,4-Trimethylbenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/24/2025 16:59	WG2498825
1,2-Dibromoethane	ND		1.00	1	04/24/2025 16:59	WG2498825
1,2-Dichlorobenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
1,2-Dichloroethane	ND		0.250	1	04/24/2025 16:59	WG2498825
1,2-Dichloropropane	ND		1.00	1	04/24/2025 16:59	WG2498825
1,3,5-Trimethylbenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
1,3-Dichlorobenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
1,3-Dichloropropane	ND		1.00	1	04/24/2025 16:59	WG2498825
1,4-Dichlorobenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
2,2-Dichloropropane	ND	C3 J3 J4	1.00	1	04/24/2025 16:59	WG2498825
2-Butanone (MEK)	ND	C3	10.0	1	04/24/2025 16:59	WG2498825
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/24/2025 16:59	WG2498825
Acetone	ND		10.0	1	04/24/2025 16:59	WG2498825
Allyl chloride	ND		1.00	1	04/24/2025 16:59	WG2498825
Benzene	ND		0.500	1	04/24/2025 16:59	WG2498825
Bromobenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
Bromochloromethane	ND		1.00	1	04/24/2025 16:59	WG2498825
Bromodichloromethane	ND		1.00	1	04/24/2025 16:59	WG2498825
Bromoform	ND		1.00	1	04/24/2025 16:59	WG2498825
Bromomethane	ND	J3	1.00	1	04/24/2025 16:59	WG2498825
Carbon tetrachloride	ND		0.250	1	04/24/2025 16:59	WG2498825
Chlorobenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
Chloroethane	ND	J3	1.00	1	04/24/2025 16:59	WG2498825
Chloroform	ND		1.00	1	04/24/2025 16:59	WG2498825
Chloromethane	ND	C3 J3	1.00	1	04/24/2025 16:59	WG2498825
Dibromochloromethane	ND		1.00	1	04/24/2025 16:59	WG2498825
Dibromomethane	ND		1.00	1	04/24/2025 16:59	WG2498825
Dichlorodifluoromethane	3.87	J3	1.00	1	04/24/2025 16:59	WG2498825
Dichlorofluoromethane	14.5		1.00	1	04/24/2025 16:59	WG2498825
Ethyl ether	24.8		1.00	1	04/24/2025 16:59	WG2498825
Ethylbenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
Hexachloro-1,3-butadiene	ND		0.250	1	04/24/2025 16:59	WG2498825
Isopropylbenzene	ND	J3	1.00	1	04/24/2025 16:59	WG2498825
Methyl tert-butyl ether	ND		1.00	1	04/24/2025 16:59	WG2498825
Methylene Chloride	ND		1.00	1	04/24/2025 16:59	WG2498825
Naphthalene	ND		1.00	1	04/24/2025 16:59	WG2498825
Styrene	ND		1.00	1	04/24/2025 16:59	WG2498825
Tetrachloroethene	ND		1.00	1	04/24/2025 16:59	WG2498825
Tetrahydrofuran	ND	C3	5.00	1	04/26/2025 10:34	WG2499929
Toluene	ND		1.00	1	04/24/2025 16:59	WG2498825
Trichloroethene	ND	J3	0.100	1	04/24/2025 16:59	WG2498825
Trichlorofluoromethane	ND		1.00	1	04/24/2025 16:59	WG2498825
Vinyl chloride	0.683	J3	0.0500	1	04/24/2025 16:59	WG2498825
Xylenes, Total	ND		2.00	1	04/24/2025 16:59	WG2498825
cis-1,2-Dichloroethene	1.00		0.100	1	04/24/2025 16:59	WG2498825
cis-1,3-Dichloropropene	ND		0.500	1	04/24/2025 16:59	WG2498825
n-Butylbenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
n-Propylbenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
o-Chlorotoluene	ND		1.00	1	04/24/2025 16:59	WG2498825
p-Chlorotoluene	ND		1.00	1	04/24/2025 16:59	WG2498825
p-Isopropyltoluene	ND		1.00	1	04/24/2025 16:59	WG2498825
sec-Butylbenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
tert-Butylbenzene	ND		1.00	1	04/24/2025 16:59	WG2498825
trans-1,2-Dichloroethene	ND		1.00	1	04/24/2025 16:59	WG2498825

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
trans-1,3-Dichloropropene	ND		1.00	1	04/24/2025 16:59	WG2498825
(S) 1,2-Dichloroethane-d4	*125*			*70.0-130*	*04/24/2025 16:59*	WG2498825
(S) 1,2-Dichloroethane-d4	*82.4*			*70.0-130*	*04/26/2025 10:34*	WG2499929
(S) Toluene-d8	*100*			*75.0-131*	*04/24/2025 16:59*	WG2498825
(S) Toluene-d8	*112*			*75.0-131*	*04/26/2025 10:34*	WG2499929
(S) 4-Bromofluorobenzene	*97.2*			*67.0-138*	*04/24/2025 16:59*	WG2498825
(S) 4-Bromofluorobenzene	*95.2*			*67.0-138*	*04/26/2025 10:34*	WG2499929

Method Blank (MB)

(MB) R4202835-2 04/21/25 10:39

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	ND		2.71	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1848930-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1848930-05 04/21/25 10:55 • (DUP) R4202835-3 04/21/25 11:03

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	288	288	1	0.207		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1850150-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1850150-03 04/21/25 14:11 • (DUP) R4202835-4 04/21/25 14:20

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	353	352	1	0.297		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R4202835-1 04/21/25 10:32

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	98.8	98.8	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R4201978-1 04/17/25 20:20

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloride	0.231		0.0519	1.00
Nitrate	ND		0.0227	0.100
Sulfate	0.301		0.0774	5.00

L1848845-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1848845-02 04/17/25 20:45 • (DUP) R4201978-3 04/18/25 03:32

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	4.25	4.31	1	1.50		15
Nitrate	ND	ND	1	0.000		15
Sulfate	11.3	5.86	1	63.7	P1	15

L1848854-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1848854-01 04/17/25 22:34 • (DUP) R4201978-5 04/18/25 03:59

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	15.4	15.4	1	0.0234		15
Nitrate	3.02	3.01	1	0.359		15
Sulfate	92.8	92.3	1	0.556		15

Laboratory Control Sample (LCS)

(LCS) R4201978-2 04/17/25 20:32

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40.0	38.3	95.8	90.0-110	
Nitrate	8.00	7.56	94.5	90.0-110	
Sulfate	40.0	37.9	94.7	90.0-110	

L1848845-02 Original Sample (OS) • Matrix Spike (MS)

(OS) L1848845-02 04/17/25 20:45 • (MS) R4201978-4 04/18/25 03:46

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	40.0	4.25	42.5	95.7	1	90.0-110	
Nitrate	8.00	ND	7.53	94.1	1	90.0-110	
Sulfate	40.0	11.3	42.8	78.8	1	90.0-110	J6

L1848854-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848854-01 04/17/25 22:34 • (MS) R4201978-6 04/18/25 04:13 • (MSD) R4201978-7 04/18/25 04:26

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	40.0	15.4	55.1	53.9	99.3	96.2	1	90.0-110			2.29	15
Nitrate	8.00	3.02	11.1	10.8	101	97.5	1	90.0-110	E	E	2.34	15
Sulfate	40.0	92.8	118	118	62.1	63.1	1	90.0-110	E J6	E J6	0.341	15

Method Blank (MB)

(MB) R4205831-1 04/27/25 00:14

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Nitrate-Nitrite	ND		0.0197	0.100

Laboratory Control Sample (LCS)

(LCS) R4205831-2 04/27/25 00:15

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Nitrate-Nitrite	2.50	2.52	101	90.0-110	

L1848713-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848713-03 04/27/25 00:24 • (MS) R4205831-3 04/27/25 00:29 • (MSD) R4205831-4 04/27/25 00:30

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.60	2.58	102	101	1	90.0-110			0.772	20

L1848713-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848713-04 04/27/25 00:32 • (MS) R4205831-5 04/27/25 00:33 • (MSD) R4205831-6 04/27/25 00:34

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.43	2.50	94.6	97.4	1	90.0-110			2.84	20

Method Blank (MB)

(MB) R4202706-1 04/21/25 03:09

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Nitrate-Nitrite	0.0200		0.0197	0.100

Laboratory Control Sample (LCS)

(LCS) R4202706-2 04/21/25 03:12

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Nitrate-Nitrite	2.50	2.55	102	90.0-110	

L1848860-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848860-03 04/21/25 03:14 • (MS) R4202706-3 04/21/25 03:16 • (MSD) R4202706-4 04/21/25 03:19

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.60	2.53	104	101	1	90.0-110			2.73	20

L1848860-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848860-04 04/21/25 03:21 • (MS) R4202706-5 04/21/25 03:23 • (MSD) R4202706-6 04/21/25 03:26

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.61	2.66	105	107	1	90.0-110			1.86	20

Method Blank (MB)

(MB) R4201911-2 04/18/25 09:06

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TOC	ND		0.102	1.00

L1848844-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1848844-03 04/18/25 11:25 • (DUP) R4201911-5 04/18/25 11:46

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC	8.32	8.34	1	0.240		20

L1848860-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1848860-03 04/18/25 15:31 • (DUP) R4201911-6 04/18/25 15:51

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC	1.20	1.27	1	5.66		20

Laboratory Control Sample (LCS)

(LCS) R4201911-1 04/18/25 08:48

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TOC	25.0	24.5	98.0	85.0-115	

L1848844-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848844-02 04/18/25 10:14 • (MS) R4201911-3 04/18/25 10:39 • (MSD) R4201911-4 04/18/25 11:04

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TOC	25.0	1.54	25.3	25.6	95.2	96.1	1	85.0-115			0.825	20

L1848948-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848948-03 04/18/25 17:27 • (MS) R4201911-7 04/18/25 17:54 • (MSD) R4201911-8 04/18/25 18:21

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TOC	25.0	6.83	29.4	29.7	90.2	91.6	1	85.0-115			1.15	20

Method Blank (MB)

(MB) R4203276-2 04/22/25 09:12

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Ethane	ND		0.000296	0.00129
Ethene	ND		0.000422	0.00127
Methane	ND		0.000287	0.000678

L1848854-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1848854-03 04/22/25 10:22 • (DUP) R4203276-3 04/22/25 11:50

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ethane	ND	ND	1	0.000		20
Ethene	ND	ND	1	0.000		20
Methane	ND	ND	1	0.000		20

L1849211-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1849211-01 04/22/25 12:30 • (DUP) R4203276-4 04/22/25 13:47

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ethane	ND	ND	1	0.000		20
Ethene	ND	ND	1	0.000		20
Methane	ND	ND	1	0.000		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4203276-1 04/22/25 09:04 • (LCSD) R4203276-7 04/22/25 14:38

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Ethane	0.129	0.122	0.121	94.6	93.8	85.0-115			0.823	20
Ethene	0.127	0.123	0.122	96.9	96.1	85.0-115			0.816	20
Methane	0.0678	0.0654	0.0659	96.5	97.2	85.0-115			0.762	20

L1849211-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849211-03 04/22/25 12:43 • (MS) R4203276-5 04/22/25 13:51 • (MSD) R4203276-6 04/22/25 14:01

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ethane	0.129	ND	0.134	0.133	104	103	1	85.0-115			0.749	20
Ethene	0.127	0.00865	0.140	0.139	103	103	1	85.0-115			0.717	20
Methane	0.0678	0.0376	0.105	0.105	99.4	99.4	1	85.0-115			0.000	20

Method Blank (MB)

(MB) R4203333-2 04/22/25 15:10

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Methane	ND		0.000287	0.000678

L1848860-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1848860-02 04/22/25 15:15 • (DUP) R4203333-3 04/22/25 15:29

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Methane	32.3	32.6	10	0.924		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4203333-1 04/22/25 15:05 • (LCSD) R4203333-4 04/22/25 15:34

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Methane	0.0678	0.0676	0.0704	99.7	104	85.0-115			4.06	20

Method Blank (MB)

(MB) R4205005-3 04/24/25 10:29

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0302	0.100
1,1,2-Trichloroethane	ND		0.0239	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	0.500
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromochloromethane	ND		0.0245	0.100
Dibromomethane	ND		0.0300	0.200

Method Blank (MB)

(MB) R4205005-3 04/24/25 10:29

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorodifluoromethane	ND		0.0644	0.200
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	0.250
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Vinyl chloride	ND		0.0462	0.0500
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
o-Chlorotoluene	ND		0.0346	0.100
p-Chlorotoluene	ND		0.0180	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 1,2-Dichloroethane-d4	*94.6*			*70.0-130*
(S) Toluene-d8	*104*			*75.0-131*
(S) 4-Bromofluorobenzene	*98.4*			*67.0-138*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4205005-1 04/24/25 09:06 • (LCSD) R4205005-2 04/24/25 09:27

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	4.96	4.61	99.2	92.2	74.0-129			7.31	20
1,1,1-Trichloroethane	5.00	4.77	4.26	95.4	85.2	69.0-126			11.3	20
1,1,2,2-Tetrachloroethane	5.00	3.49	3.99	69.8	79.8	68.0-128			13.4	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4205005-1 04/24/25 09:06 • (LCSD) R4205005-2 04/24/25 09:27

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,2-Trichloro-1,2,2-trifluoroethane	5.00	5.45	4.56	109	91.2	61.0-139			17.8	20
1,1,2-Trichloroethane	5.00	5.56	4.96	111	99.2	78.0-123			11.4	20
1,1-Dichloroethane	5.00	4.81	4.35	96.2	87.0	70.0-127			10.0	20
1,1-Dichloroethene	5.00	4.69	3.78	93.8	75.6	65.0-131		J3	21.5	20
1,1-Dichloropropene	5.00	5.59	5.27	112	105	73.0-125			5.89	20
1,2,3-Trichlorobenzene	5.00	5.22	4.89	104	97.8	59.0-139			6.53	20
1,2,3-Trichloropropane	5.00	5.26	5.01	105	100	67.0-129			4.87	20
1,2,4-Trichlorobenzene	5.00	5.55	5.00	111	100	62.0-137			10.4	20
1,2,4-Trimethylbenzene	5.00	5.96	5.28	119	106	70.0-126			12.1	20
1,2-Dibromo-3-Chloropropane	5.00	4.51	3.79	90.2	75.8	59.0-130			17.3	20
1,2-Dibromoethane	5.00	5.46	4.89	109	97.8	74.0-128			11.0	20
1,2-Dichlorobenzene	5.00	5.43	4.85	109	97.0	76.0-124			11.3	20
1,2-Dichloroethane	5.00	4.59	4.01	91.8	80.2	65.0-131			13.5	20
1,2-Dichloropropane	5.00	5.19	4.44	104	88.8	74.0-125			15.6	20
1,3,5-Trimethylbenzene	5.00	5.62	5.08	112	102	73.0-127			10.1	20
1,3-Dichlorobenzene	5.00	5.83	5.17	117	103	76.0-125			12.0	20
1,3-Dichloropropane	5.00	5.64	4.83	113	96.6	80.0-125			15.5	20
1,4-Dichlorobenzene	5.00	5.36	4.93	107	98.6	77.0-121			8.36	20
2,2-Dichloropropane	5.00	2.77	4.18	55.4	83.6	59.0-135	J4	J3	40.6	20
2-Butanone (MEK)	25.0	17.7	16.5	70.8	66.0	30.0-160			7.02	24
4-Methyl-2-pentanone (MIBK)	25.0	21.6	18.2	86.4	72.8	56.0-143			17.1	20
Acetone	25.0	23.9	21.9	95.6	87.6	10.0-160			8.73	31
Allyl chloride	25.0	25.3	24.6	101	98.4	70.0-131			2.81	20
Benzene	5.00	5.56	4.99	111	99.8	70.0-123			10.8	20
Bromobenzene	5.00	5.95	4.99	119	99.8	73.0-121			17.6	20
Bromochloromethane	5.00	5.60	4.97	112	99.4	77.0-128			11.9	20
Bromodichloromethane	5.00	4.87	4.29	97.4	85.8	73.0-121			12.7	20
Bromoform	5.00	4.85	4.26	97.0	85.2	64.0-132			13.0	20
Bromomethane	5.00	4.66	3.54	93.2	70.8	56.0-147		J3	27.3	20
Carbon tetrachloride	5.00	4.70	4.24	94.0	84.8	66.0-128			10.3	20
Chlorobenzene	5.00	5.61	4.76	112	95.2	76.0-128			16.4	20
Chloroethane	5.00	4.61	3.70	92.2	74.0	61.0-134		J3	21.9	20
Chloroform	5.00	6.03	5.05	121	101	72.0-123			17.7	20
Chloromethane	5.00	3.67	2.95	73.4	59.0	51.0-138		J3	21.8	20
Dibromochloromethane	5.00	4.84	4.34	96.8	86.8	74.0-127			10.9	20
Dibromomethane	5.00	5.24	5.02	105	100	75.0-122			4.29	20
Dichlorodifluoromethane	5.00	5.42	3.93	108	78.6	43.0-156		J3	31.9	20
Dichlorofluoromethane	5.00	4.83	3.97	96.6	79.4	65.0-137			19.5	20
Ethyl ether	5.00	4.69	4.01	93.8	80.2	64.0-137			15.6	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4205005-1 04/24/25 09:06 • (LCSD) R4205005-2 04/24/25 09:27

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Ethylbenzene	5.00	5.44	4.79	109	95.8	74.0-126			12.7	20
Hexachloro-1,3-butadiene	5.00	5.77	5.18	115	104	57.0-150			10.8	20
Isopropylbenzene	5.00	5.67	4.41	113	88.2	72.0-127		J3	25.0	20
Methyl tert-butyl ether	5.00	5.35	4.83	107	96.6	66.0-132			10.2	20
Methylene Chloride	5.00	5.79	4.98	116	99.6	68.0-123			15.0	20
Naphthalene	5.00	4.53	4.12	90.6	82.4	59.0-130			9.48	20
Styrene	5.00	5.78	5.02	116	100	72.0-127			14.1	20
Tetrachloroethene	5.00	5.51	4.99	110	99.8	70.0-136			9.90	20
Toluene	5.00	5.73	4.93	115	98.6	75.0-121			15.0	20
Trichloroethene	5.00	6.26	4.77	125	95.4	76.0-126		J3	27.0	20
Trichlorofluoromethane	5.00	4.69	3.95	93.8	79.0	61.0-142			17.1	20
Vinyl chloride	5.00	4.71	3.55	94.2	71.0	63.0-134		J3	28.1	20
Xylenes, Total	15.0	17.6	15.3	117	102	72.0-127			14.0	20
cis-1,2-Dichloroethene	5.00	5.33	4.71	107	94.2	73.0-125			12.4	20
cis-1,3-Dichloropropene	5.00	5.06	4.84	101	96.8	76.0-127			4.44	20
n-Butylbenzene	5.00	5.93	5.47	119	109	68.0-135			8.07	20
n-Propylbenzene	5.00	5.91	5.27	118	105	74.0-126			11.4	20
o-Chlorotoluene	5.00	5.12	4.89	102	97.8	75.0-124			4.60	20
p-Chlorotoluene	5.00	5.97	5.33	119	107	75.0-124			11.3	20
p-Isopropyltoluene	5.00	5.77	5.10	115	102	72.0-133			12.3	20
sec-Butylbenzene	5.00	6.14	5.35	123	107	74.0-130			13.8	20
tert-Butylbenzene	5.00	5.77	5.06	115	101	75.0-127			13.1	20
trans-1,2-Dichloroethene	5.00	5.09	4.36	102	87.2	71.0-125			15.4	20
trans-1,3-Dichloropropene	5.00	5.16	4.98	103	99.6	73.0-127			3.55	20
(S) 1,2-Dichloroethane-d4				*89.8*	*88.0*	*70.0-130*				
(S) Toluene-d8				*103*	*100*	*75.0-131*				
(S) 4-Bromofluorobenzene				*97.2*	*96.8*	*67.0-138*				

Method Blank (MB)

(MB) R4209757-3 04/26/25 08:53

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Tetrahydrofuran	ND		0.141	0.500
(S) 1,2-Dichloroethane-d4	*81.9*			*70.0-130*
(S) Toluene-d8	*112*			*75.0-131*
(S) 4-Bromofluorobenzene	*94.3*			*67.0-138*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4209757-1 04/26/25 07:33 • (LCSD) R4209757-2 04/26/25 07:53

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Tetrahydrofuran	5.00	3.09	2.58	61.8	51.6	37.0-146			18.0	24
(S) 1,2-Dichloroethane-d4				*86.0*	*85.2*	*70.0-130*				
(S) Toluene-d8				*110*	*111*	*75.0-131*				
(S) 4-Bromofluorobenzene				*95.7*	*96.3*	*67.0-138*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
MNA Parameters

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program(DOD,RCRA,DW,etc):

Client Project #
200

Lab Project #
WMELKRIVMN-00023

Collected by (print):
Mike Howe

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

No. of Cntrs

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	NO2,SO4,Cl,Alk 125mlHDPE-NoPres	NO2NO3 HOLD 250mlHDPE-H2SO4	RSK175LI. 40mlAmb-HCl	TOC 250mlAmb-HCl	V8260ULLC 40mlAmb-HCl	V8260ULLC 40mlAmb-HCl-Blk					Remarks	Sample # (lab only)
TB		GW				1						X						
P-302C	G	GW		4/16/25	1415	9	X	X	X	X	X							-01
~~P-304C~~		GW				9	X	X	X	X	X							-02
~~P-313C~~		GW				9	X	X	X	X	X							
~~P-331L~~		GW				9	X	X	X	X	X							
~~P-323L~~		GW				9	X	X	X	X	X							
~~P-325C~~		GW				9	X	X	X	X	X							
~~P-325L~~		GW				9	X	X	X	X	X							
P-334L	G	GW		4/16/25	1115	9	X	X	X	X	X							-03
P-338L	G	GW		4/16/25	1030	9	X	X	X	X	X							-04

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

SDG # L1848860
A029

Acctnum: WMELKRIVMN
Template: T261646
Prelogin: P1144758
PM: 364 - T. Alan Harvill
PB: 4/11/25 BK
Shipped Via: FedEX Priority

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 449924521464

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: (Yes) / No HCl / MeoH TBR	Date/Time
	4/16/25	1730	FedEx	1	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 11.4+1 °C Bottles Received: 27	If preservation required by Login: Date/Time
				1-2 to 4-16	PH - 10874093 TBC - 3227A333
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 4-17-25 Time: 0900	Hold: Condition: NCF / OK
			Deegan G		

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.:

Sample Point: P302C (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: L1845810

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 16 25	13:55	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Filter Device: Y or (O) 0.45 µ or _____ µ (circle or fill in)

Purging Device: C
Sampling Device: C
X-Other: _____

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Filter Type:

A-In-line Disposable, B-Pressure, C-Vacuum, X-Other _____

Sample Tube Type:

A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other _____

WELL DATA

Well Elevation (at TOC): 97063 (ft/msl)
Depth to Water (DTW) (from TOC): 21.10 (ft)
Groundwater Elevation (site datum, from TOC): 94953 (ft/msl)
Total Well Depth (from TOC): _____ (ft)
Stick Up (from ground elevation): _____ (ft)
Casing ID: _____ (in)
Casing Material: _____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit L/M	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1410	0.4	7.30	1914	13.2		0.0		
1405		7.25	1882	12.9		0.0		
1410		7.19	1887	13.0		0.0		
1415		7.12	1893	13.3	25.1	0.0	-186	
Suggested range for 3 consec. readings or site Permit/State requirements:		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Bubble

Stabilization Data Fields are Optional *(i.e. sampling stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

FIELD COMMENTS

Sample Appearance: _____ Odor: N Color: N Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4.16.25	Mike Hart		ALL

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | |

Sample Point: P 3 3 4 4 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only Lab ID: LKH 9820

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04/16/25	10:55				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing Flow Cell and Tubing Flow Cell Vols Purged. Mark changes; record field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated: (Y) or N — Filter Device: Y or (N) — 0.45 µ or _____ µ (circle or fill in)

Purging Device: C
Sampling Device: C
X-Other: _____

A- Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper/Bottle

Filter Type: _____
Sample Tube Type: _____

A-In-line Disposable; B-Pressure; C-Vacuum; X-Other _____

A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other: _____

WELL DATA

Well Elevation (at TOC): 9722.2 (ft/msl) — Depth to Water (DTW) (from TOC): 26.67 (ft) — Groundwater Elevation (site datum, from TOC): 945.55 (ft/msl)

Total Well Depth (from TOC): _____ (ft) — Stick Up (from ground elevation): _____ (ft) — Casing ID: _____ (in) — Casing Material: _____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Flow Unit: CPM	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
11:00	0.4 1st	7.54 1st	581 1st	9.1		0.6		
11:05	2nd	7.56 2nd	637 2nd	9.1		0.2		
11:10	3rd	7.45 3rd	640 3rd	9.1		0.0		
11:15	4th	7.43 4th	638 4th	9.1	23	0.1	-132	
:								
:								
:								
:								
:								
:								
:								
Suggested range for 3 consec. readings or state Permit/Site requirements:		+/- 0.2	+/- 3%			+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: _____ Units _____

Final Field Readings are required (i.e. record field measurements, final stabilized readings, pairing sample readings before sampling for all field parameters required by State/Permit/Site.

FIELD COMMENTS

Sample Appearance: _____ Odor: None Color: N/A Other: _____

Weather Conditions (required daily, or as conditions change): _____ Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4.16.25	Mike Hare		ALS

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | |

Sample Point: P3854 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form(s) that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only Work ID: LR458960

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 16 25	10:16				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Filter Device: Y or (N) [0.45 µ] or [ ] µ (circle or fill in)

Purging Device: C
A- Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper Bottle

Sampling Device: C

X-Other:

Filter Type:

A-In-line Disposable; B-Pressure; C-Vacuum; X-Other:

Sample Tube Type:

A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other:

WELL DATA

Well Elevation (at TOC): 961.13 (ft msl)

Depth to Water (DTW) (from TOC): 14.83 (ft)

Groundwater Elevation (site datum, from TOC): (ft msl)

Total Well Depth (from TOC): (ft)

Stick Up (from ground elevation): (ft)

Casing ID: (in)

Casing Material:

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Purge Unit	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
10:15	04	1st 7.35	1st 935	93		02		
10:20		2nd 7.34	2nd 936	93		02		
10:25		3rd 7.34	3rd 936	93		01		
10:30		4th 7.34	4th 937	92	0.2	01.0	-174	
Suggested range for 3 consec. readings or user Permit/State requirements:		+/- 0.2	+/- 3%	+/-	+/-	+/- 10%	+/- 25 mV	0.01 ft

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM Site or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

Sample Appearance: Odor: None Color: None Other:

Weather Conditions (required daily, or as conditions change): Direction/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4.16.25	Mike Hay		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

ANALYTICAL REPORT

May 13, 2025

Revised Report

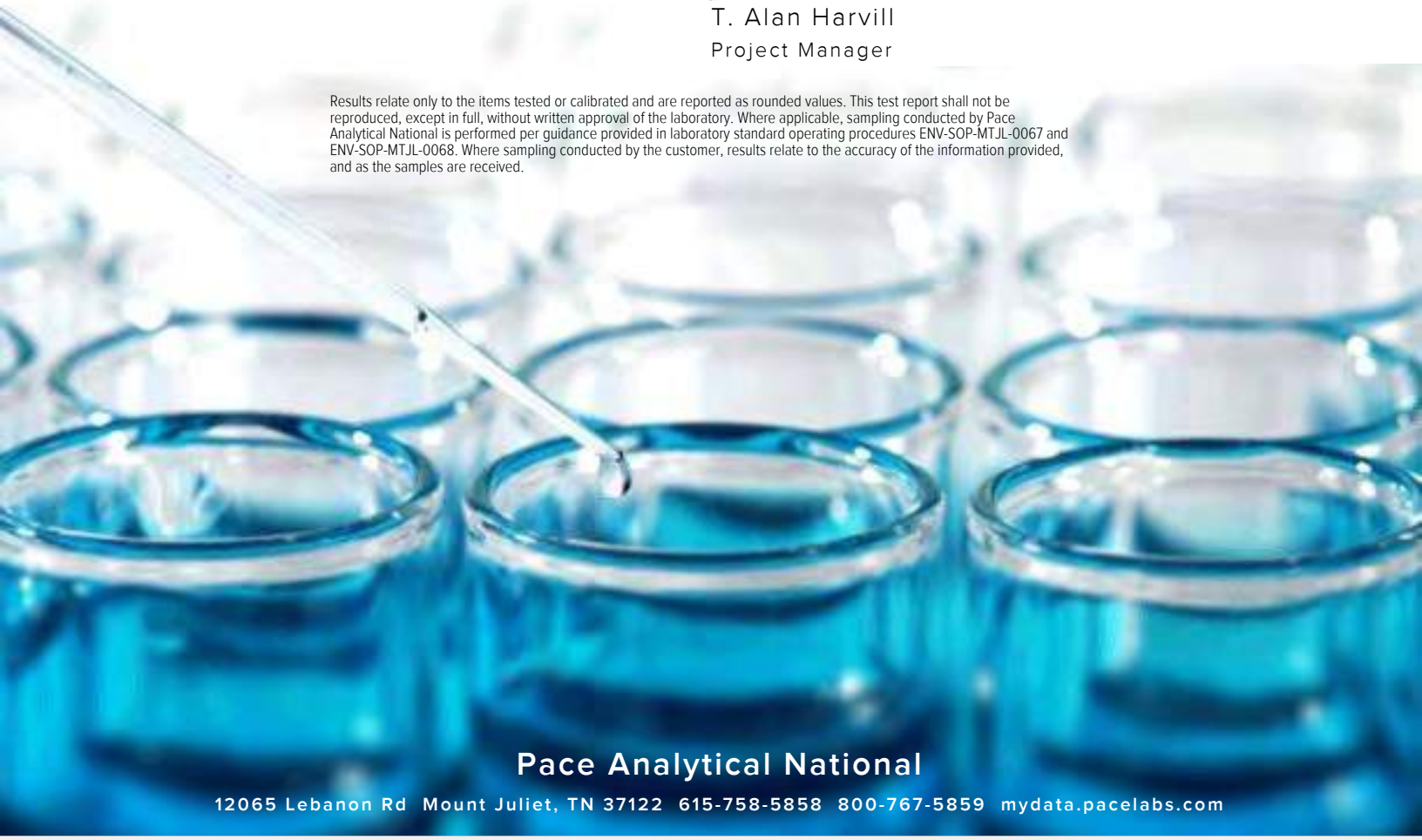
Elk River Landfill

Sample Delivery Group:	L1849382
Samples Received:	04/18/2025
Project Number:	200
Description:	MNA Parameters
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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TB L1849382-01

			Collected by	Collected date/time	Received date/time	
				04/17/25 00:00	04/18/25 08:45	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498839	1	04/26/25 01:12	04/26/25 01:12	JAH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2501712	1	04/30/25 05:41	04/30/25 05:41	ADM	Mt. Juliet, TN

P-342L L1849382-02

			Collected by	Collected date/time	Received date/time	
				04/17/25 10:50	04/18/25 08:45	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG2498394	1	04/23/25 16:55	04/23/25 16:55	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2493967	1	04/19/25 01:26	04/19/25 01:26	ZSA	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2495771	1	04/21/25 04:31	04/21/25 04:31	CAT	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2495896	1	04/21/25 21:26	04/21/25 21:26	ASH	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2497381	1	04/23/25 18:22	04/23/25 18:22	KHM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498839	1	04/26/25 05:33	04/26/25 05:33	JAH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2501712	1	04/30/25 06:21	04/30/25 06:21	ADM	Mt. Juliet, TN

P-304C L1849382-03

			Collected by	Collected date/time	Received date/time	
				04/17/25 09:30	04/18/25 08:45	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG2498394	1	04/23/25 17:01	04/23/25 17:01	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2493967	1	04/19/25 01:39	04/19/25 01:39	ZSA	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2495773	1	04/21/25 04:50	04/21/25 04:50	CAT	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2495896	1	04/21/25 21:46	04/21/25 21:46	ASH	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2497381	1	04/23/25 19:43	04/23/25 19:43	KHM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498839	1	04/26/25 05:53	04/26/25 05:53	JAH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2501712	1	04/30/25 06:41	04/30/25 06:41	ADM	Mt. Juliet, TN

P-313C L1849382-04

			Collected by	Collected date/time	Received date/time	
				04/17/25 08:40	04/18/25 08:45	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG2498394	1	04/23/25 17:08	04/23/25 17:08	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2493967	1	04/19/25 01:52	04/19/25 01:52	ZSA	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2495773	1	04/21/25 04:57	04/21/25 04:57	CAT	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2495896	2	04/21/25 22:05	04/21/25 22:05	ASH	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2497381	1	04/23/25 19:47	04/23/25 19:47	KHM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498839	1	04/26/25 06:13	04/26/25 06:13	JAH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2501712	1	04/30/25 07:01	04/30/25 07:01	ADM	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Report Revision History

Level II Report - Version 1: 05/01/25 15:51

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

revised to include Field data.

Sample Delivery Group (SDG) Narrative

Analyzed from headspace vial.

Batch	Method	Lab Sample ID
WG2501712	8260D	L1849382-01

Wet Chemistry by Method 300.0

The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).

Batch	Lab Sample ID	Analytes
WG2493967	(MS) R4201985-4	Chloride
WG2493967	(MSD) R4201985-5	Chloride
WG2493967	(MS) R4201985-7	Chloride

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2493967	(MS) R4201985-4, (MSD) R4201985-5	Chloride and Sulfate

The sample concentration is too high to evaluate accurate spike recoveries.

Batch	Lab Sample ID	Analytes
WG2493967	(MS) R4201985-7	Chloride

Wet Chemistry by Method 9060A

RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Batch	Lab Sample ID	Analytes
WG2495896	(DUP) R4202983-5	TOC

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2498839	L1849382-01	1,1-Dichloroethene, 1,2-Dichloroethane, 2-Butanone (MEK), Bromomethane, Chloromethane, Dichlorodifluoromethane, Ethyl ether and Tetrahydrofuran
WG2498839	L1849382-02	1,1-Dichloroethene, 1,2-Dichloroethane, 2-Butanone (MEK), Bromomethane, Chloromethane, Dichlorodifluoromethane, Ethyl ether and Tetrahydrofuran
WG2498839	L1849382-03	1,1-Dichloroethene, 1,2-Dichloroethane, 2-Butanone (MEK), Bromomethane, Chloromethane, Dichlorodifluoromethane, Ethyl ether and Tetrahydrofuran
WG2498839	L1849382-04	1,1-Dichloroethene, 1,2-Dichloroethane, 2-Butanone (MEK), Bromomethane, Chloromethane, Dichlorodifluoromethane, Ethyl ether and Tetrahydrofuran

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG2498839	(LCSD) R4206160-2, L1849382-01, 02, 03, 04	Bromomethane

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/26/2025 01:12	WG2498839
1,1,1-Trichloroethane	ND		1.00	1	04/26/2025 01:12	WG2498839
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/26/2025 01:12	WG2498839
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/26/2025 01:12	WG2498839
1,1,2-Trichloroethane	ND		0.750	1	04/26/2025 01:12	WG2498839
1,1-Dichloroethane	ND		1.00	1	04/26/2025 01:12	WG2498839
1,1-Dichloroethene	ND	C3	1.00	1	04/26/2025 01:12	WG2498839
1,1-Dichloropropene	ND		1.00	1	04/26/2025 01:12	WG2498839
1,2,3-Trichlorobenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
1,2,3-Trichloropropane	ND		1.00	1	04/26/2025 01:12	WG2498839
1,2,4-Trichlorobenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
1,2,4-Trimethylbenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/26/2025 01:12	WG2498839
1,2-Dibromoethane	ND		1.00	1	04/26/2025 01:12	WG2498839
1,2-Dichlorobenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
1,2-Dichloroethane	ND	C3	0.250	1	04/26/2025 01:12	WG2498839
1,2-Dichloropropane	ND		1.00	1	04/26/2025 01:12	WG2498839
1,3,5-Trimethylbenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
1,3-Dichlorobenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
1,3-Dichloropropane	ND		1.00	1	04/26/2025 01:12	WG2498839
1,4-Dichlorobenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
2,2-Dichloropropane	ND		1.00	1	04/26/2025 01:12	WG2498839
2-Butanone (MEK)	ND	C3	10.0	1	04/26/2025 01:12	WG2498839
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/26/2025 01:12	WG2498839
Acetone	ND		10.0	1	04/30/2025 05:41	WG2501712
Allyl chloride	ND		1.00	1	04/26/2025 01:12	WG2498839
Benzene	ND		0.500	1	04/26/2025 01:12	WG2498839
Bromobenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
Bromochloromethane	ND		1.00	1	04/26/2025 01:12	WG2498839
Bromodichloromethane	ND		1.00	1	04/26/2025 01:12	WG2498839
Bromoform	ND		1.00	1	04/26/2025 01:12	WG2498839
Bromomethane	ND	C3 J3	1.00	1	04/26/2025 01:12	WG2498839
Carbon tetrachloride	ND		0.250	1	04/26/2025 01:12	WG2498839
Chlorobenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
Chloroethane	ND		1.00	1	04/26/2025 01:12	WG2498839
Chloroform	ND		1.00	1	04/26/2025 01:12	WG2498839
Chloromethane	ND	C3	1.00	1	04/26/2025 01:12	WG2498839
Dibromochloromethane	ND		1.00	1	04/26/2025 01:12	WG2498839
Dibromomethane	ND		1.00	1	04/26/2025 01:12	WG2498839
Dichlorodifluoromethane	ND	C3	1.00	1	04/26/2025 01:12	WG2498839
Dichlorofluoromethane	ND		1.00	1	04/26/2025 01:12	WG2498839
Ethyl ether	ND	C3	1.00	1	04/26/2025 01:12	WG2498839
Ethylbenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
Hexachloro-1,3-butadiene	ND		0.250	1	04/26/2025 01:12	WG2498839
Isopropylbenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
Methyl tert-butyl ether	ND		1.00	1	04/26/2025 01:12	WG2498839
Methylene Chloride	ND		1.00	1	04/26/2025 01:12	WG2498839
Naphthalene	ND		1.00	1	04/26/2025 01:12	WG2498839
Styrene	ND		1.00	1	04/26/2025 01:12	WG2498839
Tetrachloroethene	ND		1.00	1	04/26/2025 01:12	WG2498839
Tetrahydrofuran	ND	C3	5.00	1	04/26/2025 01:12	WG2498839
Toluene	ND		1.00	1	04/26/2025 01:12	WG2498839
Trichloroethene	ND		0.100	1	04/26/2025 01:12	WG2498839
Trichlorofluoromethane	ND		1.00	1	04/26/2025 01:12	WG2498839
Vinyl chloride	ND		0.0500	1	04/30/2025 05:41	WG2501712

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Xylenes, Total	ND		2.00	1	04/26/2025 01:12	WG2498839
cis-1,2-Dichloroethene	ND		0.100	1	04/26/2025 01:12	WG2498839
cis-1,3-Dichloropropene	ND		0.500	1	04/26/2025 01:12	WG2498839
n-Butylbenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
n-Propylbenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
o-Chlorotoluene	ND		1.00	1	04/26/2025 01:12	WG2498839
p-Chlorotoluene	ND		1.00	1	04/26/2025 01:12	WG2498839
p-Isopropyltoluene	ND		1.00	1	04/26/2025 01:12	WG2498839
sec-Butylbenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
tert-Butylbenzene	ND		1.00	1	04/26/2025 01:12	WG2498839
trans-1,2-Dichloroethene	ND		1.00	1	04/26/2025 01:12	WG2498839
trans-1,3-Dichloropropene	ND		1.00	1	04/26/2025 01:12	WG2498839
(S) 1,2-Dichloroethane-d4	*83.8*			*70.0-130*	*04/26/2025 01:12*	WG2498839
(S) 1,2-Dichloroethane-d4	*95.7*			*70.0-130*	*04/30/2025 05:41*	WG2501712
(S) Toluene-d8	*113*			*75.0-131*	*04/26/2025 01:12*	WG2498839
(S) Toluene-d8	*119*			*75.0-131*	*04/30/2025 05:41*	WG2501712
(S) 4-Bromofluorobenzene	*96.8*			*67.0-138*	*04/26/2025 01:12*	WG2498839
(S) 4-Bromofluorobenzene	*94.9*			*67.0-138*	*04/30/2025 05:41*	WG2501712

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	7.68	su
Specific Conductance (on site)	383	umhos/cm
Temperature (on-site)	7.9	Deg. C
Turbidity (on-site)	0.5	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-179	mV

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	186		20.0	1	04/23/2025 16:55	WG2498394

Sample Narrative:

L1849382-02 WG2498394: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	1.70		1.00	1	04/19/2025 01:26	WG2493967
Nitrate	ND		1.00	1	04/19/2025 01:26	WG2493967
Sulfate	12.3		5.00	1	04/19/2025 01:26	WG2493967

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/21/2025 04:31	WG2495771

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
TOC	1.20		1.00	1	04/21/2025 21:26	WG2495896

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ethane	ND		0.00120	1	04/23/2025 18:22	WG2497381
Ethene	ND		0.00120	1	04/23/2025 18:22	WG2497381
Methane	0.0409		0.000678	1	04/23/2025 18:22	WG2497381

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/26/2025 05:33	WG2498839
1,1,1-Trichloroethane	ND		1.00	1	04/26/2025 05:33	WG2498839
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/26/2025 05:33	WG2498839
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/26/2025 05:33	WG2498839
1,1,2-Trichloroethane	ND		0.750	1	04/26/2025 05:33	WG2498839
1,1-Dichloroethane	ND		1.00	1	04/26/2025 05:33	WG2498839
1,1-Dichloroethene	ND	C3	1.00	1	04/26/2025 05:33	WG2498839
1,1-Dichloropropene	ND		1.00	1	04/26/2025 05:33	WG2498839
1,2,3-Trichlorobenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
1,2,3-Trichloropropane	ND		1.00	1	04/26/2025 05:33	WG2498839

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
1,2,4-Trimethylbenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/26/2025 05:33	WG2498839
1,2-Dibromoethane	ND		1.00	1	04/26/2025 05:33	WG2498839
1,2-Dichlorobenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
1,2-Dichloroethane	ND	C3	0.250	1	04/26/2025 05:33	WG2498839
1,2-Dichloropropane	ND		1.00	1	04/26/2025 05:33	WG2498839
1,3,5-Trimethylbenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
1,3-Dichlorobenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
1,3-Dichloropropane	ND		1.00	1	04/26/2025 05:33	WG2498839
1,4-Dichlorobenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
2,2-Dichloropropane	ND		1.00	1	04/26/2025 05:33	WG2498839
2-Butanone (MEK)	ND	C3	10.0	1	04/26/2025 05:33	WG2498839
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/26/2025 05:33	WG2498839
Acetone	ND		10.0	1	04/30/2025 06:21	WG2501712
Allyl chloride	ND		1.00	1	04/26/2025 05:33	WG2498839
Benzene	ND		0.500	1	04/26/2025 05:33	WG2498839
Bromobenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
Bromochloromethane	ND		1.00	1	04/26/2025 05:33	WG2498839
Bromodichloromethane	ND		1.00	1	04/26/2025 05:33	WG2498839
Bromoform	ND		1.00	1	04/26/2025 05:33	WG2498839
Bromomethane	ND	C3 J3	1.00	1	04/26/2025 05:33	WG2498839
Carbon tetrachloride	ND		0.250	1	04/26/2025 05:33	WG2498839
Chlorobenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
Chloroethane	ND		1.00	1	04/26/2025 05:33	WG2498839
Chloroform	ND		1.00	1	04/26/2025 05:33	WG2498839
Chloromethane	ND	C3	1.00	1	04/26/2025 05:33	WG2498839
Dibromochloromethane	ND		1.00	1	04/26/2025 05:33	WG2498839
Dibromomethane	ND		1.00	1	04/26/2025 05:33	WG2498839
Dichlorodifluoromethane	ND	C3	1.00	1	04/26/2025 05:33	WG2498839
Dichlorofluoromethane	ND		1.00	1	04/26/2025 05:33	WG2498839
Ethyl ether	ND	C3	1.00	1	04/26/2025 05:33	WG2498839
Ethylbenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
Hexachloro-1,3-butadiene	ND		0.250	1	04/26/2025 05:33	WG2498839
Isopropylbenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
Methyl tert-butyl ether	ND		1.00	1	04/26/2025 05:33	WG2498839
Methylene Chloride	ND		1.00	1	04/26/2025 05:33	WG2498839
Naphthalene	ND		1.00	1	04/26/2025 05:33	WG2498839
Styrene	ND		1.00	1	04/26/2025 05:33	WG2498839
Tetrachloroethene	ND		1.00	1	04/26/2025 05:33	WG2498839
Tetrahydrofuran	ND	C3	5.00	1	04/26/2025 05:33	WG2498839
Toluene	ND		1.00	1	04/26/2025 05:33	WG2498839
Trichloroethene	ND		0.100	1	04/26/2025 05:33	WG2498839
Trichlorofluoromethane	ND		1.00	1	04/26/2025 05:33	WG2498839
Vinyl chloride	ND		0.0500	1	04/30/2025 06:21	WG2501712
Xylenes, Total	ND		2.00	1	04/26/2025 05:33	WG2498839
cis-1,2-Dichloroethene	ND		0.100	1	04/26/2025 05:33	WG2498839
cis-1,3-Dichloropropene	ND		0.500	1	04/26/2025 05:33	WG2498839
n-Butylbenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
n-Propylbenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
o-Chlorotoluene	ND		1.00	1	04/26/2025 05:33	WG2498839
p-Chlorotoluene	ND		1.00	1	04/26/2025 05:33	WG2498839
p-Isopropyltoluene	ND		1.00	1	04/26/2025 05:33	WG2498839
sec-Butylbenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
tert-Butylbenzene	ND		1.00	1	04/26/2025 05:33	WG2498839
trans-1,2-Dichloroethene	ND		1.00	1	04/26/2025 05:33	WG2498839

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
trans-1,3-Dichloropropene	ND		1.00	1	04/26/2025 05:33	WG2498839
(S) 1,2-Dichloroethane-d4	*83.1*			*70.0-130*	*04/26/2025 05:33*	WG2498839
(S) 1,2-Dichloroethane-d4	*96.7*			*70.0-130*	*04/30/2025 06:21*	WG2501712
(S) Toluene-d8	*110*			*75.0-131*	*04/26/2025 05:33*	WG2498839
(S) Toluene-d8	*116*			*75.0-131*	*04/30/2025 06:21*	WG2501712
(S) 4-Bromofluorobenzene	*95.8*			*67.0-138*	*04/26/2025 05:33*	WG2498839
(S) 4-Bromofluorobenzene	*87.2*			*67.0-138*	*04/30/2025 06:21*	WG2501712

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	6.89	su
Specific Conductance (on site)	1133	umhos/cm
Temperature (on-site)	10.6	Deg. C
Turbidity (on-site)	26	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-124	mV

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	556		20.0	1	04/23/2025 17:01	WG2498394

Sample Narrative:

L1849382-03 WG2498394: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	26.6		1.00	1	04/19/2025 01:39	WG2493967
Nitrate	ND		1.00	1	04/19/2025 01:39	WG2493967
Sulfate	29.5		5.00	1	04/19/2025 01:39	WG2493967

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/21/2025 04:50	WG2495773

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
TOC	6.11		1.00	1	04/21/2025 21:46	WG2495896

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ethane	ND		0.00120	1	04/23/2025 19:43	WG2497381
Ethene	ND		0.00120	1	04/23/2025 19:43	WG2497381
Methane	0.0871		0.000678	1	04/23/2025 19:43	WG2497381

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/26/2025 05:53	WG2498839
1,1,1-Trichloroethane	ND		1.00	1	04/26/2025 05:53	WG2498839
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/26/2025 05:53	WG2498839
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/26/2025 05:53	WG2498839
1,1,2-Trichloroethane	ND		0.750	1	04/26/2025 05:53	WG2498839
1,1-Dichloroethane	ND		1.00	1	04/26/2025 05:53	WG2498839
1,1-Dichloroethene	ND	C3	1.00	1	04/26/2025 05:53	WG2498839
1,1-Dichloropropene	ND		1.00	1	04/26/2025 05:53	WG2498839
1,2,3-Trichlorobenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
1,2,3-Trichloropropane	ND		1.00	1	04/26/2025 05:53	WG2498839

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
1,2,4-Trimethylbenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/26/2025 05:53	WG2498839
1,2-Dibromoethane	ND		1.00	1	04/26/2025 05:53	WG2498839
1,2-Dichlorobenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
1,2-Dichloroethane	ND	C3	0.250	1	04/26/2025 05:53	WG2498839
1,2-Dichloropropane	ND		1.00	1	04/26/2025 05:53	WG2498839
1,3,5-Trimethylbenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
1,3-Dichlorobenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
1,3-Dichloropropane	ND		1.00	1	04/26/2025 05:53	WG2498839
1,4-Dichlorobenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
2,2-Dichloropropane	ND		1.00	1	04/26/2025 05:53	WG2498839
2-Butanone (MEK)	ND	C3	10.0	1	04/26/2025 05:53	WG2498839
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/26/2025 05:53	WG2498839
Acetone	ND		10.0	1	04/30/2025 06:41	WG2501712
Allyl chloride	ND		1.00	1	04/26/2025 05:53	WG2498839
Benzene	ND		0.500	1	04/26/2025 05:53	WG2498839
Bromobenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
Bromochloromethane	ND		1.00	1	04/26/2025 05:53	WG2498839
Bromodichloromethane	ND		1.00	1	04/26/2025 05:53	WG2498839
Bromoform	ND		1.00	1	04/26/2025 05:53	WG2498839
Bromomethane	ND	C3 J3	1.00	1	04/26/2025 05:53	WG2498839
Carbon tetrachloride	ND		0.250	1	04/26/2025 05:53	WG2498839
Chlorobenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
Chloroethane	ND		1.00	1	04/26/2025 05:53	WG2498839
Chloroform	ND		1.00	1	04/26/2025 05:53	WG2498839
Chloromethane	ND	C3	1.00	1	04/26/2025 05:53	WG2498839
Dibromochloromethane	ND		1.00	1	04/26/2025 05:53	WG2498839
Dibromomethane	ND		1.00	1	04/26/2025 05:53	WG2498839
Dichlorodifluoromethane	ND	C3	1.00	1	04/26/2025 05:53	WG2498839
Dichlorofluoromethane	ND		1.00	1	04/26/2025 05:53	WG2498839
Ethyl ether	4.86	C3	1.00	1	04/26/2025 05:53	WG2498839
Ethylbenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
Hexachloro-1,3-butadiene	ND		0.250	1	04/26/2025 05:53	WG2498839
Isopropylbenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
Methyl tert-butyl ether	ND		1.00	1	04/26/2025 05:53	WG2498839
Methylene Chloride	ND		1.00	1	04/26/2025 05:53	WG2498839
Naphthalene	ND		1.00	1	04/26/2025 05:53	WG2498839
Styrene	ND		1.00	1	04/26/2025 05:53	WG2498839
Tetrachloroethene	ND		1.00	1	04/26/2025 05:53	WG2498839
Tetrahydrofuran	ND	C3	5.00	1	04/26/2025 05:53	WG2498839
Toluene	ND		1.00	1	04/26/2025 05:53	WG2498839
Trichloroethene	0.106		0.100	1	04/26/2025 05:53	WG2498839
Trichlorofluoromethane	ND		1.00	1	04/26/2025 05:53	WG2498839
Vinyl chloride	ND		0.0500	1	04/30/2025 06:41	WG2501712
Xylenes, Total	ND		2.00	1	04/26/2025 05:53	WG2498839
cis-1,2-Dichloroethene	0.286		0.100	1	04/26/2025 05:53	WG2498839
cis-1,3-Dichloropropene	ND		0.500	1	04/26/2025 05:53	WG2498839
n-Butylbenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
n-Propylbenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
o-Chlorotoluene	ND		1.00	1	04/26/2025 05:53	WG2498839
p-Chlorotoluene	ND		1.00	1	04/26/2025 05:53	WG2498839
p-Isopropyltoluene	ND		1.00	1	04/26/2025 05:53	WG2498839
sec-Butylbenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
tert-Butylbenzene	ND		1.00	1	04/26/2025 05:53	WG2498839
trans-1,2-Dichloroethene	ND		1.00	1	04/26/2025 05:53	WG2498839

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
trans-1,3-Dichloropropene	ND		1.00	1	04/26/2025 05:53	WG2498839
(S) 1,2-Dichloroethane-d4	*83.4*			*70.0-130*	*04/26/2025 05:53*	WG2498839
(S) 1,2-Dichloroethane-d4	*95.3*			*70.0-130*	*04/30/2025 06:41*	WG2501712
(S) Toluene-d8	*111*			*75.0-131*	*04/26/2025 05:53*	WG2498839
(S) Toluene-d8	*119*			*75.0-131*	*04/30/2025 06:41*	WG2501712
(S) 4-Bromofluorobenzene	*96.0*			*67.0-138*	*04/26/2025 05:53*	WG2498839
(S) 4-Bromofluorobenzene	*89.3*			*67.0-138*	*04/30/2025 06:41*	WG2501712

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	6.95	su
Specific Conductance (on site)	1315	umhos/cm
Temperature (on-site)	9	Deg. C
Turbidity (on-site)	5	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-117	mV

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	544		20.0	1	04/23/2025 17:08	WG2498394

Sample Narrative:

L1849382-04 WG2498394: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	82.8		1.00	1	04/19/2025 01:52	WG2493967
Nitrate	ND		1.00	1	04/19/2025 01:52	WG2493967
Sulfate	19.5		5.00	1	04/19/2025 01:52	WG2493967

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/21/2025 04:57	WG2495773

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
TOC	4.47		1.00	2	04/21/2025 22:05	WG2495896

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ethane	ND		0.00120	1	04/23/2025 19:47	WG2497381
Ethene	ND		0.00120	1	04/23/2025 19:47	WG2497381
Methane	0.374		0.000678	1	04/23/2025 19:47	WG2497381

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/26/2025 06:13	WG2498839
1,1,1-Trichloroethane	ND		1.00	1	04/26/2025 06:13	WG2498839
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/26/2025 06:13	WG2498839
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/26/2025 06:13	WG2498839
1,1,2-Trichloroethane	ND		0.750	1	04/26/2025 06:13	WG2498839
1,1-Dichloroethane	2.62		1.00	1	04/26/2025 06:13	WG2498839
1,1-Dichloroethene	ND	C3	1.00	1	04/26/2025 06:13	WG2498839
1,1-Dichloropropene	ND		1.00	1	04/26/2025 06:13	WG2498839
1,2,3-Trichlorobenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
1,2,3-Trichloropropane	ND		1.00	1	04/26/2025 06:13	WG2498839

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
1,2,4-Trimethylbenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/26/2025 06:13	WG2498839
1,2-Dibromoethane	ND		1.00	1	04/26/2025 06:13	WG2498839
1,2-Dichlorobenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
1,2-Dichloroethane	ND	C3	0.250	1	04/26/2025 06:13	WG2498839
1,2-Dichloropropane	ND		1.00	1	04/26/2025 06:13	WG2498839
1,3,5-Trimethylbenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
1,3-Dichlorobenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
1,3-Dichloropropane	ND		1.00	1	04/26/2025 06:13	WG2498839
1,4-Dichlorobenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
2,2-Dichloropropane	ND		1.00	1	04/26/2025 06:13	WG2498839
2-Butanone (MEK)	ND	C3	10.0	1	04/26/2025 06:13	WG2498839
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/26/2025 06:13	WG2498839
Acetone	ND		10.0	1	04/30/2025 07:01	WG2501712
Allyl chloride	ND		1.00	1	04/26/2025 06:13	WG2498839
Benzene	ND		0.500	1	04/26/2025 06:13	WG2498839
Bromobenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
Bromochloromethane	ND		1.00	1	04/26/2025 06:13	WG2498839
Bromodichloromethane	ND		1.00	1	04/26/2025 06:13	WG2498839
Bromoform	ND		1.00	1	04/26/2025 06:13	WG2498839
Bromomethane	ND	C3 J3	1.00	1	04/26/2025 06:13	WG2498839
Carbon tetrachloride	ND		0.250	1	04/26/2025 06:13	WG2498839
Chlorobenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
Chloroethane	ND		1.00	1	04/26/2025 06:13	WG2498839
Chloroform	ND		1.00	1	04/26/2025 06:13	WG2498839
Chloromethane	ND	C3	1.00	1	04/26/2025 06:13	WG2498839
Dibromochloromethane	ND		1.00	1	04/26/2025 06:13	WG2498839
Dibromomethane	ND		1.00	1	04/26/2025 06:13	WG2498839
Dichlorodifluoromethane	ND	C3	1.00	1	04/26/2025 06:13	WG2498839
Dichlorofluoromethane	2.70		1.00	1	04/26/2025 06:13	WG2498839
Ethyl ether	10.2	C3	1.00	1	04/26/2025 06:13	WG2498839
Ethylbenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
Hexachloro-1,3-butadiene	ND		0.250	1	04/26/2025 06:13	WG2498839
Isopropylbenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
Methyl tert-butyl ether	ND		1.00	1	04/26/2025 06:13	WG2498839
Methylene Chloride	ND		1.00	1	04/26/2025 06:13	WG2498839
Naphthalene	ND		1.00	1	04/26/2025 06:13	WG2498839
Styrene	ND		1.00	1	04/26/2025 06:13	WG2498839
Tetrachloroethene	ND		1.00	1	04/26/2025 06:13	WG2498839
Tetrahydrofuran	ND	C3	5.00	1	04/26/2025 06:13	WG2498839
Toluene	ND		1.00	1	04/26/2025 06:13	WG2498839
Trichloroethene	0.106		0.100	1	04/26/2025 06:13	WG2498839
Trichlorofluoromethane	ND		1.00	1	04/26/2025 06:13	WG2498839
Vinyl chloride	ND		0.0500	1	04/30/2025 07:01	WG2501712
Xylenes, Total	ND		2.00	1	04/26/2025 06:13	WG2498839
cis-1,2-Dichloroethene	0.400		0.100	1	04/26/2025 06:13	WG2498839
cis-1,3-Dichloropropene	ND		0.500	1	04/26/2025 06:13	WG2498839
n-Butylbenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
n-Propylbenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
o-Chlorotoluene	ND		1.00	1	04/26/2025 06:13	WG2498839
p-Chlorotoluene	ND		1.00	1	04/26/2025 06:13	WG2498839
p-Isopropyltoluene	ND		1.00	1	04/26/2025 06:13	WG2498839
sec-Butylbenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
tert-Butylbenzene	ND		1.00	1	04/26/2025 06:13	WG2498839
trans-1,2-Dichloroethene	ND		1.00	1	04/26/2025 06:13	WG2498839

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
trans-1,3-Dichloropropene	ND		1.00	1	04/26/2025 06:13	WG2498839
(S) 1,2-Dichloroethane-d4	*85.2*			*70.0-130*	*04/26/2025 06:13*	WG2498839
(S) 1,2-Dichloroethane-d4	*96.4*			*70.0-130*	*04/30/2025 07:01*	WG2501712
(S) Toluene-d8	*111*			*75.0-131*	*04/26/2025 06:13*	WG2498839
(S) Toluene-d8	*124*			*75.0-131*	*04/30/2025 07:01*	WG2501712
(S) 4-Bromofluorobenzene	*96.3*			*67.0-138*	*04/26/2025 06:13*	WG2498839
(S) 4-Bromofluorobenzene	*90.4*			*67.0-138*	*04/30/2025 07:01*	WG2501712

Method Blank (MB)

(MB) R4204185-2 04/23/25 16:34

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	ND		2.71	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1850830-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1850830-01 04/23/25 16:43 • (DUP) R4204185-3 04/23/25 16:49

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	471	473	1	0.244		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1850867-09 Original Sample (OS) • Duplicate (DUP)

(OS) L1850867-09 04/23/25 18:58 • (DUP) R4204185-4 04/23/25 19:03

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	238	249	1	4.40		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R4204185-1 04/23/25 16:27

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	99.0	99.0	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R4201985-1 04/18/25 18:36

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloride	0.0523		0.0519	1.00
Nitrate	ND		0.0227	0.100
Sulfate	0.0778		0.0774	5.00

L1849327-06 Original Sample (OS) • Duplicate (DUP)

(OS) L1849327-06 04/18/25 20:44 • (DUP) R4201985-3 04/18/25 20:57

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Nitrate	ND	ND	1	7.58		15
Sulfate	18.8	18.5	1	1.40		15

L1849327-08 Original Sample (OS) • Duplicate (DUP)

(OS) L1849327-08 04/18/25 22:26 • (DUP) R4201985-6 04/18/25 22:39

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Nitrate	ND	ND	1	0.000		15
Sulfate	ND	ND	1	9.16		15

Laboratory Control Sample (LCS)

(LCS) R4201985-2 04/18/25 18:49

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40.0	39.9	99.8	90.0-110	
Nitrate	8.00	7.84	98.1	90.0-110	
Sulfate	40.0	40.3	101	90.0-110	

L1849327-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849327-06 04/18/25 20:44 • (MS) R4201985-4 04/18/25 21:10 • (MSD) R4201985-5 04/18/25 21:22

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	40.0	120	130	128	24.4	20.1	1	90.0-110	E J6	E J6	1.33	15
Nitrate	8.00	ND	7.83	7.74	93.3	92.1	1	90.0-110			1.18	15
Sulfate	40.0	18.8	53.4	52.8	86.6	85.0	1	90.0-110	J6	J6	1.20	15

L1849327-08 Original Sample (OS) • Matrix Spike (MS)

(OS) L1849327-08 04/18/25 22:26 • (MS) R4201985-7 04/18/25 22:52

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	40.0	841	674	0.000	1	90.0-110	E V
Nitrate	8.00	ND	7.48	93.5	1	90.0-110	
Sulfate	40.0	ND	39.3	94.7	1	90.0-110	

Method Blank (MB)

(MB) R4202706-1 04/21/25 03:09

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Nitrate-Nitrite	0.0200		0.0197	0.100

Laboratory Control Sample (LCS)

(LCS) R4202706-2 04/21/25 03:12

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Nitrate-Nitrite	2.50	2.55	102	90.0-110	

L1848860-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848860-03 04/21/25 03:14 • (MS) R4202706-3 04/21/25 03:16 • (MSD) R4202706-4 04/21/25 03:19

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.60	2.53	104	101	1	90.0-110			2.73	20

L1848860-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848860-04 04/21/25 03:21 • (MS) R4202706-5 04/21/25 03:23 • (MSD) R4202706-6 04/21/25 03:26

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.61	2.66	105	107	1	90.0-110			1.86	20

QUALITY CONTROL SUMMARY

L1849382-03,04

Method Blank (MB)

(MB) R4202703-1 04/21/25 04:45

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Nitrate-Nitrite	0.0230		0.0197	0.100

Laboratory Control Sample (LCS)

(LCS) R4202703-2 04/21/25 04:47

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Nitrate-Nitrite	2.50	2.56	102	90.0-110	

L1849382-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849382-03 04/21/25 04:50 • (MS) R4202703-3 04/21/25 04:52 • (MSD) R4202703-4 04/21/25 04:54

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.67	2.62	107	105	1	90.0-110			1.66	20

L1849382-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849382-04 04/21/25 04:57 • (MS) R4202703-5 04/21/25 04:59 • (MSD) R4202703-6 04/21/25 05:01

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.67	2.67	105	105	1	90.0-110			0.0374	20

Method Blank (MB)

(MB) R4202983-2 04/21/25 11:53

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TOC	0.141		0.102	1.00

L1849363-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1849363-02 04/21/25 15:54 • (DUP) R4202983-5 04/21/25 16:13

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC	ND	ND	1	30.3	P1	20

L1849367-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1849367-01 04/21/25 20:35 • (DUP) R4202983-8 04/21/25 20:52

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC	ND	ND	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R4202983-1 04/21/25 11:36

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TOC	25.0	25.7	103	85.0-115	

L1849366-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849366-03 04/21/25 19:35 • (MS) R4202983-6 04/21/25 19:56 • (MSD) R4202983-7 04/21/25 20:18

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TOC	25.0	2.75	28.6	28.6	103	103	1	85.0-115			0.140	20

Method Blank (MB)

(MB) R4204211-2 04/23/25 17:09

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Ethane	ND		0.000296	0.00129
Ethene	ND		0.000422	0.00127
Methane	ND		0.000287	0.000678

L1849314-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1849314-03 04/23/25 17:16 • (DUP) R4204211-3 04/23/25 18:13

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ethane	ND	ND	1	0.000		20
Ethene	ND	ND	1	0.000		20
Methane	ND	ND	1	0.000		20

L1849420-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1849420-04 04/23/25 21:23 • (DUP) R4204211-4 04/23/25 23:10

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ethane	ND	ND	1	0.000		20
Ethene	ND	ND	1	0.000		20
Methane	ND	ND	1	0.000		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4204211-1 04/23/25 17:05 • (LCSD) R4204211-9 04/24/25 00:10

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Ethane	0.129	0.121	0.119	93.8	92.2	85.0-115			1.67	20
Ethene	0.127	0.121	0.120	95.3	94.5	85.0-115			0.830	20
Methane	0.0678	0.0713	0.0708	105	104	85.0-115			0.704	20

L1849322-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849322-01 04/23/25 17:23 • (MS) R4204211-5 04/23/25 23:22 • (MSD) R4204211-6 04/23/25 23:38

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ethane	0.129	ND	0.125	0.123	96.9	95.3	1	85.0-115			1.61	20
Ethene	0.127	ND	0.124	0.122	97.6	96.1	1	85.0-115			1.63	20
Methane	0.0678	0.0202	0.0885	0.0866	101	97.9	1	85.0-115			2.17	20

L1849346-12 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849346-12 04/23/25 18:01 • (MS) R4204211-7 04/23/25 23:47 • (MSD) R4204211-8 04/24/25 00:05

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ethane	0.129	ND	0.126	0.125	97.7	96.9	1	85.0-115			0.797	20
Ethene	0.127	ND	0.125	0.123	98.4	96.9	1	85.0-115			1.61	20
Methane	0.0678	ND	0.0754	0.0748	111	110	1	85.0-115			0.799	20

Method Blank (MB)

(MB) R4206160-3 04/26/25 00:12

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0302	0.100
1,1,2-Trichloroethane	ND		0.0239	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Allyl chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	0.500
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromochloromethane	ND		0.0245	0.100
Dibromomethane	ND		0.0300	0.200
Dichlorodifluoromethane	ND		0.0644	0.200

Method Blank (MB)

(MB) R4206160-3 04/26/25 00:12

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	0.250
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
o-Chlorotoluene	ND		0.0346	0.100
p-Chlorotoluene	ND		0.0180	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 1,2-Dichloroethane-d4	*84.0*			*70.0-130*
(S) Toluene-d8	*111*			*75.0-131*
(S) 4-Bromofluorobenzene	*97.2*			*67.0-138*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4206160-1 04/25/25 22:32 • (LCSD) R4206160-2 04/25/25 22:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	4.99	5.10	99.8	102	74.0-129			2.18	20
1,1,1-Trichloroethane	5.00	4.14	4.17	82.8	83.4	69.0-126			0.722	20
1,1,2,2-Tetrachloroethane	5.00	4.60	4.65	92.0	93.0	68.0-128			1.08	20
1,1,2-Trichloro-1,2,2-trifluoroethane	5.00	4.46	4.55	89.2	91.0	61.0-139			2.00	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4206160-1 04/25/25 22:32 • (LCSD) R4206160-2 04/25/25 22:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,2-Trichloroethane	5.00	5.35	5.35	107	107	78.0-123			0.000	20
1,1-Dichloroethane	5.00	4.04	3.99	80.8	79.8	70.0-127			1.25	20
1,1-Dichloroethene	5.00	3.95	3.81	79.0	76.2	65.0-131			3.61	20
1,1-Dichloropropene	5.00	4.53	4.48	90.6	89.6	73.0-125			1.11	20
1,2,3-Trichlorobenzene	5.00	5.00	5.15	100	103	59.0-139			2.96	20
1,2,3-Trichloropropane	5.00	5.35	5.29	107	106	67.0-129			1.13	20
1,2,4-Trichlorobenzene	5.00	5.15	5.26	103	105	62.0-137			2.11	20
1,2,4-Trimethylbenzene	5.00	5.41	5.37	108	107	70.0-126			0.742	20
1,2-Dibromo-3-Chloropropane	5.00	4.22	4.26	84.4	85.2	59.0-130			0.943	20
1,2-Dibromoethane	5.00	5.26	5.34	105	107	74.0-128			1.51	20
1,2-Dichlorobenzene	5.00	5.51	5.39	110	108	76.0-124			2.20	20
1,2-Dichloroethane	5.00	3.64	3.73	72.8	74.6	65.0-131			2.44	20
1,2-Dichloropropane	5.00	4.01	4.01	80.2	80.2	74.0-125			0.000	20
1,3,5-Trimethylbenzene	5.00	5.24	5.24	105	105	73.0-127			0.000	20
1,3-Dichlorobenzene	5.00	5.73	5.81	115	116	76.0-125			1.39	20
1,3-Dichloropropane	5.00	5.24	5.30	105	106	80.0-125			1.14	20
1,4-Dichlorobenzene	5.00	5.65	5.64	113	113	77.0-121			0.177	20
2,2-Dichloropropane	5.00	4.00	4.05	80.0	81.0	59.0-135			1.24	20
2-Butanone (MEK)	25.0	15.8	15.7	63.2	62.8	30.0-160			0.635	24
4-Methyl-2-pentanone (MIBK)	25.0	21.0	21.3	84.0	85.2	56.0-143			1.42	20
Allyl chloride	25.0	23.3	23.3	93.2	93.2	70.0-131			0.000	20
Benzene	5.00	4.60	4.55	92.0	91.0	70.0-123			1.09	20
Bromobenzene	5.00	5.45	5.43	109	109	73.0-121			0.368	20
Bromochloromethane	5.00	5.40	5.38	108	108	77.0-128			0.371	20
Bromodichloromethane	5.00	4.07	4.20	81.4	84.0	73.0-121			3.14	20
Bromoform	5.00	4.28	4.54	85.6	90.8	64.0-132			5.90	20
Bromomethane	5.00	2.92	3.80	58.4	76.0	56.0-147		J3	26.2	20
Carbon tetrachloride	5.00	4.33	4.39	86.6	87.8	66.0-128			1.38	20
Chlorobenzene	5.00	5.66	5.63	113	113	76.0-128			0.531	20
Chloroethane	5.00	4.04	4.14	80.8	82.8	61.0-134			2.44	20
Chloroform	5.00	4.13	4.17	82.6	83.4	72.0-123			0.964	20
Chloromethane	5.00	2.83	2.81	56.6	56.2	51.0-138			0.709	20
Dibromochloromethane	5.00	4.94	5.19	98.8	104	74.0-127			4.94	20
Dibromomethane	5.00	4.27	4.39	85.4	87.8	75.0-122			2.77	20
Dichlorodifluoromethane	5.00	3.48	3.47	69.6	69.4	43.0-156			0.288	20
Dichlorofluoromethane	5.00	4.07	4.30	81.4	86.0	65.0-137			5.50	20
Ethyl ether	5.00	3.85	3.79	77.0	75.8	64.0-137			1.57	20
Ethylbenzene	5.00	5.66	5.76	113	115	74.0-126			1.75	20
Hexachloro-1,3-butadiene	5.00	4.06	4.18	81.2	83.6	57.0-150			2.91	20
Isopropylbenzene	5.00	5.68	5.64	114	113	72.0-127			0.707	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4206160-1 04/25/25 22:32 • (LCSD) R4206160-2 04/25/25 22:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Methyl tert-butyl ether	5.00	4.58	4.62	91.6	92.4	66.0-132			0.870	20
Methylene Chloride	5.00	4.37	4.41	87.4	88.2	68.0-123			0.911	20
Naphthalene	5.00	5.31	5.44	106	109	59.0-130			2.42	20
Styrene	5.00	5.39	5.51	108	110	72.0-127			2.20	20
Tetrachloroethene	5.00	5.77	5.68	115	114	70.0-136			1.57	20
Tetrahydrofuran	5.00	2.98	2.99	59.6	59.8	37.0-146			0.335	24
Toluene	5.00	5.68	5.72	114	114	75.0-121			0.702	20
Trichloroethene	5.00	5.03	4.88	101	97.6	76.0-126			3.03	20
Trichlorofluoromethane	5.00	4.02	3.93	80.4	78.6	61.0-142			2.26	20
Xylenes, Total	15.0	16.2	16.1	108	107	72.0-127			0.619	20
cis-1,2-Dichloroethene	5.00	4.69	4.76	93.8	95.2	73.0-125			1.48	20
cis-1,3-Dichloropropene	5.00	4.38	4.47	87.6	89.4	76.0-127			2.03	20
n-Butylbenzene	5.00	5.05	4.96	101	99.2	68.0-135			1.80	20
n-Propylbenzene	5.00	5.50	5.56	110	111	74.0-126			1.08	20
o-Chlorotoluene	5.00	5.57	5.31	111	106	75.0-124			4.78	20
p-Chlorotoluene	5.00	5.19	5.29	104	106	75.0-124			1.91	20
p-Isopropyltoluene	5.00	5.45	5.40	109	108	72.0-133			0.922	20
sec-Butylbenzene	5.00	5.33	5.26	107	105	74.0-130			1.32	20
tert-Butylbenzene	5.00	5.64	5.50	113	110	75.0-127			2.51	20
trans-1,2-Dichloroethene	5.00	4.43	4.54	88.6	90.8	71.0-125			2.45	20
trans-1,3-Dichloropropene	5.00	4.79	4.92	95.8	98.4	73.0-127			2.68	20
(S) 1,2-Dichloroethane-d4				*84.1*	*85.7*	*70.0-130*				
(S) Toluene-d8				*110*	*111*	*75.0-131*				
(S) 4-Bromofluorobenzene				*96.6*	*96.6*	*67.0-138*				

Method Blank (MB)

(MB) R4207364-3 04/29/25 22:07

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
Acetone	ND		1.46	2.00
Vinyl chloride	ND		0.0462	0.0500
(S) 1,2-Dichloroethane-d4	*94.0*			*70.0-130*
(S) Toluene-d8	*117*			*75.0-131*
(S) 4-Bromofluorobenzene	*90.4*			*67.0-138*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4207364-1 04/29/25 20:49 • (LCSD) R4207364-2 04/29/25 21:08

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
Acetone	25.0	24.5	23.7	98.0	94.8	10.0-160			3.32	31
Vinyl chloride	5.00	4.45	4.50	89.0	90.0	63.0-134			1.12	20
(S) 1,2-Dichloroethane-d4				*92.9*	*95.2*	*70.0-130*				
(S) Toluene-d8				*115*	*117*	*75.0-131*				
(S) 4-Bromofluorobenzene				*90.2*	*89.6*	*67.0-138*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J3	The associated batch QC was outside the established quality control range for precision.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
MNA Parameters

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program (DOD,RCRA,DW,etc):

Client Project #
200

Lab Project #
WMELKRIVMN-00023

Collected by (print):
M. E Hur

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

Analysis / Container / Preservative

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

SDG # **I162**

Acctnum: **WMELKRIVMN**
Template: **T261646**
Prelogin: **P1144758**
PM: **364 - T. Alan Harvill**
PB: **4/11/25 BK**
Shipped Via: **FedEx Priority**

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	NO2,SO4,CL,Alk 125mlHDPE-NoPres	NO2NO3 HOLD 250mlHDPE-H2SO4	RSK175LL 40mlAmb-HCl	TOC 250mlAmb-HCl	V8260ULLC 40mlAmb-HCl	V8260ULLC 40mlAmb-HCl-Blk	Remarks	Sample # (Lab only)
TB		GW				1						X		
~~P-302C~~ P342L		GW		4/17/25	1050	9	X	X	X	X	X			
P-304C		GW			0930	9	X	X	X	X	X			
P-313C		GW			0840	9	X	X	X	X	X			
~~P-333C~~		GW				9	X	X	X	X	X			
~~P-303C~~		GW				9	X	X	X	X	X			
~~P-325C~~		GW				9	X	X	X	X	X			
~~P-324C~~		GW				9	X	X	X	X	X			
~~P-331C~~		GW				9	X	X	X	X	X			
~~P-318C~~ ~~P-342L~~		GW				9	X	X	X	X	X			

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 4439 2451 5539

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N
RAD Screen <0.5 mR/hr:		Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No (HCl / MeoH) TBR
	4/17/25	1710	Fedex	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 2.0+0.4=2.4°C Bottles Received: 27
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 4/18/25 Time: 8:45

If ___ te/Time
PH – 18BCH2611
TRC – 4072A72

Hold:

Condition: NCF / OK

FIELD INFORMATION FORM

WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | | Sample Point: P 3 4 2 L (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: LIS-493857

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 17 25	1030				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment — Dedicated: (Y) or N

Purging Device: C
Sampling Device: C
X-Other:

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Filter Device: Y or (N) — 0.45 µ or ____ µ (circle or fill in)

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other ____

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: ____

WELL DATA

Well Elevation (at TOC): 947.27 (ft/msl)
Depth to Water (DTW) (from TOC): 2.15 (ft)
Groundwater Elevation (site datum, from TOC): 945.12 (ft/msl)
Total Well Depth (from TOC): ____ (ft)
Stick Up (from ground elevation): ____ (ft)
Casing ID: ____ (in)
Casing Material: ____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit (LPM)	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1035	0.4	1st 7.73	1st 3816	7.8		0.0		
1040		2nd 7.71	2nd 3787	7.8		0.0		
1045		3rd 7.68	3rd 3814	7.9		0.0		
1050		4th 7.68	3rd 3813	7.9	0.5	0.0	-179.	
Suggested range for 3 consec. readings or note Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ Units ____

Final Field Readings are required *(i.e. record field measurement, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site)*

Sample Appearance: ____ Odor: None Color: None Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/17/25	Mike Hay		ALS

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | | Sample Point: P3 0 4 C (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: L1549287

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 17 25	09:10				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Attach changes, w/ and field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Filter Device: (Y) or N — 0.45 µ or _____ µ (circle or fill in)

Purging Device: C
Sampling Device: C
X-Other: _____

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other _____

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: _____

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)
959.89 (ft msl)	6.88 (ft)	953.01 (ft msl)

Total Well Depth (from TOC): _____ (ft)
Stick Up (from ground elevation): _____ (ft)
Casing ID: _____ (in)
Casing Material: _____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit L/M	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
09:15	0.4	1st 6.94	1st 1.0188	9.9		1.11		
09:20		2nd 6.85	2nd 1.1130	10.5		0.83		
09:25		3rd 6.88	3rd 1.1099	10.6		0.80		
09:30		4th 6.89	4th 1.1133	10.6	2.10	0.80	-12.4	
Suggested range for 3 consec. readings or per Permit/State requirements:		+/- 0.2	+/- 3%	–	–	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used when four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: _____ Units _____

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site.*

FIELD COMMENTS

Sample Appearance: _____ Odor: None Color: None Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/17/25	Mike Hess		All.

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | | Sample Point: P 3 1 3 4 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only Lab ID: C18040367

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 17 25	08:20	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing Flow Cell and Tubing Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Purging Device: C
Sampling Device: C
X-Other:

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Filter Device: Y or (6) 0.45 µ or ____ µ (circle or fill in)

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other ____

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: ____

WELL DATA

Well Elevation (at TOC) ____ (ft/msl)
Depth to Water (DTW) (from TOC) ____ (ft)
Groundwater Elevation (site datum, from TOC) ____ (ft/msl)
Total Well Depth (from TOC) ____ (ft)
Stick Up (from ground elevation) ____ (ft)
Casing ID ____ (in)
Casing Material ____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elev. must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit L/M	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
08:25	0.4 1"	7.38 1"	1329 1"	9.10		0.16		
08:30	2"	7.05 2"	1325 2"	9.0		0.1		
08:35	3"	6.97 3"	1318 3"	9.0		0.0		
08:40	4"	6.95 4"	1315 4"	9.0	5.0	0.0 -	1.17	
Suggested range for 3 consec. readings or state Permit/State requirements		+/- 0.2	+/- 3%	–	–	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ Units ____

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site.*

FIELD COMMENTS

Sample Appearance: ____ Odor: None Color: None Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

*flowing

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4.17.25	Mike Hoo		All-4

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

ANALYTICAL REPORT

May 21, 2025

Revised Report

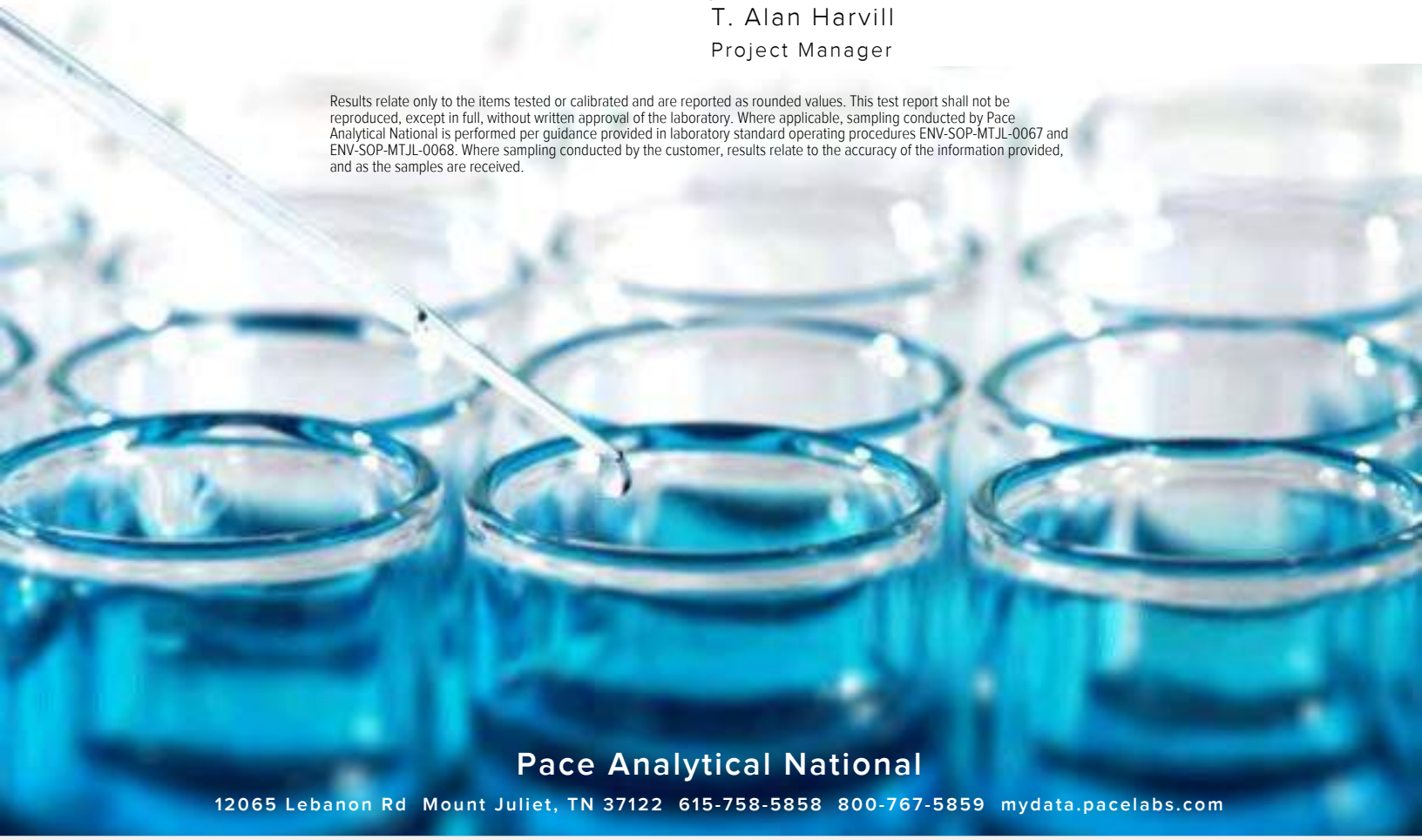
Elk River Landfill

Sample Delivery Group:	L1849779
Samples Received:	04/18/2025
Project Number:	200
Description:	NDA Spring Sampling (4)
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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408-OWA L1849779-01

Collected by: Kenneth Smith | Collected date/time: 04/17/25 09:30 | Received date/time: 04/18/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG2495683	1	04/24/25 04:34	04/24/25 04:34	DLH	Mt. Juliet, TN
Calculated Results	WG2499696	1	04/29/25 12:08	04/29/25 12:08	RLS	Mt. Juliet, TN
Gravimetric Analysis by Method 2540 C-2011	WG2496059	1	04/22/25 07:19	04/23/25 09:20	BDC	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG2495683	1	04/20/25 17:31	04/20/25 17:31	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2494623	1	04/24/25 04:34	04/24/25 04:34	DLH	Mt. Juliet, TN
Wet Chemistry by Method 350.1	WG2495675	1	04/20/25 19:26	04/20/25 19:26	RTW	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG2499696	1	04/29/25 00:21	04/29/25 12:08	RLS	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG2496296	1	04/24/25 22:18	04/25/25 02:31	UNP	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498839	1	04/26/25 06:33	04/26/25 06:33	JAH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2501712	1	04/30/25 07:21	04/30/25 07:21	ADM	Mt. Juliet, TN

P-403C L1849779-02

Collected by: Kenneth Smith | Collected date/time: 04/17/25 15:20 | Received date/time: 04/18/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG2495683	1	04/24/25 04:48	04/24/25 04:48	DLH	Mt. Juliet, TN
Calculated Results	WG2499696	1	04/29/25 12:09	04/29/25 12:09	RLS	Mt. Juliet, TN
Gravimetric Analysis by Method 2540 C-2011	WG2496059	1	04/22/25 07:19	04/23/25 09:20	BDC	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG2495683	1	04/20/25 17:34	04/20/25 17:34	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2494623	1	04/24/25 04:48	04/24/25 04:48	DLH	Mt. Juliet, TN
Wet Chemistry by Method 350.1	WG2495675	1	04/20/25 19:28	04/20/25 19:28	RTW	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG2499696	1	04/29/25 00:21	04/29/25 12:09	RLS	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG2496296	1	04/24/25 22:18	04/25/25 02:34	UNP	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498839	1	04/26/25 06:53	04/26/25 06:53	JAH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2501712	1	04/30/25 07:41	04/30/25 07:41	ADM	Mt. Juliet, TN

TB L1849779-03

Collected by: Kenneth Smith | Collected date/time: 04/17/25 08:55 | Received date/time: 04/18/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2498839	1	04/26/25 01:32	04/26/25 01:32	JAH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2501712	1	04/30/25 06:01	04/30/25 06:01	ADM	Mt. Juliet, TN

401-OWA L1849779-04

Collected by: Kenneth Smith | Collected date/time: 04/17/25 08:55 | Received date/time: 04/18/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG2495709	1	04/24/25 05:14	04/24/25 05:14	DLH	Mt. Juliet, TN
Calculated Results	WG2499696	1	04/29/25 12:11	04/29/25 12:11	RLS	Mt. Juliet, TN
Gravimetric Analysis by Method 2540 C-2011	WG2496059	1	04/22/25 07:19	04/23/25 09:20	BDC	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG2495709	1	04/20/25 19:13	04/20/25 19:13	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2494623	1	04/24/25 05:01	04/24/25 05:01	DLH	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2494623	5	04/24/25 05:14	04/24/25 05:14	DLH	Mt. Juliet, TN
Wet Chemistry by Method 350.1	WG2495675	1	04/20/25 19:29	04/20/25 19:29	RTW	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG2499696	1	04/29/25 00:21	04/29/25 12:11	RLS	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG2496296	1	04/24/25 22:18	04/25/25 02:38	UNP	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502487	1	04/29/25 12:26	04/29/25 12:26	JAH	Mt. Juliet, TN

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Report Revision History

Level II Report - Version 1: 05/05/25 13:45

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Revised to correct Total Anions

Wet Chemistry by Method 300.0

The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).

Batch	Lab Sample ID	Analytes
WG2494623	(MS) R4204453-4	Chloride
WG2494623	(MSD) R4204453-5	Chloride
WG2494623	(MS) R4204453-7	Chloride

The sample concentration is too high to evaluate accurate spike recoveries.

Batch	Lab Sample ID	Analytes
WG2494623	(MS) R4204453-4, (MS) R4204453-7, (MSD) R4204453-5	Chloride

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2494623	(MS) R4204453-4, (MS) R4204453-7, (MSD) R4204453-5	Sulfate

Metals (ICP) by Method 6010D

Analysis was filtered in the laboratory.

Batch	Method	Lab Sample ID
WG2499696	6010D	L1849779-01, 02, 04

Metals (ICPMS) by Method 6020

Analysis was filtered in the laboratory.

Batch	Method	Lab Sample ID
WG2496296	6020	L1849779-01, 02, 04

The sample concentration is too high to evaluate accurate spike recoveries.

Batch	Lab Sample ID	Analytes
WG2496296	(MS) R4204833-4	Magnesium,Dissolved

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2498839	L1849779-01	1,1-Dichloroethene, 1,2-Dichloroethane, 2-Butanone (MEK), Bromomethane, Chloromethane, Dichlorodifluoromethane, Ethyl ether and Tetrahydrofuran
WG2498839	L1849779-02	1,1-Dichloroethene, 1,2-Dichloroethane, 2-Butanone (MEK), Bromomethane, Chloromethane, Dichlorodifluoromethane, Ethyl ether and Tetrahydrofuran
WG2498839	L1849779-03	1,1-Dichloroethene, 1,2-Dichloroethane, 2-Butanone (MEK), Bromomethane, Chloromethane, Dichlorodifluoromethane, Ethyl ether and Tetrahydrofuran
WG2502487	L1849779-04	Bromoform and Vinyl chloride

The associated batch QC was above the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG2502487	(LCS) R4207602-1, (LCSD) R4207602-2, L1849779-04	2-Butanone (MEK) and Acetone

The associated batch QC was outside the established quality control range for precision.

Batch	Lab Sample ID	Analytes
WG2498839	(LCSD) R4206160-2, L1849779-01, 02, 03	Bromomethane

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Depth to water (DTW) (FROM TOC)	30.42	ft
pH (On Site)	7.78	su
Specific Conductance (on site)	384	umhos/cm
Temperature (on-site)	11.3	Deg. C
Turbidity (on-site)	1.7	NTU
Dissolved Oxygen (on-site)	0.2	mg/l
eH/ORP (On Site)	53.8	mV

Calculated Results

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	meq/l		meq/l		date / time	
Total Anions (calculated)	5.88		0.00146	1	04/24/2025 04:34	WG2495683
Total Cations (calculated)	5.94		0.000505	1	04/29/2025 12:08	WG2499696

Calculated Results

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	%		%		date / time	
Percent Difference (calculated)	0.432		0.000	1	04/29/2025 12:08	WG2499696

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	302		10.0	1	04/23/2025 09:20	WG2496059

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	280		20.0	1	04/20/2025 17:31	WG2495683

Sample Narrative:

L1849779-01 WG2495683: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	1.17		1.00	1	04/24/2025 04:34	WG2494623
Sulfate	12.6		5.00	1	04/24/2025 04:34	WG2494623

Wet Chemistry by Method 350.1

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ammonia Nitrogen	ND		0.100	1	04/20/2025 19:26	WG2495675

Metals (ICP) by Method 6010D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Calcium,Dissolved	73.0		1.00	1	04/29/2025 12:08	WG2499696

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Boron,Dissolved	ND		100	1	04/29/2025 12:08	WG2499696
Iron,Dissolved	ND		100	1	04/29/2025 12:08	WG2499696
Potassium,Dissolved	ND		1000	1	04/29/2025 12:08	WG2499696
Sodium,Dissolved	6300		1000	1	04/29/2025 12:08	WG2499696

Metals (ICPMS) by Method 6020

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Chromium,Dissolved	ND		4.00	1	04/25/2025 02:31	WG2496296
Magnesium,Dissolved	24200		200	1	04/25/2025 02:31	WG2496296
Zinc,Dissolved	ND		10.0	1	04/25/2025 02:31	WG2496296
Arsenic,Dissolved	ND		1.00	1	04/25/2025 02:31	WG2496296

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/26/2025 06:33	WG2498839
1,1,1-Trichloroethane	ND		1.00	1	04/26/2025 06:33	WG2498839
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/26/2025 06:33	WG2498839
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/26/2025 06:33	WG2498839
1,1,2-Trichloroethane	ND		0.750	1	04/26/2025 06:33	WG2498839
1,1-Dichloroethane	ND		1.00	1	04/26/2025 06:33	WG2498839
1,1-Dichloroethene	ND	C3	1.00	1	04/26/2025 06:33	WG2498839
1,1-Dichloropropene	ND		1.00	1	04/26/2025 06:33	WG2498839
1,2,3-Trichlorobenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
1,2,3-Trichloropropane	ND		1.00	1	04/26/2025 06:33	WG2498839
1,2,4-Trichlorobenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
1,2,4-Trimethylbenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/26/2025 06:33	WG2498839
1,2-Dibromoethane	ND		1.00	1	04/26/2025 06:33	WG2498839
1,2-Dichlorobenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
1,2-Dichloroethane	ND	C3	0.250	1	04/26/2025 06:33	WG2498839
1,2-Dichloropropane	ND		1.00	1	04/26/2025 06:33	WG2498839
1,3,5-Trimethylbenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
1,3-Dichlorobenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
1,3-Dichloropropane	ND		1.00	1	04/26/2025 06:33	WG2498839
1,4-Dichlorobenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
2,2-Dichloropropane	ND		1.00	1	04/26/2025 06:33	WG2498839
2-Butanone (MEK)	ND	C3	10.0	1	04/26/2025 06:33	WG2498839
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/26/2025 06:33	WG2498839
Acetone	ND		10.0	1	04/30/2025 07:21	WG2501712
Allyl chloride	ND		1.00	1	04/26/2025 06:33	WG2498839
Benzene	ND		0.500	1	04/26/2025 06:33	WG2498839
Bromobenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
Bromochloromethane	ND		1.00	1	04/26/2025 06:33	WG2498839
Bromodichloromethane	ND		1.00	1	04/26/2025 06:33	WG2498839
Bromoform	ND		1.00	1	04/26/2025 06:33	WG2498839
Bromomethane	ND	C3 J3	1.00	1	04/26/2025 06:33	WG2498839
Carbon tetrachloride	ND		0.250	1	04/26/2025 06:33	WG2498839
Chlorobenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
Chloroethane	ND		1.00	1	04/26/2025 06:33	WG2498839
Chloroform	ND		1.00	1	04/26/2025 06:33	WG2498839
Chloromethane	ND	C3	1.00	1	04/26/2025 06:33	WG2498839
Dibromochloromethane	ND		1.00	1	04/26/2025 06:33	WG2498839
Dibromomethane	ND		1.00	1	04/26/2025 06:33	WG2498839
Dichlorodifluoromethane	ND	C3	1.00	1	04/26/2025 06:33	WG2498839

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Dichlorofluoromethane	ND		1.00	1	04/26/2025 06:33	WG2498839
Ethyl ether	ND	C3	1.00	1	04/26/2025 06:33	WG2498839
Ethylbenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
Hexachloro-1,3-butadiene	ND		0.250	1	04/26/2025 06:33	WG2498839
Isopropylbenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
Methyl tert-butyl ether	ND		1.00	1	04/26/2025 06:33	WG2498839
Methylene Chloride	ND		1.00	1	04/26/2025 06:33	WG2498839
Naphthalene	ND		1.00	1	04/26/2025 06:33	WG2498839
Styrene	ND		1.00	1	04/26/2025 06:33	WG2498839
Tetrachloroethene	ND		1.00	1	04/26/2025 06:33	WG2498839
Tetrahydrofuran	ND	C3	5.00	1	04/26/2025 06:33	WG2498839
Toluene	ND		1.00	1	04/26/2025 06:33	WG2498839
Trichloroethene	ND		0.100	1	04/26/2025 06:33	WG2498839
Trichlorofluoromethane	ND		1.00	1	04/26/2025 06:33	WG2498839
Vinyl chloride	ND		0.0500	1	04/30/2025 07:21	WG2501712
Xylenes, Total	ND		2.00	1	04/26/2025 06:33	WG2498839
cis-1,2-Dichloroethene	ND		0.100	1	04/26/2025 06:33	WG2498839
cis-1,3-Dichloropropene	ND		0.500	1	04/26/2025 06:33	WG2498839
n-Butylbenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
n-Propylbenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
o-Chlorotoluene	ND		1.00	1	04/26/2025 06:33	WG2498839
p-Chlorotoluene	ND		1.00	1	04/26/2025 06:33	WG2498839
p-Isopropyltoluene	ND		1.00	1	04/26/2025 06:33	WG2498839
sec-Butylbenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
tert-Butylbenzene	ND		1.00	1	04/26/2025 06:33	WG2498839
trans-1,2-Dichloroethene	ND		1.00	1	04/26/2025 06:33	WG2498839
trans-1,3-Dichloropropene	ND		1.00	1	04/26/2025 06:33	WG2498839
(S) 4-Bromofluorobenzene	*96.6*			*67.0-138*	*04/26/2025 06:33*	WG2498839
(S) 4-Bromofluorobenzene	*90.8*			*67.0-138*	*04/30/2025 07:21*	WG2501712
(S) Toluene-d8	*111*			*75.0-131*	*04/26/2025 06:33*	WG2498839
(S) Toluene-d8	*115*			*75.0-131*	*04/30/2025 07:21*	WG2501712
(S) 1,2-Dichloroethane-d4	*86.0*			*70.0-130*	*04/26/2025 06:33*	WG2498839
(S) 1,2-Dichloroethane-d4	*98.9*			*70.0-130*	*04/30/2025 07:21*	WG2501712

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Depth to water (DTW) (FROM TOC)	41.94	ft
pH (On Site)	7.57	su
Specific Conductance (on site)	543	umhos/cm
Temperature (on-site)	9.3	Deg. C
Turbidity (on-site)	51	NTU
Dissolved Oxygen (on-site)	0.3	mg/l
eH/ORP (On Site)	-41.2	mV

Calculated Results

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	meq/l		meq/l		date / time	
Total Anions (calculated)	8.62		0.00146	1	04/24/2025 04:48	WG2495683
Total Cations (calculated)	8.67		0.000505	1	04/29/2025 12:09	WG2499696

Calculated Results

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	%		%		date / time	
Percent Difference (calculated)	0.268		0.000	1	04/29/2025 12:09	WG2499696

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	447		10.0	1	04/23/2025 09:20	WG2496059

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	370		20.0	1	04/20/2025 17:34	WG2495683

Sample Narrative:

L1849779-02 WG2495683: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	2.58		1.00	1	04/24/2025 04:48	WG2494623
Sulfate	55.1		5.00	1	04/24/2025 04:48	WG2494623

Wet Chemistry by Method 350.1

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ammonia Nitrogen	ND		0.100	1	04/20/2025 19:28	WG2495675

Metals (ICP) by Method 6010D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Calcium,Dissolved	92.6		1.00	1	04/29/2025 12:09	WG2499696

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Boron,Dissolved	ND		100	1	04/29/2025 12:09	WG2499696
Iron,Dissolved	ND		100	1	04/29/2025 12:09	WG2499696
Potassium,Dissolved	1350		1000	1	04/29/2025 12:09	WG2499696
Sodium,Dissolved	8650		1000	1	04/29/2025 12:09	WG2499696

Metals (ICPMS) by Method 6020

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Chromium,Dissolved	ND		4.00	1	04/25/2025 02:34	WG2496296
Magnesium,Dissolved	44200		200	1	04/25/2025 02:34	WG2496296
Zinc,Dissolved	ND		10.0	1	04/25/2025 02:34	WG2496296
Arsenic,Dissolved	ND		1.00	1	04/25/2025 02:34	WG2496296

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/26/2025 06:53	WG2498839
1,1,1-Trichloroethane	ND		1.00	1	04/26/2025 06:53	WG2498839
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/26/2025 06:53	WG2498839
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/26/2025 06:53	WG2498839
1,1,2-Trichloroethane	ND		0.750	1	04/26/2025 06:53	WG2498839
1,1-Dichloroethane	ND		1.00	1	04/26/2025 06:53	WG2498839
1,1-Dichloroethene	ND	C3	1.00	1	04/26/2025 06:53	WG2498839
1,1-Dichloropropene	ND		1.00	1	04/26/2025 06:53	WG2498839
1,2,3-Trichlorobenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
1,2,3-Trichloropropane	ND		1.00	1	04/26/2025 06:53	WG2498839
1,2,4-Trichlorobenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
1,2,4-Trimethylbenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/26/2025 06:53	WG2498839
1,2-Dibromoethane	ND		1.00	1	04/26/2025 06:53	WG2498839
1,2-Dichlorobenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
1,2-Dichloroethane	ND	C3	0.250	1	04/26/2025 06:53	WG2498839
1,2-Dichloropropane	ND		1.00	1	04/26/2025 06:53	WG2498839
1,3,5-Trimethylbenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
1,3-Dichlorobenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
1,3-Dichloropropane	ND		1.00	1	04/26/2025 06:53	WG2498839
1,4-Dichlorobenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
2,2-Dichloropropane	ND		1.00	1	04/26/2025 06:53	WG2498839
2-Butanone (MEK)	ND	C3	10.0	1	04/26/2025 06:53	WG2498839
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/26/2025 06:53	WG2498839
Acetone	ND		10.0	1	04/30/2025 07:41	WG2501712
Allyl chloride	ND		1.00	1	04/26/2025 06:53	WG2498839
Benzene	ND		0.500	1	04/26/2025 06:53	WG2498839
Bromobenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
Bromochloromethane	ND		1.00	1	04/26/2025 06:53	WG2498839
Bromodichloromethane	ND		1.00	1	04/26/2025 06:53	WG2498839
Bromoform	ND		1.00	1	04/26/2025 06:53	WG2498839
Bromomethane	ND	C3 J3	1.00	1	04/26/2025 06:53	WG2498839
Carbon tetrachloride	ND		0.250	1	04/26/2025 06:53	WG2498839
Chlorobenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
Chloroethane	ND		1.00	1	04/26/2025 06:53	WG2498839
Chloroform	ND		1.00	1	04/26/2025 06:53	WG2498839
Chloromethane	ND	C3	1.00	1	04/26/2025 06:53	WG2498839
Dibromochloromethane	ND		1.00	1	04/26/2025 06:53	WG2498839
Dibromomethane	ND		1.00	1	04/26/2025 06:53	WG2498839
Dichlorodifluoromethane	ND	C3	1.00	1	04/26/2025 06:53	WG2498839

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Dichlorofluoromethane	ND		1.00	1	04/26/2025 06:53	WG2498839
Ethyl ether	ND	C3	1.00	1	04/26/2025 06:53	WG2498839
Ethylbenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
Hexachloro-1,3-butadiene	ND		0.250	1	04/26/2025 06:53	WG2498839
Isopropylbenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
Methyl tert-butyl ether	ND		1.00	1	04/26/2025 06:53	WG2498839
Methylene Chloride	ND		1.00	1	04/26/2025 06:53	WG2498839
Naphthalene	ND		1.00	1	04/26/2025 06:53	WG2498839
Styrene	ND		1.00	1	04/26/2025 06:53	WG2498839
Tetrachloroethene	ND		1.00	1	04/26/2025 06:53	WG2498839
Tetrahydrofuran	ND	C3	5.00	1	04/26/2025 06:53	WG2498839
Toluene	ND		1.00	1	04/26/2025 06:53	WG2498839
Trichloroethene	ND		0.100	1	04/26/2025 06:53	WG2498839
Trichlorofluoromethane	ND		1.00	1	04/26/2025 06:53	WG2498839
Vinyl chloride	ND		0.0500	1	04/30/2025 07:41	WG2501712
Xylenes, Total	ND		2.00	1	04/26/2025 06:53	WG2498839
cis-1,2-Dichloroethene	ND		0.100	1	04/26/2025 06:53	WG2498839
cis-1,3-Dichloropropene	ND		0.500	1	04/26/2025 06:53	WG2498839
n-Butylbenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
n-Propylbenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
o-Chlorotoluene	ND		1.00	1	04/26/2025 06:53	WG2498839
p-Chlorotoluene	ND		1.00	1	04/26/2025 06:53	WG2498839
p-Isopropyltoluene	ND		1.00	1	04/26/2025 06:53	WG2498839
sec-Butylbenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
tert-Butylbenzene	ND		1.00	1	04/26/2025 06:53	WG2498839
trans-1,2-Dichloroethene	ND		1.00	1	04/26/2025 06:53	WG2498839
trans-1,3-Dichloropropene	ND		1.00	1	04/26/2025 06:53	WG2498839
(S) 4-Bromofluorobenzene	*95.9*			*67.0-138*	*04/26/2025 06:53*	WG2498839
(S) 4-Bromofluorobenzene	*88.6*			*67.0-138*	*04/30/2025 07:41*	WG2501712
(S) Toluene-d8	*111*			*75.0-131*	*04/26/2025 06:53*	WG2498839
(S) Toluene-d8	*110*			*75.0-131*	*04/30/2025 07:41*	WG2501712
(S) 1,2-Dichloroethane-d4	*83.4*			*70.0-130*	*04/26/2025 06:53*	WG2498839
(S) 1,2-Dichloroethane-d4	*96.2*			*70.0-130*	*04/30/2025 07:41*	WG2501712

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/26/2025 01:32	WG2498839
1,1,1-Trichloroethane	ND		1.00	1	04/26/2025 01:32	WG2498839
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/26/2025 01:32	WG2498839
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/26/2025 01:32	WG2498839
1,1,2-Trichloroethane	ND		0.750	1	04/26/2025 01:32	WG2498839
1,1-Dichloroethane	ND		1.00	1	04/26/2025 01:32	WG2498839
1,1-Dichloroethene	ND	C3	1.00	1	04/26/2025 01:32	WG2498839
1,1-Dichloropropene	ND		1.00	1	04/26/2025 01:32	WG2498839
1,2,3-Trichlorobenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
1,2,3-Trichloropropane	ND		1.00	1	04/26/2025 01:32	WG2498839
1,2,4-Trichlorobenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
1,2,4-Trimethylbenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/26/2025 01:32	WG2498839
1,2-Dibromoethane	ND		1.00	1	04/26/2025 01:32	WG2498839
1,2-Dichlorobenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
1,2-Dichloroethane	ND	C3	0.250	1	04/26/2025 01:32	WG2498839
1,2-Dichloropropane	ND		1.00	1	04/26/2025 01:32	WG2498839
1,3,5-Trimethylbenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
1,3-Dichlorobenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
1,3-Dichloropropane	ND		1.00	1	04/26/2025 01:32	WG2498839
1,4-Dichlorobenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
2,2-Dichloropropane	ND		1.00	1	04/26/2025 01:32	WG2498839
2-Butanone (MEK)	ND	C3	10.0	1	04/26/2025 01:32	WG2498839
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/26/2025 01:32	WG2498839
Acetone	ND		10.0	1	04/30/2025 06:01	WG2501712
Allyl chloride	ND		1.00	1	04/26/2025 01:32	WG2498839
Benzene	ND		0.500	1	04/26/2025 01:32	WG2498839
Bromobenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
Bromochloromethane	ND		1.00	1	04/26/2025 01:32	WG2498839
Bromodichloromethane	ND		1.00	1	04/26/2025 01:32	WG2498839
Bromoform	ND		1.00	1	04/26/2025 01:32	WG2498839
Bromomethane	ND	C3 J3	1.00	1	04/26/2025 01:32	WG2498839
Carbon tetrachloride	ND		0.250	1	04/26/2025 01:32	WG2498839
Chlorobenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
Chloroethane	ND		1.00	1	04/26/2025 01:32	WG2498839
Chloroform	ND		1.00	1	04/26/2025 01:32	WG2498839
Chloromethane	ND	C3	1.00	1	04/26/2025 01:32	WG2498839
Dibromochloromethane	ND		1.00	1	04/26/2025 01:32	WG2498839
Dibromomethane	ND		1.00	1	04/26/2025 01:32	WG2498839
Dichlorodifluoromethane	ND	C3	1.00	1	04/26/2025 01:32	WG2498839
Dichlorofluoromethane	ND		1.00	1	04/26/2025 01:32	WG2498839
Ethyl ether	ND	C3	1.00	1	04/26/2025 01:32	WG2498839
Ethylbenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
Hexachloro-1,3-butadiene	ND		0.250	1	04/26/2025 01:32	WG2498839
Isopropylbenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
Methyl tert-butyl ether	ND		1.00	1	04/26/2025 01:32	WG2498839
Methylene Chloride	ND		1.00	1	04/26/2025 01:32	WG2498839
Naphthalene	ND		1.00	1	04/26/2025 01:32	WG2498839
Styrene	ND		1.00	1	04/26/2025 01:32	WG2498839
Tetrachloroethene	ND		1.00	1	04/26/2025 01:32	WG2498839
Tetrahydrofuran	ND	C3	5.00	1	04/26/2025 01:32	WG2498839
Toluene	ND		1.00	1	04/26/2025 01:32	WG2498839
Trichloroethene	ND		0.100	1	04/26/2025 01:32	WG2498839
Trichlorofluoromethane	ND		1.00	1	04/26/2025 01:32	WG2498839
Vinyl chloride	ND		0.0500	1	04/30/2025 06:01	WG2501712

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Xylenes, Total	ND		2.00	1	04/26/2025 01:32	WG2498839
cis-1,2-Dichloroethene	ND		0.100	1	04/26/2025 01:32	WG2498839
cis-1,3-Dichloropropene	ND		0.500	1	04/26/2025 01:32	WG2498839
n-Butylbenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
n-Propylbenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
o-Chlorotoluene	ND		1.00	1	04/26/2025 01:32	WG2498839
p-Chlorotoluene	ND		1.00	1	04/26/2025 01:32	WG2498839
p-Isopropyltoluene	ND		1.00	1	04/26/2025 01:32	WG2498839
sec-Butylbenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
tert-Butylbenzene	ND		1.00	1	04/26/2025 01:32	WG2498839
trans-1,2-Dichloroethene	ND		1.00	1	04/26/2025 01:32	WG2498839
trans-1,3-Dichloropropene	ND		1.00	1	04/26/2025 01:32	WG2498839
(S) 4-Bromofluorobenzene	*96.5*			*67.0-138*	*04/26/2025 01:32*	WG2498839
(S) 4-Bromofluorobenzene	*89.4*			*67.0-138*	*04/30/2025 06:01*	WG2501712
(S) Toluene-d8	*111*			*75.0-131*	*04/26/2025 01:32*	WG2498839
(S) Toluene-d8	*113*			*75.0-131*	*04/30/2025 06:01*	WG2501712
(S) 1,2-Dichloroethane-d4	*82.7*			*70.0-130*	*04/26/2025 01:32*	WG2498839
(S) 1,2-Dichloroethane-d4	*98.6*			*70.0-130*	*04/30/2025 06:01*	WG2501712

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Depth to water (DTW) (FROM TOC)	53.32	ft
pH (On Site)	7.65	su
Specific Conductance (on site)	1355	umhos/cm
Temperature (on-site)	10.3	Deg. C
Turbidity (on-site)	24.6	NTU
Dissolved Oxygen (on-site)	0.2	mg/l
eH/ORP (On Site)	52	mV

Calculated Results

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	meq/l		meq/l		date / time	
Total Anions (calculated)	17.5		0.00732	1	04/24/2025 05:14	WG2495709
Total Cations (calculated)	19.1		0.000505	1	04/29/2025 12:11	WG2499696

Calculated Results

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	%		%		date / time	
Percent Difference (calculated)	46.5		0.000	1	04/29/2025 12:11	WG2499696

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	1250		10.0	1	04/23/2025 09:20	WG2496059

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	337		20.0	1	04/20/2025 19:13	WG2495709

Sample Narrative:

L1849779-04 WG2495709: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	381		1.00	5	04/24/2025 05:14	WG2494623
Sulfate	12.8		5.00	1	04/24/2025 05:01	WG2494623

Wet Chemistry by Method 350.1

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ammonia Nitrogen	ND		0.100	1	04/20/2025 19:29	WG2495675

Metals (ICP) by Method 6010D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Calcium,Dissolved	176		1.00	1	04/29/2025 12:11	WG2499696

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Boron,Dissolved	ND		100	1	04/29/2025 12:11	WG2499696
Iron,Dissolved	ND		100	1	04/29/2025 12:11	WG2499696
Potassium,Dissolved	3820		1000	1	04/29/2025 12:11	WG2499696
Sodium,Dissolved	143000		1000	1	04/29/2025 12:11	WG2499696

Metals (ICPMS) by Method 6020

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Chromium,Dissolved	ND		4.00	1	04/25/2025 02:38	WG2496296
Magnesium,Dissolved	48900		200	1	04/25/2025 02:38	WG2496296
Zinc,Dissolved	ND		10.0	1	04/25/2025 02:38	WG2496296
Arsenic,Dissolved	ND		1.00	1	04/25/2025 02:38	WG2496296

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 12:26	WG2502487
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 12:26	WG2502487
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 12:26	WG2502487
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 12:26	WG2502487
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 12:26	WG2502487
1,1-Dichloroethane	ND		1.00	1	04/29/2025 12:26	WG2502487
1,1-Dichloroethene	ND		1.00	1	04/29/2025 12:26	WG2502487
1,1-Dichloropropene	ND		1.00	1	04/29/2025 12:26	WG2502487
1,2,3-Trichlorobenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 12:26	WG2502487
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
1,2-Dibromo-3-Chloropropane	ND		1.00	1	04/29/2025 12:26	WG2502487
1,2-Dibromoethane	ND		1.00	1	04/29/2025 12:26	WG2502487
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
1,2-Dichloroethane	ND		0.250	1	04/29/2025 12:26	WG2502487
1,2-Dichloropropane	ND		1.00	1	04/29/2025 12:26	WG2502487
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
1,3-Dichloropropane	ND		1.00	1	04/29/2025 12:26	WG2502487
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
2,2-Dichloropropane	ND		1.00	1	04/29/2025 12:26	WG2502487
2-Butanone (MEK)	ND	J4	10.0	1	04/29/2025 12:26	WG2502487
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 12:26	WG2502487
Acetone	ND	J4	10.0	1	04/29/2025 12:26	WG2502487
Allyl chloride	ND		1.00	1	04/29/2025 12:26	WG2502487
Benzene	ND		0.500	1	04/29/2025 12:26	WG2502487
Bromobenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
Bromochloromethane	ND		1.00	1	04/29/2025 12:26	WG2502487
Bromodichloromethane	ND		1.00	1	04/29/2025 12:26	WG2502487
Bromoform	ND	C3	1.00	1	04/29/2025 12:26	WG2502487
Bromomethane	ND		1.00	1	04/29/2025 12:26	WG2502487
Carbon tetrachloride	ND		0.250	1	04/29/2025 12:26	WG2502487
Chlorobenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
Chloroethane	ND		1.00	1	04/29/2025 12:26	WG2502487
Chloroform	ND		1.00	1	04/29/2025 12:26	WG2502487
Chloromethane	ND		1.00	1	04/29/2025 12:26	WG2502487
Dibromochloromethane	ND		1.00	1	04/29/2025 12:26	WG2502487
Dibromomethane	ND		1.00	1	04/29/2025 12:26	WG2502487
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 12:26	WG2502487

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Dichlorofluoromethane	ND		1.00	1	04/29/2025 12:26	WG2502487
Ethyl ether	ND		1.00	1	04/29/2025 12:26	WG2502487
Ethylbenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
Hexachloro-1,3-butadiene	ND		0.250	1	04/29/2025 12:26	WG2502487
Isopropylbenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 12:26	WG2502487
Methylene Chloride	ND		1.00	1	04/29/2025 12:26	WG2502487
Naphthalene	ND		1.00	1	04/29/2025 12:26	WG2502487
Styrene	ND		1.00	1	04/29/2025 12:26	WG2502487
Tetrachloroethene	ND		1.00	1	04/29/2025 12:26	WG2502487
Tetrahydrofuran	ND		5.00	1	04/29/2025 12:26	WG2502487
Toluene	ND		1.00	1	04/29/2025 12:26	WG2502487
Trichloroethene	ND		0.100	1	04/29/2025 12:26	WG2502487
Trichlorofluoromethane	ND		1.00	1	04/29/2025 12:26	WG2502487
Vinyl chloride	ND	C3	0.0500	1	04/29/2025 12:26	WG2502487
Xylenes, Total	ND		2.00	1	04/29/2025 12:26	WG2502487
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 12:26	WG2502487
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 12:26	WG2502487
n-Butylbenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
n-Propylbenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
o-Chlorotoluene	ND		1.00	1	04/29/2025 12:26	WG2502487
p-Chlorotoluene	ND		1.00	1	04/29/2025 12:26	WG2502487
p-Isopropyltoluene	ND		1.00	1	04/29/2025 12:26	WG2502487
sec-Butylbenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
tert-Butylbenzene	ND		1.00	1	04/29/2025 12:26	WG2502487
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 12:26	WG2502487
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 12:26	WG2502487
(S) 4-Bromofluorobenzene	*89.4*			*67.0-138*	*04/29/2025 12:26*	WG2502487
(S) Toluene-d8	*101*			*75.0-131*	*04/29/2025 12:26*	WG2502487
(S) 1,2-Dichloroethane-d4	*110*			*70.0-130*	*04/29/2025 12:26*	WG2502487

Method Blank (MB)

(MB) R4205088-1 04/23/25 09:20

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Dissolved Solids	ND		2.82	10.0

L1849671-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1849671-04 04/23/25 09:20 • (DUP) R4205088-3 04/23/25 09:20

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	781	775	1	0.856		10

L1849796-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1849796-04 04/23/25 09:20 • (DUP) R4205088-4 04/23/25 09:20

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	13700	14100	1	2.59		10

Laboratory Control Sample (LCS)

(LCS) R4205088-2 04/23/25 09:20

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Dissolved Solids	8800	8600	97.7	90.0-110	

Method Blank (MB)

(MB) R4202355-2 04/20/25 16:39

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	3.43		2.71	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1849306-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1849306-01 04/20/25 16:45 • (DUP) R4202355-3 04/20/25 16:50

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	288	289	1	0.142		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1849972-08 Original Sample (OS) • Duplicate (DUP)

(OS) L1849972-08 04/20/25 18:10 • (DUP) R4202355-4 04/20/25 18:13

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	188	192	1	1.88		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R4202355-1 04/20/25 16:28

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	101	101	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R4202486-2 04/20/25 18:22

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	ND		2.71	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1848930-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1848930-01 04/20/25 18:29 • (DUP) R4202486-3 04/20/25 18:38

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	299	296	1	0.766		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1849823-08 Original Sample (OS) • Duplicate (DUP)

(OS) L1849823-08 04/20/25 20:50 • (DUP) R4202486-4 04/20/25 20:56

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	414	417	1	0.627		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R4202486-1 04/20/25 18:10

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	97.3	97.3	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R4204453-1 04/23/25 20:18

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloride	ND		0.0519	1.00
Sulfate	ND		0.0774	5.00

L1849614-14 Original Sample (OS) • Duplicate (DUP)

(OS) L1849614-14 04/23/25 20:45 • (DUP) R4204453-3 04/23/25 20:58

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	33.5	33.4	1	0.294		15

L1849614-15 Original Sample (OS) • Duplicate (DUP)

(OS) L1849614-15 04/23/25 21:38 • (DUP) R4204453-6 04/23/25 21:52

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	36.0	36.3	1	0.812		15

Laboratory Control Sample (LCS)

(LCS) R4204453-2 04/23/25 20:31

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40.0	40.3	101	90.0-110	
Sulfate	40.0	40.5	101	90.0-110	

L1849614-14 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849614-14 04/23/25 20:45 • (MS) R4204453-4 04/23/25 21:12 • (MSD) R4204453-5 04/23/25 21:25

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	40.0	335	309	305	0.000	0.000	1	90.0-110	E V	E V	1.43	15
Sulfate	40.0	33.5	65.5	64.5	80.0	77.5	1	90.0-110	J6	J6	1.53	15

L1849614-15 Original Sample (OS) • Matrix Spike (MS)

(OS) L1849614-15 04/23/25 21:38 • (MS) R4204453-7 04/23/25 22:05

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	40.0	410	358	0.000	1	90.0-110	E V
Sulfate	40.0	36.0	66.5	76.3	1	90.0-110	J6

Method Blank (MB)

(MB) R4202436-1 04/20/25 18:44

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Ammonia Nitrogen	ND		0.0317	0.100

L1848861-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1848861-02 04/20/25 18:50 • (DUP) R4202436-3 04/20/25 18:52

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ammonia Nitrogen	ND	ND	1	0.000		10

L1848866-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1848866-01 04/20/25 18:56 • (DUP) R4202436-6 04/20/25 18:58

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ammonia Nitrogen	0.158	0.158	1	0.000		10

Laboratory Control Sample (LCS)

(LCS) R4202436-2 04/20/25 18:46

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Ammonia Nitrogen	7.50	7.39	98.5	90.0-110	

L1848861-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848861-02 04/20/25 18:50 • (MS) R4202436-4 04/20/25 18:53 • (MSD) R4202436-5 04/20/25 18:55

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ammonia Nitrogen	5.00	ND	5.08	5.02	102	100	1	90.0-110			1.27	10

L1848866-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1848866-01 04/20/25 18:56 • (MS) R4202436-7 04/20/25 19:04 • (MSD) R4202436-8 04/20/25 19:05

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ammonia Nitrogen	5.00	0.158	5.25	5.38	102	104	1	90.0-110			2.54	10

Method Blank (MB)

(MB) R4207049-1 04/29/25 11:38

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Boron,Dissolved	ND		12.6	100
Calcium,Dissolved	ND		0.0463	1.00
Iron,Dissolved	ND		14.1	100
Potassium,Dissolved	ND		102	1000
Sodium,Dissolved	ND		98.5	1000

Laboratory Control Sample (LCS)

(LCS) R4207049-2 04/29/25 11:40

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Boron,Dissolved	1000	943	94.3	80.0-120	
Calcium,Dissolved	10.0	9.46	94.6	80.0-120	
Iron,Dissolved	10000	9660	96.6	80.0-120	
Potassium,Dissolved	10000	9610	96.1	80.0-120	
Sodium,Dissolved	10000	10000	100	80.0-120	

L1849608-18 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849608-18 04/29/25 11:42 • (MS) R4207049-4 04/29/25 11:45 • (MSD) R4207049-5 04/29/25 11:47

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Boron,Dissolved	1000	ND	996	1010	95.4	96.4	1	75.0-125			0.976	20
Calcium,Dissolved	10.0	94.9	103	102	76.3	75.4	1	75.0-125			0.0939	20
Iron,Dissolved	10000	ND	9590	9640	95.9	96.4	1	75.0-125			0.504	20
Potassium,Dissolved	10000	9750	19400	19600	96.9	98.1	1	75.0-125			0.650	20
Sodium,Dissolved	10000	48500	57000	57500	84.6	89.6	1	75.0-125			0.871	20

QUALITY CONTROL SUMMARY

L1849779-01,02,04

Method Blank (MB)

(MB) R4204833-1 04/25/25 01:35

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Chromium,Dissolved	ND		0.540	2.00
Magnesium,Dissolved	ND		100	100
Zinc,Dissolved	0.424		0.256	1.00
Arsenic,Dissolved	ND		0.250	1.00

Laboratory Control Sample (LCS)

(LCS) R4204833-2 04/25/25 01:38

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chromium,Dissolved	50.0	50.3	101	80.0-120	
Magnesium,Dissolved	5000	4900	98.0	80.0-120	
Zinc,Dissolved	50.0	47.5	94.9	80.0-120	
Arsenic,Dissolved	50.0	49.2	98.4	80.0-120	

L1849540-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849540-01 04/25/25 01:41 • (MS) R4204833-4 04/25/25 01:48 • (MSD) R4204833-5 04/25/25 01:51

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chromium,Dissolved	50.0	ND	45.5	47.9	91.0	95.8	1	75.0-125			5.11	20
Magnesium,Dissolved	5000	186000	180000	192000	0.000	117	1	75.0-125	V		6.07	20
Zinc,Dissolved	50.0	ND	43.7	45.2	87.4	90.4	1	75.0-125			3.30	20
Arsenic,Dissolved	50.0	1.59	46.9	48.2	90.5	93.2	1	75.0-125			2.84	20

Method Blank (MB)

(MB) R4206160-3 04/26/25 00:12

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0302	0.100
1,1,2-Trichloroethane	ND		0.0239	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Allyl chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	1.00
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromochloromethane	ND		0.0245	0.100
Dibromomethane	ND		0.0300	0.200
Dichlorodifluoromethane	ND		0.0644	0.200

Method Blank (MB)

(MB) R4206160-3 04/26/25 00:12

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	0.250
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
o-Chlorotoluene	ND		0.0346	0.100
p-Chlorotoluene	ND		0.0180	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 4-Bromofluorobenzene	*97.2*			*67.0-138*
(S) Toluene-d8	*111*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*84.0*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4206160-1 04/25/25 22:32 • (LCSD) R4206160-2 04/25/25 22:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	4.99	5.10	99.8	102	74.0-129			2.18	20
1,1,1-Trichloroethane	5.00	4.14	4.17	82.8	83.4	69.0-126			0.722	20
1,1,2,2-Tetrachloroethane	5.00	4.60	4.65	92.0	93.0	68.0-128			1.08	20
1,1,2-Trichloro-1,2,2-trifluoroethane	5.00	4.46	4.55	89.2	91.0	61.0-139			2.00	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4206160-1 04/25/25 22:32 • (LCSD) R4206160-2 04/25/25 22:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,2-Trichloroethane	5.00	5.35	5.35	107	107	78.0-123			0.000	20
1,1-Dichloroethane	5.00	4.04	3.99	80.8	79.8	70.0-127			1.25	20
1,1-Dichloroethene	5.00	3.95	3.81	79.0	76.2	65.0-131			3.61	20
1,1-Dichloropropene	5.00	4.53	4.48	90.6	89.6	73.0-125			1.11	20
1,2,3-Trichlorobenzene	5.00	5.00	5.15	100	103	59.0-139			2.96	20
1,2,3-Trichloropropane	5.00	5.35	5.29	107	106	67.0-129			1.13	20
1,2,4-Trichlorobenzene	5.00	5.15	5.26	103	105	62.0-137			2.11	20
1,2,4-Trimethylbenzene	5.00	5.41	5.37	108	107	70.0-126			0.742	20
1,2-Dibromo-3-Chloropropane	5.00	4.22	4.26	84.4	85.2	59.0-130			0.943	20
1,2-Dibromoethane	5.00	5.26	5.34	105	107	74.0-128			1.51	20
1,2-Dichlorobenzene	5.00	5.51	5.39	110	108	76.0-124			2.20	20
1,2-Dichloroethane	5.00	3.64	3.73	72.8	74.6	65.0-131			2.44	20
1,2-Dichloropropane	5.00	4.01	4.01	80.2	80.2	74.0-125			0.000	20
1,3,5-Trimethylbenzene	5.00	5.24	5.24	105	105	73.0-127			0.000	20
1,3-Dichlorobenzene	5.00	5.73	5.81	115	116	76.0-125			1.39	20
1,3-Dichloropropane	5.00	5.24	5.30	105	106	80.0-125			1.14	20
1,4-Dichlorobenzene	5.00	5.65	5.64	113	113	77.0-121			0.177	20
2,2-Dichloropropane	5.00	4.00	4.05	80.0	81.0	59.0-135			1.24	20
2-Butanone (MEK)	25.0	15.8	15.7	63.2	62.8	30.0-160			0.635	24
4-Methyl-2-pentanone (MIBK)	25.0	21.0	21.3	84.0	85.2	56.0-143			1.42	20
Allyl chloride	25.0	23.3	23.3	93.2	93.2	70.0-131			0.000	20
Benzene	5.00	4.60	4.55	92.0	91.0	70.0-123			1.09	20
Bromobenzene	5.00	5.45	5.43	109	109	73.0-121			0.368	20
Bromochloromethane	5.00	5.40	5.38	108	108	77.0-128			0.371	20
Bromodichloromethane	5.00	4.07	4.20	81.4	84.0	73.0-121			3.14	20
Bromoform	5.00	4.28	4.54	85.6	90.8	64.0-132			5.90	20
Bromomethane	5.00	2.92	3.80	58.4	76.0	56.0-147		J3	26.2	20
Carbon tetrachloride	5.00	4.33	4.39	86.6	87.8	66.0-128			1.38	20
Chlorobenzene	5.00	5.66	5.63	113	113	76.0-128			0.531	20
Chloroethane	5.00	4.04	4.14	80.8	82.8	61.0-134			2.44	20
Chloroform	5.00	4.13	4.17	82.6	83.4	72.0-123			0.964	20
Chloromethane	5.00	2.83	2.81	56.6	56.2	51.0-138			0.709	20
Dibromochloromethane	5.00	4.94	5.19	98.8	104	74.0-127			4.94	20
Dibromomethane	5.00	4.27	4.39	85.4	87.8	75.0-122			2.77	20
Dichlorodifluoromethane	5.00	3.48	3.47	69.6	69.4	43.0-156			0.288	20
Dichlorofluoromethane	5.00	4.07	4.30	81.4	86.0	65.0-137			5.50	20
Ethyl ether	5.00	3.85	3.79	77.0	75.8	64.0-137			1.57	20
Ethylbenzene	5.00	5.66	5.76	113	115	74.0-126			1.75	20
Hexachloro-1,3-butadiene	5.00	4.06	4.18	81.2	83.6	57.0-150			2.91	20
Isopropylbenzene	5.00	5.68	5.64	114	113	72.0-127			0.707	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4206160-1 04/25/25 22:32 • (LCSD) R4206160-2 04/25/25 22:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Methyl tert-butyl ether	5.00	4.58	4.62	91.6	92.4	66.0-132			0.870	20
Methylene Chloride	5.00	4.37	4.41	87.4	88.2	68.0-123			0.911	20
Naphthalene	5.00	5.31	5.44	106	109	59.0-130			2.42	20
Styrene	5.00	5.39	5.51	108	110	72.0-127			2.20	20
Tetrachloroethene	5.00	5.77	5.68	115	114	70.0-136			1.57	20
Tetrahydrofuran	5.00	2.98	2.99	59.6	59.8	37.0-146			0.335	24
Toluene	5.00	5.68	5.72	114	114	75.0-121			0.702	20
Trichloroethene	5.00	5.03	4.88	101	97.6	76.0-126			3.03	20
Trichlorofluoromethane	5.00	4.02	3.93	80.4	78.6	61.0-142			2.26	20
Xylenes, Total	15.0	16.2	16.1	108	107	72.0-127			0.619	20
cis-1,2-Dichloroethene	5.00	4.69	4.76	93.8	95.2	73.0-125			1.48	20
cis-1,3-Dichloropropene	5.00	4.38	4.47	87.6	89.4	76.0-127			2.03	20
n-Butylbenzene	5.00	5.05	4.96	101	99.2	68.0-135			1.80	20
n-Propylbenzene	5.00	5.50	5.56	110	111	74.0-126			1.08	20
o-Chlorotoluene	5.00	5.57	5.31	111	106	75.0-124			4.78	20
p-Chlorotoluene	5.00	5.19	5.29	104	106	75.0-124			1.91	20
p-Isopropyltoluene	5.00	5.45	5.40	109	108	72.0-133			0.922	20
sec-Butylbenzene	5.00	5.33	5.26	107	105	74.0-130			1.32	20
tert-Butylbenzene	5.00	5.64	5.50	113	110	75.0-127			2.51	20
trans-1,2-Dichloroethene	5.00	4.43	4.54	88.6	90.8	71.0-125			2.45	20
trans-1,3-Dichloropropene	5.00	4.79	4.92	95.8	98.4	73.0-127			2.68	20
(S) 4-Bromofluorobenzene				*96.6*	*96.6*	*67.0-138*				
(S) Toluene-d8				*110*	*111*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*84.1*	*85.7*	*70.0-130*				

Method Blank (MB)

(MB) R4207364-3 04/29/25 22:07

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
Acetone	ND		1.46	2.00
Vinyl chloride	ND		0.0462	0.0500
(S) 4-Bromofluorobenzene	*90.4*			*67.0-138*
(S) Toluene-d8	*117*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*94.0*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4207364-1 04/29/25 20:49 • (LCSD) R4207364-2 04/29/25 21:08

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
Acetone	25.0	24.5	23.7	98.0	94.8	10.0-160			3.32	31
Vinyl chloride	5.00	4.45	4.50	89.0	90.0	63.0-134			1.12	20
(S) 4-Bromofluorobenzene				*90.2*	*89.6*	*67.0-138*				
(S) Toluene-d8				*115*	*117*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*92.9*	*95.2*	*70.0-130*				

Method Blank (MB)

(MB) R4207602-3 04/29/25 10:27

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0302	0.100
1,1,2-Trichloroethane	ND		0.0239	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND		0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	1.00
Bromomethane	ND		0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	ND		0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromochloromethane	ND		0.0245	0.100
Dibromomethane	ND		0.0300	0.200

Method Blank (MB)

(MB) R4207602-3 04/29/25 10:27

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorodifluoromethane	ND		0.0644	0.200
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	0.250
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	ND		0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	ND		0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Vinyl chloride	ND		0.0462	0.0500
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
o-Chlorotoluene	ND		0.0346	0.100
p-Chlorotoluene	ND		0.0180	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 4-Bromofluorobenzene	*94.1*			*67.0-138*
(S) Toluene-d8	*101*			*75.0-131*
(S) 1,2-Dichloroethane-d4	*112*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4207602-1 04/29/25 09:11 • (LCSD) R4207602-2 04/29/25 09:30

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,1,2-Tetrachloroethane	5.00	4.01	3.99	80.2	79.8	74.0-129			0.500	20
1,1,1-Trichloroethane	5.00	4.86	4.86	97.2	97.2	69.0-126			0.000	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4207602-1 04/29/25 09:11 • (LCSD) R4207602-2 04/29/25 09:30

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,1,2,2-Tetrachloroethane	5.00	5.16	5.42	103	108	68.0-128			4.91	20
1,1,2-Trichloro-1,2,2-trifluoroethane	5.00	4.88	4.46	97.6	89.2	61.0-139			8.99	20
1,1,2-Trichloroethane	5.00	4.33	4.49	86.6	89.8	78.0-123			3.63	20
1,1-Dichloroethane	5.00	4.76	4.69	95.2	93.8	70.0-127			1.48	20
1,1-Dichloroethene	5.00	4.61	4.54	92.2	90.8	65.0-131			1.53	20
1,1-Dichloropropene	5.00	4.37	4.35	87.4	87.0	73.0-125			0.459	20
1,2,3-Trichlorobenzene	5.00	4.48	4.46	89.6	89.2	59.0-139			0.447	20
1,2,3-Trichloropropane	5.00	5.32	5.33	106	107	67.0-129			0.188	20
1,2,4-Trichlorobenzene	5.00	4.39	4.14	87.8	82.8	62.0-137			5.86	20
1,2,4-Trimethylbenzene	5.00	4.43	4.62	88.6	92.4	70.0-126			4.20	20
1,2-Dibromo-3-Chloropropane	5.00	4.95	4.76	99.0	95.2	59.0-130			3.91	20
1,2-Dibromoethane	5.00	4.24	4.24	84.8	84.8	74.0-128			0.000	20
1,2-Dichlorobenzene	5.00	4.32	4.36	86.4	87.2	76.0-124			0.922	20
1,2-Dichloroethane	5.00	5.04	4.81	101	96.2	65.0-131			4.67	20
1,2-Dichloropropane	5.00	4.89	5.12	97.8	102	74.0-125			4.60	20
1,3,5-Trimethylbenzene	5.00	4.46	4.65	89.2	93.0	73.0-127			4.17	20
1,3-Dichlorobenzene	5.00	4.38	4.59	87.6	91.8	76.0-125			4.68	20
1,3-Dichloropropane	5.00	4.46	4.60	89.2	92.0	80.0-125			3.09	20
1,4-Dichlorobenzene	5.00	4.06	4.27	81.2	85.4	77.0-121			5.04	20
2,2-Dichloropropane	5.00	5.01	4.57	100	91.4	59.0-135			9.19	20
2-Butanone (MEK)	25.0	38.3	40.5	153	162	30.0-160		J4	5.58	24
4-Methyl-2-pentanone (MIBK)	25.0	29.5	28.7	118	115	56.0-143			2.75	20
Acetone	25.0	41.1	43.4	164	174	10.0-160	J4	J4	5.44	31
Allyl chloride	25.0	20.9	20.7	83.6	82.8	70.0-131			0.962	20
Benzene	5.00	4.06	4.08	81.2	81.6	70.0-123			0.491	20
Bromobenzene	5.00	4.21	4.82	84.2	96.4	73.0-121			13.5	20
Bromochloromethane	5.00	4.64	4.47	92.8	89.4	77.0-128			3.73	20
Bromodichloromethane	5.00	4.51	4.60	90.2	92.0	73.0-121			1.98	20
Bromoform	5.00	3.77	3.55	75.4	71.0	64.0-132			6.01	20
Bromomethane	5.00	4.16	3.73	83.2	74.6	56.0-147			10.9	20
Carbon tetrachloride	5.00	4.84	4.77	96.8	95.4	66.0-128			1.46	20
Chlorobenzene	5.00	4.02	4.12	80.4	82.4	76.0-128			2.46	20
Chloroethane	5.00	4.22	4.07	84.4	81.4	61.0-134			3.62	20
Chloroform	5.00	4.66	4.62	93.2	92.4	72.0-123			0.862	20
Chloromethane	5.00	4.22	4.01	84.4	80.2	51.0-138			5.10	20
Dibromochloromethane	5.00	4.10	4.21	82.0	84.2	74.0-127			2.65	20
Dibromomethane	5.00	4.57	4.47	91.4	89.4	75.0-122			2.21	20
Dichlorodifluoromethane	5.00	4.35	4.17	87.0	83.4	43.0-156			4.23	20
Dichlorofluoromethane	5.00	4.81	4.69	96.2	93.8	65.0-137			2.53	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4207602-1 04/29/25 09:11 • (LCSD) R4207602-2 04/29/25 09:30

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Ethyl ether	5.00	4.90	4.75	98.0	95.0	64.0-137			3.11	20
Ethylbenzene	5.00	4.02	4.13	80.4	82.6	74.0-126			2.70	20
Hexachloro-1,3-butadiene	5.00	4.09	3.67	81.8	73.4	57.0-150			10.8	20
Isopropylbenzene	5.00	4.15	3.94	83.0	78.8	72.0-127			5.19	20
Methyl tert-butyl ether	5.00	4.76	4.53	95.2	90.6	66.0-132			4.95	20
Methylene Chloride	5.00	4.27	4.04	85.4	80.8	68.0-123			5.54	20
Naphthalene	5.00	4.62	4.47	92.4	89.4	59.0-130			3.30	20
Styrene	5.00	4.11	4.02	82.2	80.4	72.0-127			2.21	20
Tetrachloroethene	5.00	4.04	4.15	80.8	83.0	70.0-136			2.69	20
Tetrahydrofuran	5.00	4.66	5.33	93.2	107	37.0-146			13.4	24
Toluene	5.00	4.05	4.24	81.0	84.8	75.0-121			4.58	20
Trichloroethene	5.00	4.24	4.23	84.8	84.6	76.0-126			0.236	20
Trichlorofluoromethane	5.00	4.78	4.47	95.6	89.4	61.0-142			6.70	20
Vinyl chloride	5.00	3.79	3.75	75.8	75.0	63.0-134			1.06	20
Xylenes, Total	15.0	12.0	12.1	80.0	80.7	72.0-127			0.830	20
cis-1,2-Dichloroethene	5.00	4.22	4.09	84.4	81.8	73.0-125			3.13	20
cis-1,3-Dichloropropene	5.00	4.53	4.60	90.6	92.0	76.0-127			1.53	20
n-Butylbenzene	5.00	4.24	4.38	84.8	87.6	68.0-135			3.25	20
n-Propylbenzene	5.00	4.44	4.93	88.8	98.6	74.0-126			10.5	20
o-Chlorotoluene	5.00	4.31	4.72	86.2	94.4	75.0-124			9.08	20
p-Chlorotoluene	5.00	4.09	4.49	81.8	89.8	75.0-124			9.32	20
p-Isopropyltoluene	5.00	4.57	4.58	91.4	91.6	72.0-133			0.219	20
sec-Butylbenzene	5.00	4.50	4.69	90.0	93.8	74.0-130			4.13	20
tert-Butylbenzene	5.00	4.61	5.01	92.2	100	75.0-127			8.32	20
trans-1,2-Dichloroethene	5.00	4.14	4.06	82.8	81.2	71.0-125			1.95	20
trans-1,3-Dichloropropene	5.00	4.47	4.56	89.4	91.2	73.0-127			1.99	20
(S) 4-Bromofluorobenzene				*95.4*	*88.6*	*67.0-138*				
(S) Toluene-d8				*97.2*	*100*	*75.0-131*				
(S) 1,2-Dichloroethane-d4				*116*	*109*	*70.0-130*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
NDA Spring Sampling (4)

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program (DOD, NCRA, DW, etc):

Client Project #
200

Lab Project #
WMELKRIVMN-00006

Collected by (print):
Kenneth Smith

Site/Facility ID #
MN02

P.O. #
13607867

Collected by (signature):

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

12065 Lebanon Rd Mount Juliet, TN 37122
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # 184779
I195

Acctnum: WMELKRIVMN
Template: T166602
Prelogin: P1138805
PM: 364 - T. Alan Harvill
PB: 3/19/25 BK
Shipped Via: FedEX Ground

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	ALK,CHLORIDE,SULFATE 250mlHDPE-NoPres	Metals 1L-HDPE NoPres	Metals, Diss 1L-HDPE NoPres	NH3 250mlHDPENaThioH2SO4	TDS 1L-HDPE NoPres	V8260ULLC 40mlAmb HCl	V8260ULLC 40mlAmb-HCl-Blk	Remarks	Sample # (lab only)
408-OWA	G	GW		4/17/25	930	7	X		X	X	X	X			-01
P-403C	G	GW		4/17/25	1520	7	X	X		X	X	X			-02
TB	G	GW		4/17/25	855	2							X		-03
401-OWA	G	GW		4/17/25	855	7	X		X	X	X	X			-04

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 4439 2445 4794

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N
RAD Screen <0.5 mR/hr:		Y N

Relinquished by: (Signature)	Date: 4/17/25	Time: 1600	Received by: (Signature)	Trip Blank Received: Yes / No HCl / MeoH TBR
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp: 0.3 +4 =4.7 °C Bottles Received: 21
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 4/18/25 Time: 0845

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

FIELD INFORMATION FORM

WASTE MANAGEMENT

Site Name: ERL

Site No.:

Sample Point: 408WA (Sample ID)

This Waste Management Field Information Form is Required. This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only: Lab ID: L1891779

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (Hrs:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
4/17/25	9:10				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing, Flow Cell and Tubing Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment... Dedicated: (Y) or N

Purging Device: C

Sampling Device: C

X-Other:

A- Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Digger/Bucket

Filter Device: (Y) or N; 0.45 µ or ____ µ (circle or fill in)

Filter Type: F

A-In-line Disposable; B-Pressure; C-Vacuum; X-Other

Sample Tube Type:

A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other:

WELL DATA

Well Elevation (at TOC): (ft msl)

Depth to Water (DTW) (from TOC): 30.42 (ft)

Groundwater Elevation (site datum, from TOC): (ft msl)

Total Well Depth (from TOC): (ft)

Stick Up (from ground elevation): (ft)

Casing ID: (in)

Casing Material:

Note: Final Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit: L/M	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (nta)	D.O (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
9:15	0.4	7.87	382	11.3		0.3		
9:20	"	7.86	384	11.3		0.3		
9:25	"	7.77	385	11.3		0.2		
9:30	"	7.78	384	11.3	1.7	0.2	53.8	
:								
:								
:								
:								
:								
:								

Suggested range for 3 consec. readings or corp. Permit/State requirements: +/- 0.2 | +/- 3% | - | - | +/- 10% | +/- 25 mV | Stabilize

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data generated to Site. If more fields above are needed, use separate sheet or form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (nta)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required (i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).

FIELD COMMENTS

Sample Appearance:

Odor: NONE

Color: NONE

Other:

Weather Conditions (required daily, or as conditions change):

Direction Speed:

Outlook:

Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/17/25	Kenneth Smith	KS	Alliance

DISTRIBUTION: WHITE/ORIGINAL - Stays with sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.:

Sample Point: R40BC (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample container (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only Table ID: L1849779

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
4 1 7 2 5	1500				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated (Y) or N

Purging Device: C

Sampling Device: C

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

X-Other:

Filter Device: Y or (N) 0.45 µ or ____ µ (circle or fill in)

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other ____

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: ____

WELL DATA

Well Elevation (at TOC) (ft/msl)	Depth to Water (DTW) (from TOC) (ft)	Groundwater Elevation (site datum, from TOC) (ft/msl)
	41.94	

Total Well Depth (from TOC) (ft)	Stick Up (from ground elevation) (ft)	Casing ID (in)	Casing Material

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit: LPM	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1505	0.4 1st	7.42 1st	597	9.4		0.2		
1510	2nd	7.47 2nd	550	9.3		0.2		
1515	3rd	7.52 3rd	545	9.3		0.2		
1520	4th	7.57 4th	543	9.3	5.10	0.3	-41.2	
Suggested range for 3 consec. readings or more Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separate to Site. If metric fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ Units ____

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

Sample Appearance: ____ Odor: ____ Color: ____ Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign)

Date	Name	Signature	Company
4.17.25	Kenneth Smith		Addurce

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.: | | | | | Sample Point: | 4 | 0 | 1 | 0 | WA | (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only (Lab ID): L1849779

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hrs:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
4 17 25	8:35				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing-Flow Cell and Tubing-Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Purging Device: C
Sampling Device: C
X-Other:

A- Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper/Bottle

Filter Device: (Y) or N — 0.45 µ or ____ µ (check or fill in)

Filter Type: A
A-In-line Disposable; B-Pressure; C-Vacuum; X-Other ____

Sample Tube Type:
A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other ____

WELL DATA

Well Elevation (at TOC) ____ (ft msl)
Depth to Water (DTW) (from TOC) 5 3 32 (ft)
Groundwater Elevation (site datum, from TOC) ____ (ft msl)
Total Well Depth (from TOC) ____ (ft)
Stick Up (from ground elevation) ____ (ft)
Casing ID ____ (in)
Casing Material ____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
8:40	0.4 L/M	7.66	1336	10.3		10.3		
8:45	"	7.63	1351	10.3		10.2		
8:50	"	7.65	1355	10.3		10.2		
8:55	"	7.65	1355	10.3	7.16	10.2	521.0	
:								
:								
:								
:								
:								
:								
Suggested range for 3 consec. readings to note Forced Stab. requirements		+/- 0.2	+/- 3%	–	–	+/- 10%	+/- 25 mV	Stabilizes

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ Units ____

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State Permit/Site).*

FIELD COMMENTS

Sample Appearance: ____ Odor: NONE Color: NONE Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: NW 11mph Outlook: Sunny Precipitation: Y (N)

Specific Comments (including purge/well volume calculations if required): ____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign).

Date	Name	Signature	Company
4.17.25	Kenneth Smith		Arcadis

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

ORIGINAL COPY

ANALYTICAL REPORT

May 14, 2025

Revised Report

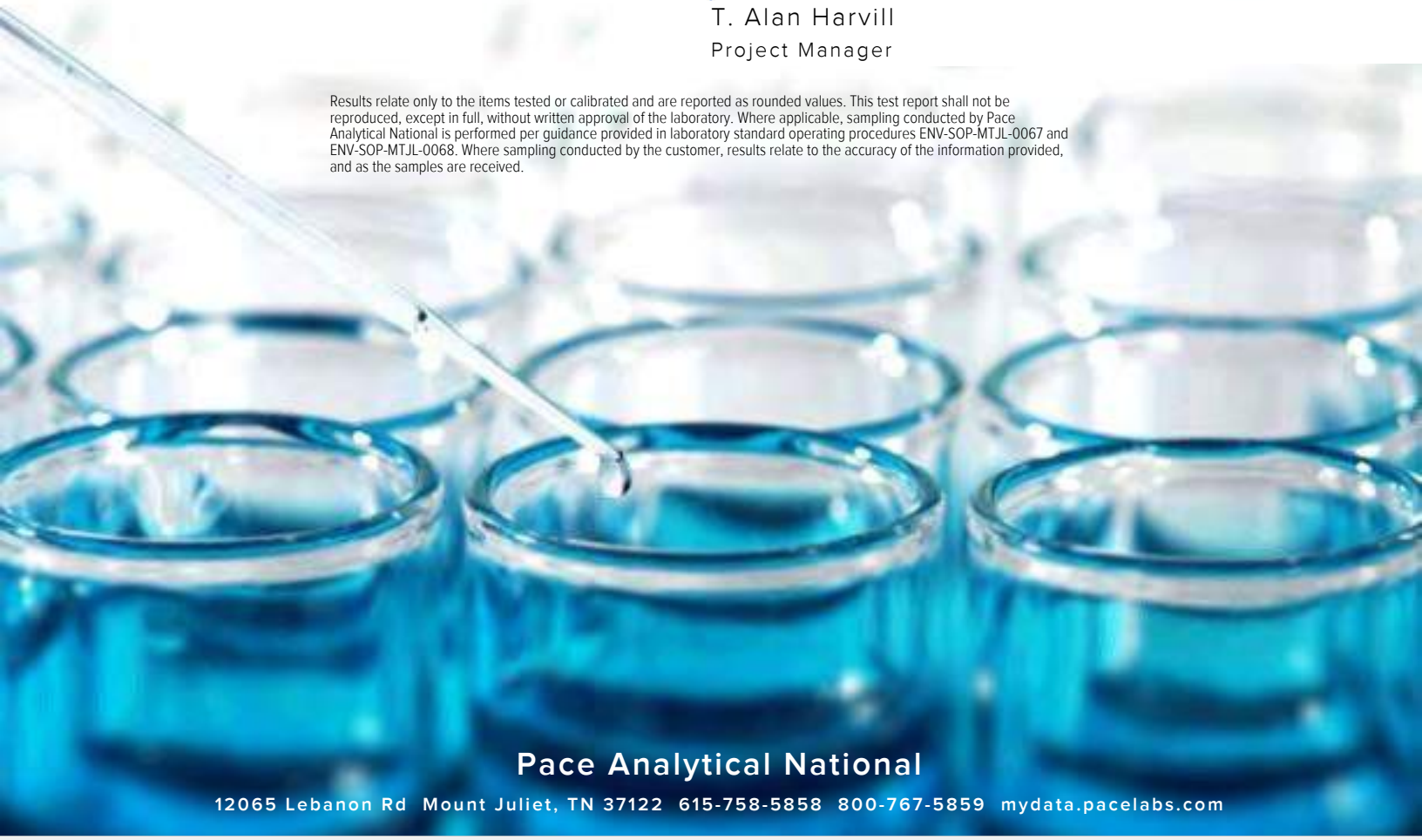
Elk River Landfill

Sample Delivery Group:	L1850102
Samples Received:	04/19/2025
Project Number:	200
Description:	MNA Parameters
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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SAMPLE SUMMARY

P-342C L1850102-01

			Collected by	Collected date/time	Received date/time	
			Mike H.	04/18/25 11:00	04/19/25 08:45	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG2495882	1	04/28/25 22:16	04/28/25 22:16	RTW	Mt. Juliet, TN
Calculated Results	WG2499701	1	05/01/25 11:52	05/01/25 11:52	JPD	Mt. Juliet, TN
Gravimetric Analysis by Method 2540 C-2011	WG2498628	1	04/24/25 08:56	04/24/25 10:04	JAC	Mt. Juliet, TN
Gravimetric Analysis by Method 2540 D-2020	WG2496890	1	04/22/25 11:34	04/22/25 17:30	MMF	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG2495882	1	04/21/25 12:02	04/21/25 12:02	BJM	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG2495099	1	04/24/25 07:36	04/24/25 07:36	ZSA	Mt. Juliet, TN
Wet Chemistry by Method 350.1	WG2496375	1	04/21/25 17:38	04/21/25 17:38	RTW	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG2496476	1	04/28/25 22:16	04/28/25 22:16	RTW	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG2502806	1	04/29/25 18:20	04/29/25 18:20	AF	Mt. Juliet, TN
Mercury by Method 7470A	WG2495366	1	04/23/25 14:30	04/25/25 12:49	LAS	Mt. Juliet, TN
Metals (ICP) by Method 6010D	WG2499701	1	04/30/25 09:06	04/30/25 17:30	MAP	Mt. Juliet, TN
Metals (ICPMS) by Method 6020B	WG2499715	1	04/30/25 04:59	05/01/25 11:52	JPD	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 3810/RSK175	WG2502936	1	04/30/25 09:14	04/30/25 09:14	CCM	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 00:50	04/29/25 00:50	JAH	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Report Revision History

Level II Report - Version 1: 05/02/25 08:34
Level II Report - Version 2: 05/13/25 12:46

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Revised report to change ID to P-342C per Barr Engineering

Gravimetric Analysis by Method 2540 D-2020

RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Batch	Lab Sample ID	Analytes
WG2496890	(DUP) R4203897-5	Suspended Solids

Wet Chemistry by Method 300.0

The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).

Batch	Lab Sample ID	Analytes
WG2495099	(MS) R4204495-4	Chloride

The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Batch	Lab Sample ID	Analytes
WG2495099	(MS) R4204495-4, (MS) R4204495-6, (MSD) R4204495-7	Chloride and Sulfate

Wet Chemistry by Method 353.2

The sample matrix interfered with the ability to make any accurate determination; spike value is high.

Batch	Lab Sample ID	Analytes
WG2496476	(MSD) R4206643-6	Nitrate-Nitrite

Mercury by Method 7470A

Analysis was filtered in the laboratory.

Batch	Method	Lab Sample ID
WG2495366	7470A	L1850102-01

Metals (ICP) by Method 6010D

Analysis was filtered in the laboratory.

Batch	Method	Lab Sample ID
WG2499701	6010D	L1850102-01

Metals (ICPMS) by Method 6020B

Analysis was filtered in the laboratory.

Batch	Method	Lab Sample ID
WG2499715	6020B	L1850102-01

The sample concentration is too high to evaluate accurate spike recoveries.

Batch	Lab Sample ID	Analytes
WG2499715	(MS) R4208233-4, (MSD) R4208233-5	Magnesium,Dissolved

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2502097	L1850102-01	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene

The associated batch QC was above the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG2502097	(LCS) R4207086-1, L1850102-01	Bromomethane and Chloroethane

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	7.5	su
Specific Conductance (on site)	300	umhos/cm
Temperature (on-site)	7.5	Deg. C
Dissolved Oxygen (on-site)	7.3	mg/l
Turbidity (on-site)	0	NTU
eH/ORP (On Site)	-191	mV

Calculated Results

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	meq/l		meq/l		date / time	
Total Anions (calculated)	3.82		0.000318	1	04/28/2025 22:16	WG2495882
Total Cations (calculated)	4.11		0.0000368	1	05/01/2025 11:52	WG2499701

Calculated Results

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	%		%		date / time	
Percent Difference (calculated)	3.64		0.000	1	05/01/2025 11:52	WG2499701

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Dissolved Solids	227		10.0	1	04/24/2025 10:04	WG2498628

Gravimetric Analysis by Method 2540 D-2020

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	ND		4.00	1	04/22/2025 17:30	WG2496890

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity	181		20.0	1	04/21/2025 12:02	WG2495882

Sample Narrative:

L1850102-01 WG2495882: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	ND		1.00	1	04/24/2025 07:36	WG2495099
Sulfate	8.56		5.00	1	04/24/2025 07:36	WG2495099

Wet Chemistry by Method 350.1

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Ammonia Nitrogen	ND		0.100	1	04/21/2025 17:38	WG2496375

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Nitrate-Nitrite	ND		0.100	1	04/28/2025 22:16	WG2496476

Wet Chemistry by Method 9060A

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
TOC	1.01		1.00	1	04/29/2025 18:20	WG2502806

Mercury by Method 7470A

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
Mercury,Dissolved	ND		0.000200	1	04/25/2025 12:49	WG2495366

Metals (ICP) by Method 6010D

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
Boron,Dissolved	ND		0.200	1	04/30/2025 17:30	WG2499701
Cadmium,Dissolved	ND		0.00200	1	04/30/2025 17:30	WG2499701
Calcium,Dissolved	49.8		1.00	1	04/30/2025 17:30	WG2499701
Copper,Dissolved	ND		0.0100	1	04/30/2025 17:30	WG2499701
Iron,Dissolved	ND		0.100	1	04/30/2025 17:30	WG2499701
Lead,Dissolved	ND		0.0100	1	04/30/2025 17:30	WG2499701
Manganese,Dissolved	0.124		0.0100	1	04/30/2025 17:30	WG2499701
Potassium,Dissolved	1.42		1.00	1	04/30/2025 17:30	WG2499701
Sodium,Dissolved	4.35		1.00	1	04/30/2025 17:30	WG2499701

Metals (ICPMS) by Method 6020B

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Arsenic,Dissolved	ND		2.00	1	05/01/2025 11:52	WG2499715
Chromium,Dissolved	ND		4.00	1	05/01/2025 11:52	WG2499715
Magnesium,Dissolved	17000		200	1	05/01/2025 11:52	WG2499715
Zinc,Dissolved	ND		10.0	1	05/01/2025 11:52	WG2499715

Volatile Organic Compounds (GC) by Method 3810/RSK175

Analyte	Result mg/l	Qualifier	RL mg/l	Dilution	Analysis date / time	Batch
Ethane	ND		0.00120	1	04/30/2025 09:14	WG2502936
Ethene	ND		0.00120	1	04/30/2025 09:14	WG2502936
Methane	ND		0.000678	1	04/30/2025 09:14	WG2502936

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 00:50	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 00:50	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 00:50	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 00:50	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 00:50	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 00:50	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 00:50	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 00:50	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 00:50	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 00:50	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 00:50	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 00:50	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 00:50	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,2-Dichloroethane	ND		0.250	1	04/29/2025 00:50	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 00:50	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 00:50	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 00:50	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 00:50	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 00:50	WG2502097
Acetone	ND		10.0	1	04/29/2025 00:50	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 00:50	WG2502097
Benzene	ND		0.500	1	04/29/2025 00:50	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 00:50	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 00:50	WG2502097
Bromoform	ND		1.00	1	04/29/2025 00:50	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 00:50	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 00:50	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 00:50	WG2502097
Chloroform	ND		1.00	1	04/29/2025 00:50	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 00:50	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 00:50	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 00:50	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 00:50	WG2502097
Dichlorofluoromethane	ND		1.00	1	04/29/2025 00:50	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 00:50	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 00:50	WG2502097
Isopropylbenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 00:50	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 00:50	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 00:50	WG2502097
Styrene	ND		1.00	1	04/29/2025 00:50	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 00:50	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 00:50	WG2502097
Toluene	ND		1.00	1	04/29/2025 00:50	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 00:50	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 00:50	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 00:50	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 00:50	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 00:50	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 00:50	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 00:50	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 00:50	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 00:50	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 00:50	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 00:50	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 00:50	WG2502097
(S) 1,2-Dichloroethane-d4	*121*			*70.0-130*	*04/29/2025 00:50*	WG2502097
(S) Toluene-d8	*97.2*			*75.0-131*	*04/29/2025 00:50*	WG2502097
(S) 4-Bromofluorobenzene	*90.7*			*67.0-138*	*04/29/2025 00:50*	WG2502097

Method Blank (MB)

(MB) R4205362-1 04/24/25 10:04

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Dissolved Solids	ND		2.82	10.0

L1847744-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1847744-01 04/24/25 10:04 • (DUP) R4205362-3 04/24/25 10:04

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	28200	29100	1	3.07		10

Sample Narrative:

OS: Re-analyzed out of hold for lab dup. Reporting both data sets.

Laboratory Control Sample (LCS)

(LCS) R4205362-2 04/24/25 10:04

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Dissolved Solids	8800	8660	98.4	90.0-110	

Method Blank (MB)

(MB) R4203897-1 04/22/25 17:30

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Suspended Solids	ND		0.350	2.50

L1850260-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1850260-02 04/22/25 17:30 • (DUP) R4203897-4 04/22/25 17:30

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	25.2	27.1	1	7.42		10

L1850343-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1850343-01 04/22/25 17:30 • (DUP) R4203897-5 04/22/25 17:30

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	527	640	1	19.4	P1	10

Laboratory Control Sample (LCS)

(LCS) R4203897-2 04/22/25 17:30

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Suspended Solids	773	848	110	85.0-115	

Method Blank (MB)

(MB) R4202835-2 04/21/25 10:39

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	ND		2.71	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1848930-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1848930-05 04/21/25 10:55 • (DUP) R4202835-3 04/21/25 11:03

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	288	288	1	0.207		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1850150-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1850150-03 04/21/25 14:11 • (DUP) R4202835-4 04/21/25 14:20

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	353	352	1	0.297		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R4202835-1 04/21/25 10:32

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	98.8	98.8	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R4204495-1 04/24/25 01:00

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloride	ND		0.0519	1.00
Sulfate	ND		0.0774	5.00

L1850033-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1850033-01 04/24/25 04:33 • (DUP) R4204495-3 04/24/25 04:52

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	68.7	67.8	1	1.33		15

L1850114-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1850114-02 04/24/25 08:12 • (DUP) R4204495-5 04/24/25 08:31

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	49.6	49.4	1	0.448		15
Sulfate	18.7	18.4	1	1.62		15

Laboratory Control Sample (LCS)

(LCS) R4204495-2 04/24/25 01:16

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40.0	38.8	97.1	90.0-110	
Sulfate	40.0	39.5	98.7	90.0-110	

L1850033-01 Original Sample (OS) • Matrix Spike (MS)

(OS) L1850033-01 04/24/25 04:33 • (MS) R4204495-4 04/24/25 05:10

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	40.0	117	130	32.5	1	90.0-110	E J6
Sulfate	40.0	68.7	92.4	59.3	1	90.0-110	J6

L1850114-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1850114-02 04/24/25 08:12 • (MS) R4204495-6 04/24/25 08:49 • (MSD) R4204495-7 04/24/25 09:07

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	40.0	49.6	77.7	76.4	70.1	66.9	1	90.0-110	J6	J6	1.64	15
Sulfate	40.0	18.7	54.1	53.1	88.5	85.9	1	90.0-110	J6	J6	1.93	15

Method Blank (MB)

(MB) R4202870-1 04/21/25 17:24

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Ammonia Nitrogen	ND		0.0317	0.100

L1849978-17 Original Sample (OS) • Duplicate (DUP)

(OS) L1849978-17 04/21/25 17:29 • (DUP) R4202870-3 04/21/25 17:30

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ammonia Nitrogen	ND	ND	1	0.000		10

Laboratory Control Sample (LCS)

(LCS) R4202870-2 04/21/25 17:26

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Ammonia Nitrogen	7.50	7.50	99.9	90.0-110	

L1849978-17 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849978-17 04/21/25 17:29 • (MS) R4202870-4 04/21/25 17:32 • (MSD) R4202870-5 04/21/25 17:33

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ammonia Nitrogen	5.00	ND	5.04	5.20	101	104	1	90.0-110			3.24	10

Method Blank (MB)

(MB) R4206643-1 04/28/25 21:40

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Nitrate-Nitrite	ND		0.0197	0.100

Laboratory Control Sample (LCS)

(LCS) R4206643-2 04/28/25 21:42

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Nitrate-Nitrite	2.50	2.56	102	90.0-110	

L1849978-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849978-04 04/28/25 21:44 • (MS) R4206643-3 04/28/25 21:45 • (MSD) R4206643-4 04/28/25 21:47

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	ND	2.59	2.60	104	104	1	90.0-110			0.385	20

L1849978-05 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1849978-05 04/28/25 21:48 • (MS) R4206643-5 04/28/25 21:49 • (MSD) R4206643-6 04/28/25 21:50

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Nitrate-Nitrite	2.50	0.152	2.78	2.94	105	112	1	90.0-110		J5	5.59	20

Method Blank (MB)

(MB) R4207253-2 04/29/25 18:08

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TOC	ND		0.102	1.00

L1852817-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1852817-02 04/29/25 19:26 • (DUP) R4207253-5 04/29/25 19:42

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC	16.6	16.5	1	0.604		20

Laboratory Control Sample (LCS)

(LCS) R4207253-1 04/29/25 17:55

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TOC	25.0	24.7	98.7	80.0-120	

L1852817-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1852817-01 04/29/25 18:36 • (MS) R4207253-3 04/29/25 18:53 • (MSD) R4207253-4 04/29/25 19:10

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TOC	25.0	15.8	41.4	41.4	103	103	1	75.0-125			0.000	20

Method Blank (MB)

(MB) R4205042-1 04/25/25 12:44

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Mercury,Dissolved	ND		0.0000490	0.000200

Laboratory Control Sample (LCS)

(LCS) R4205042-2 04/25/25 12:46

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Mercury,Dissolved	0.00300	0.00296	98.7	80.0-120	

L1850102-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1850102-01 04/25/25 12:49 • (MS) R4205042-4 04/25/25 12:54 • (MSD) R4205042-5 04/25/25 13:04

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury,Dissolved	0.00300	ND	0.00315	0.00285	105	95.0	1	75.0-125			9.89	20

Method Blank (MB)

(MB) R4208018-1 04/30/25 16:44

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Boron,Dissolved	ND		0.0126	0.200
Calcium,Dissolved	ND		0.0463	1.00
Cadmium,Dissolved	ND		0.000700	0.00200
Copper,Dissolved	ND		0.00530	0.0100
Iron,Dissolved	ND		0.0141	0.100
Potassium,Dissolved	ND		0.102	1.00
Manganese,Dissolved	ND		0.00120	0.0100
Sodium,Dissolved	ND		0.0985	1.00
Lead,Dissolved	ND		0.00190	0.00500

Laboratory Control Sample (LCS)

(LCS) R4208018-2 04/30/25 16:46

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Boron,Dissolved	1.00	1.02	102	80.0-120	
Calcium,Dissolved	10.0	10.6	106	80.0-120	
Cadmium,Dissolved	1.00	1.01	101	80.0-120	
Copper,Dissolved	1.00	1.08	108	80.0-120	
Iron,Dissolved	10.0	10.6	106	80.0-120	
Potassium,Dissolved	10.0	10.1	101	80.0-120	
Manganese,Dissolved	1.00	1.09	109	80.0-120	
Sodium,Dissolved	10.0	11.4	114	80.0-120	
Lead,Dissolved	1.00	0.998	99.8	80.0-120	

L1850059-12 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1850059-12 04/30/25 16:48 • (MS) R4208018-4 04/30/25 16:52 • (MSD) R4208018-5 04/30/25 16:53

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Boron,Dissolved	1.00	ND	1.06	1.05	99.4	98.2	1	75.0-125			1.08	20
Calcium,Dissolved	10.0	ND	11.3	11.1	103	102	1	75.0-125			1.48	20
Cadmium,Dissolved	1.00	ND	0.985	0.978	98.3	97.7	1	75.0-125			0.656	20
Copper,Dissolved	1.00	ND	1.05	1.04	105	104	1	75.0-125			1.13	20
Iron,Dissolved	10.0	ND	10.4	10.2	103	102	1	75.0-125			1.37	20
Potassium,Dissolved	10.0	4.07	14.0	13.9	99.5	98.0	1	75.0-125			1.06	20
Manganese,Dissolved	1.00	1.52	2.51	2.51	98.5	99.1	1	75.0-125			0.212	20
Sodium,Dissolved	10.0	4.11	13.3	13.1	91.6	90.3	1	75.0-125			0.930	20
Lead,Dissolved	1.00	ND	0.998	0.994	99.8	99.4	1	75.0-125			0.366	20

Method Blank (MB)

(MB) R4208233-1 05/01/25 11:32

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Arsenic,Dissolved	ND		0.250	2.00
Chromium,Dissolved	0.633		0.540	2.00
Magnesium,Dissolved	ND		100	1000
Zinc,Dissolved	ND		2.56	25.0

Laboratory Control Sample (LCS)

(LCS) R4208233-2 05/01/25 11:36

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Arsenic,Dissolved	50.0	51.1	102	80.0-120	
Chromium,Dissolved	50.0	52.1	104	80.0-120	
Magnesium,Dissolved	5000	5040	101	80.0-120	
Zinc,Dissolved	50.0	52.5	105	80.0-120	

L1850511-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1850511-01 05/01/25 11:39 • (MS) R4208233-4 05/01/25 11:45 • (MSD) R4208233-5 05/01/25 11:48

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Arsenic,Dissolved	50.0	ND	52.6	53.4	101	103	1	75.0-125			1.51	20
Chromium,Dissolved	50.0	ND	50.8	50.8	102	102	1	75.0-125			0.103	20
Magnesium,Dissolved	5000	176000	177000	177000	30.9	19.9	1	75.0-125	V	V	0.311	20
Zinc,Dissolved	50.0	ND	51.3	50.8	103	102	1	75.0-125			0.806	20

Method Blank (MB)

(MB) R4207533-2 04/30/25 09:08

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Ethane	ND		0.000296	0.00129
Ethene	ND		0.000422	0.00127
Methane	ND		0.000287	0.000678

L1852474-06 Original Sample (OS) • Duplicate (DUP)

(OS) L1852474-06 04/30/25 10:33 • (DUP) R4207533-3 04/30/25 10:55

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ethane	ND	ND	1	0.000		20
Ethene	ND	ND	1	0.000		20
Methane	ND	ND	1	0.000		20

L1852572-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1852572-04 04/30/25 11:27 • (DUP) R4207533-4 04/30/25 11:50

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ethane	ND	ND	1	0.000		20
Ethene	ND	ND	1	0.000		20
Methane	ND	ND	1	0.000		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R4207533-1 04/30/25 08:57 • (LCSD) R4207533-5 04/30/25 11:53

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Ethane	0.129	0.131	0.130	102	101	85.0-115			0.766	20
Ethene	0.127	0.131	0.129	103	102	85.0-115			1.54	20
Methane	0.0678	0.0685	0.0671	101	99.0	85.0-115			2.06	20

Method Blank (MB)

(MB) R4207086-2 04/28/25 23:16

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0302	0.100
1,1,2-Trichloroethane	ND		0.0239	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND	J	0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	0.500
Bromomethane	0.238	J	0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	0.0583	J	0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromochloromethane	ND		0.0245	0.100
Dibromomethane	ND		0.0300	0.200

Method Blank (MB)

(MB) R4207086-2 04/28/25 23:16

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorodifluoromethane	ND		0.0644	0.200
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	0.250
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	0.282	J	0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	0.108	J	0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Vinyl chloride	ND		0.0462	0.0500
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
o-Chlorotoluene	ND		0.0346	0.100
p-Chlorotoluene	ND		0.0180	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 1,2-Dichloroethane-d4	*114*			*70.0-130*
(S) Toluene-d8	*98.5*			*75.0-131*
(S) 4-Bromofluorobenzene	*97.8*			*67.0-138*

Laboratory Control Sample (LCS)

(LCS) R4207086-1 04/28/25 21:57

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
1,1,1,2-Tetrachloroethane	5.00	4.68	93.6	74.0-129	
1,1,1-Trichloroethane	5.00	5.24	105	69.0-126	

Laboratory Control Sample (LCS)

(LCS) R4207086-1 04/28/25 21:57

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
1,1,2,2-Tetrachloroethane	5.00	4.61	92.2	68.0-128	
1,1,2-Trichloro-1,2,2-trifluoroethane	5.00	5.00	100	61.0-139	
1,1,2-Trichloroethane	5.00	4.61	92.2	78.0-123	
1,1-Dichloroethane	5.00	5.19	104	70.0-127	
1,1-Dichloroethene	5.00	4.62	92.4	65.0-131	
1,1-Dichloropropene	5.00	4.83	96.6	73.0-125	
1,2,3-Trichlorobenzene	5.00	4.03	80.6	59.0-139	
1,2,3-Trichloropropane	5.00	5.07	101	67.0-129	
1,2,4-Trichlorobenzene	5.00	4.25	85.0	62.0-137	
1,2,4-Trimethylbenzene	5.00	4.82	96.4	70.0-126	
1,2-Dibromo-3-Chloropropane	5.00	3.78	75.6	59.0-130	
1,2-Dibromoethane	5.00	4.57	91.4	74.0-128	
1,2-Dichlorobenzene	5.00	4.91	98.2	76.0-124	
1,2-Dichloroethane	5.00	5.62	112	65.0-131	
1,2-Dichloropropane	5.00	5.01	100	74.0-125	
1,3,5-Trimethylbenzene	5.00	4.81	96.2	73.0-127	
1,3-Dichlorobenzene	5.00	4.99	99.8	76.0-125	
1,3-Dichloropropane	5.00	4.97	99.4	80.0-125	
1,4-Dichlorobenzene	5.00	4.97	99.4	77.0-121	
2,2-Dichloropropane	5.00	4.92	98.4	59.0-135	
2-Butanone (MEK)	25.0	29.6	118	30.0-160	
4-Methyl-2-pentanone (MIBK)	25.0	26.7	107	56.0-143	
Acetone	25.0	35.0	140	10.0-160	
Allyl chloride	25.0	25.2	101	70.0-131	
Benzene	5.00	4.83	96.6	70.0-123	
Bromobenzene	5.00	4.97	99.4	73.0-121	
Bromochloromethane	5.00	5.33	107	77.0-128	
Bromodichloromethane	5.00	5.19	104	73.0-121	
Bromoform	5.00	4.34	86.8	64.0-132	
Bromomethane	5.00	8.09	162	56.0-147	J4
Carbon tetrachloride	5.00	4.83	96.6	66.0-128	
Chlorobenzene	5.00	4.98	99.6	76.0-128	
Chloroethane	5.00	6.99	140	61.0-134	J4
Chloroform	5.00	5.32	106	72.0-123	
Chloromethane	5.00	5.13	103	51.0-138	
Dibromochloromethane	5.00	4.65	93.0	74.0-127	
Dibromomethane	5.00	5.35	107	75.0-122	
Dichlorodifluoromethane	5.00	6.63	133	43.0-156	
Dichlorofluoromethane	5.00	6.17	123	65.0-137	

Laboratory Control Sample (LCS)

(LCS) R4207086-1 04/28/25 21:57

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Ethyl ether	5.00	4.89	97.8	64.0-137	
Ethylbenzene	5.00	4.59	91.8	74.0-126	
Hexachloro-1,3-butadiene	5.00	3.53	70.6	57.0-150	
Isopropylbenzene	5.00	4.68	93.6	72.0-127	
Methyl tert-butyl ether	5.00	5.30	106	66.0-132	
Methylene Chloride	5.00	5.11	102	68.0-123	
Naphthalene	5.00	4.06	81.2	59.0-130	
Styrene	5.00	4.51	90.2	72.0-127	
Tetrachloroethene	5.00	4.56	91.2	70.0-136	
Tetrahydrofuran	5.00	5.08	102	37.0-146	
Toluene	5.00	4.71	94.2	75.0-121	
Trichloroethene	5.00	4.88	97.6	76.0-126	
Trichlorofluoromethane	5.00	5.91	118	61.0-142	
Vinyl chloride	5.00	6.52	130	63.0-134	
Xylenes, Total	15.0	13.7	91.3	72.0-127	
cis-1,2-Dichloroethene	5.00	4.61	92.2	73.0-125	
cis-1,3-Dichloropropene	5.00	4.80	96.0	76.0-127	
n-Butylbenzene	5.00	4.84	96.8	68.0-135	
n-Propylbenzene	5.00	5.00	100	74.0-126	
o-Chlorotoluene	5.00	5.16	103	75.0-124	
p-Chlorotoluene	5.00	5.01	100	75.0-124	
p-Isopropyltoluene	5.00	4.62	92.4	72.0-133	
sec-Butylbenzene	5.00	4.74	94.8	74.0-130	
tert-Butylbenzene	5.00	4.65	93.0	75.0-127	
trans-1,2-Dichloroethene	5.00	4.73	94.6	71.0-125	
trans-1,3-Dichloropropene	5.00	4.91	98.2	73.0-127	
(S) 1,2-Dichloroethane-d4			*122*	*70.0-130*	
(S) Toluene-d8			*98.3*	*75.0-131*	
(S) 4-Bromofluorobenzene			*94.9*	*67.0-138*	

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
J4	The associated batch QC was outside the established quality control range for accuracy.
J5	The sample matrix interfered with the ability to make any accurate determination; spike value is high.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable / mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
Baseline Parameters

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program (DOD, RCRA, DW, etc):

Client Project #
300

Lab Project #
WMELKRIVMN-00022

Collected by (print):
Mike Hans

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y **V**

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Analysis / Container / Preservative: AlK, Cl, SO4 125mlHDPE-NoPres	Metals-Diss 1L-HDPE NoPres	NH3,NO2NO3 250mlHDPE-H2SO4	TSS 1L-HDPE NoPres	Total Cations 250mlHDPE-HNO3	V8260ULLC 40mlAmb-HCl	V8260ULLC 40mlAmb-HCl-Blk				Remarks	Sample # (lab only)
~~P-342L~~		GW				~~8~~	X	X	X	X	X	X						
P-342L		GW		4/8/25	1100	8	X	X	X	X	X	X						-01
TB		GW				1							X					

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

SDG # 1850102
J062

Acctnum: **WMELKRIVMN**
Template: **T250136**
Prelogin: **P1144766**
PM: 354 - T. Alan Harvill
PB: 4/11/25 BK
Shipped Via: **FedEX Ground**

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 731532091226

Sample Receipt Checklist
COC Seal Present/Intact: __NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N
RAD screen <0.5 mR/hr: Y __N

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TSR
	4/18/25	1510	FedEx	
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp: 9.6+4=10 °C Bottles Received: 8
				If preservation required by Login: Date/Time
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 4/19/25 Time: 0845
				Hold: Condition: NCF / OK

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | |

Sample Point: P342C (Sample ID)

This Waste Management Field Information Form is Required. This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only: Lab ID: L1850102

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04/18/25	1014C				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record/field desc. below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: Y or N — Filter Device: Y or N (Capsule) or _____ (e.g. 0.45um or 0.1 um)

Purging Device: C — Sampling Device: C

A- Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper/Bottle

Filter Type: A — A-In-line Disposable; B-Pressure; C-Vacuum; X-Other

X-Other: — Sample Tube Type: — A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other:

WELL DATA

Well Elevation (at TOC): (ft msl) — Depth to Water (DTW) (from TOC): 2.20 (ft) — Groundwater Elevation (site datum, from TOC): (ft msl)

Total Well Depth (from TOC): (ft) — Stick Up (from ground elevation): (ft) — Casing ID: (in) — Casing Material:

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by State Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit L/Min	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (nts)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
10:45	0.4	7.42	327	7.6		00		
10:50		7.47	304	7.6		00		
10:55		7.50	300	7.6		00		
11:00		7.50	300	7.5	7.3	00	-191	
:								
:								
:								
:								
:								
:								
Suggested range for 3 consec. readings or see Permit/Site requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM, Inc. or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately as Att. If more fields above are needed, use separate sheet or form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (nts)	DO (mg/L-ppm)	eH/ORP (mV)	Other: _____ Units _____

Final Field Readings are required (i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State Permit/Site)

FIELD COMMENTS

Sample Appearance: _____ Odor: None Color: None Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4.18.25	Mike Hess		ATC

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

4/19 - NCF-L1850102 WMELKRIVMN

R5

Time estimate: 0h **Time spent:** 0h

Members

AH Alan Harvill Paul Minnich

Due on *28 April 2025 5:00 PM* for target *Done*

- [x] Login Clarification needed
- [ ] Chain of custody is incomplete
- [ ] Custody seal not intact
- [ ] Please specify Metals requested
- [ ] Please specify TCLP requested
- [ ] Received additional samples not listed on COC
- [ ] Sample IDs on containers do not match IDs on COC
- [ ] Client did not "X" analysis
- [ ] Chain of Custody is missing
- [ ] If no COC: Received by:_____
- [ ] If no COC: Date/Time:_____
- [ ] If no COC: Temp./Cont.Rec./pH:_____
- [ ] If no COC: Carrier:_____
- [ ] If no COC: Tracking #:_____
- [ ] Client informed by call
- [x] Client informed by Email
- [ ] Client informed by Voicemail
- [x] Date/Time:4/21/25 9:25
- [x] PM initials: TAH
- [x] Client Contact: Jim Eidem / Anna Schneider

Comments

Andy Vann *21 April 2025 8:43 AM*

We did not receive the tripblank.

Alan Harvill *21 April 2025 9:25 AM*

client notified by email.

Matthew Shacklock *21 April 2025 10:16 AM*

Done

ANALYTICAL REPORT

May 21, 2025

Revised Report

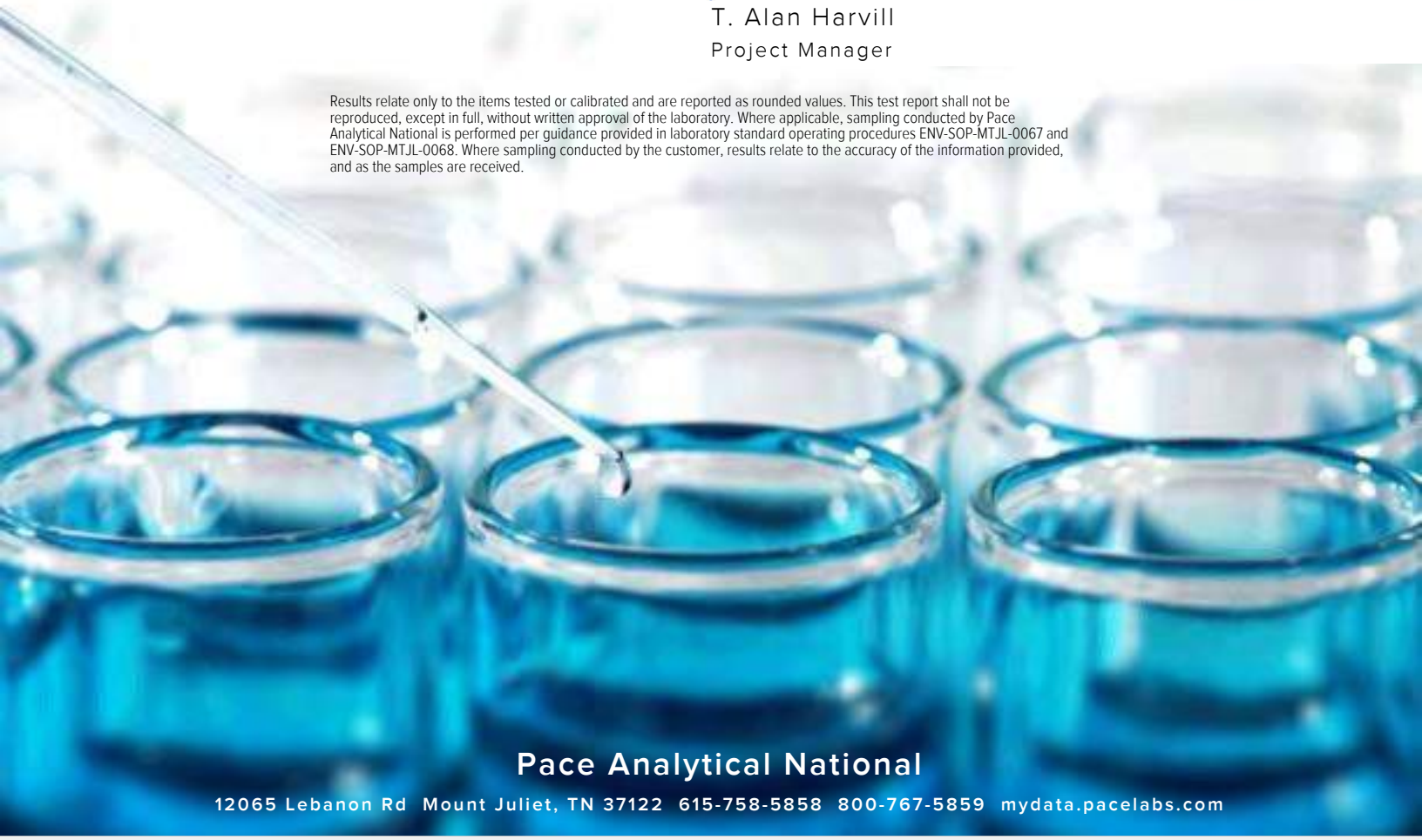
Elk River Landfill

Sample Delivery Group:	L1850104
Samples Received:	04/19/2025
Project Number:	200
Description:	Quarterly Routine GW-GW STD wells
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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SAMPLE SUMMARY

TB L1850104-01

Collected by | Collected date/time 04/15/25 00:00 | Received date/time 04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 00:31	04/29/25 00:31	JAH	Mt. Juliet, TN

P-694477 L1850104-02

Collected by | Collected date/time 04/16/25 09:30 | Received date/time 04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 01:10	04/29/25 01:10	JAH	Mt. Juliet, TN

P-335L L1850104-03

Collected by | Collected date/time 04/17/25 14:45 | Received date/time 04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 01:30	04/29/25 01:30	JAH	Mt. Juliet, TN

P-329L L1850104-04

Collected by | Collected date/time 04/17/25 11:30 | Received date/time 04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 01:50	04/29/25 01:50	JAH	Mt. Juliet, TN

P-324L L1850104-05

Collected by | Collected date/time 04/17/25 14:05 | Received date/time 04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 02:10	04/29/25 02:10	JAH	Mt. Juliet, TN

P-322L L1850104-06

Collected by | Collected date/time 04/17/25 13:10 | Received date/time 04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 02:29	04/29/25 02:29	JAH	Mt. Juliet, TN

P-320L L1850104-07

Collected by | Collected date/time 04/15/25 13:35 | Received date/time 04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 02:49	04/29/25 02:49	JAH	Mt. Juliet, TN

P-320C2 L1850104-08

Collected by | Collected date/time 04/15/25 14:05 | Received date/time 04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 03:09	04/29/25 03:09	JAH	Mt. Juliet, TN

P-320C L1850104-09

Collected by	Collected date/time	Received date/time
	04/15/25 14:35	04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 03:29	04/29/25 03:29	JAH	Mt. Juliet, TN

P-314C L1850104-10

Collected by	Collected date/time	Received date/time
	04/17/25 13:35	04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 03:48	04/29/25 03:48	JAH	Mt. Juliet, TN

P-311L L1850104-11

Collected by	Collected date/time	Received date/time
	04/16/25 14:13	04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 04:08	04/29/25 04:08	JAH	Mt. Juliet, TN

P-311D L1850104-12

Collected by	Collected date/time	Received date/time
	04/16/25 14:18	04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 04:28	04/29/25 04:28	JAH	Mt. Juliet, TN

P-305C L1850104-13

Collected by	Collected date/time	Received date/time
	04/16/25 13:20	04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 04:48	04/29/25 04:48	JAH	Mt. Juliet, TN

P-333L L1850104-14

Collected by	Collected date/time	Received date/time
	04/18/25 11:30	04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 05:08	04/29/25 05:08	JAH	Mt. Juliet, TN

P-301L L1850104-15

Collected by	Collected date/time	Received date/time
	04/17/25 14:20	04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 05:27	04/29/25 05:27	JAH	Mt. Juliet, TN

P-301C L1850104-16

Collected by	Collected date/time	Received date/time
	04/16/25 13:40	04/19/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 05:47	04/29/25 05:47	JAH	Mt. Juliet, TN

P-29D L1850104-17

			Collected by	Collected date/time	Received date/time	
				04/15/25 15:10	04/19/25 08:45	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 06:07	04/29/25 06:07	JAH	Mt. Juliet, TN

P-29C L1850104-18

			Collected by	Collected date/time	Received date/time	
				04/16/25 12:55	04/19/25 08:45	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 06:27	04/29/25 06:27	JAH	Mt. Juliet, TN

P-315L L1850104-19

			Collected by	Collected date/time	Received date/time	
				04/16/25 14:55	04/19/25 08:45	
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2502097	1	04/29/25 06:47	04/29/25 06:47	JAH	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Report Revision History

Level II Report - Version 1: 05/02/25 08:25

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Revised to correct onsite data.

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2502097	L1850104-01	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-02	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-03	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-04	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-05	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-06	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-07	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-08	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-09	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-10	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-11	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene

Volatile Organic Compounds (GC/MS) by Method 8260D

The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.

Batch	Lab Sample ID	Analytes
WG2502097	L1850104-12	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-13	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-14	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-15	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-16	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-17	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-18	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene
WG2502097	L1850104-19	1,2,3-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane, Hexachloro-1,3-butadiene and Naphthalene

The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.

Batch	Lab Sample ID	Analytes
WG2502097	L1850104-02	Chloroethane, Dichlorodifluoromethane, Dichlorofluoromethane and Vinyl chloride
WG2502097	L1850104-04	Dichlorodifluoromethane
WG2502097	L1850104-05	Dichlorofluoromethane
WG2502097	L1850104-06	Dichlorodifluoromethane
WG2502097	L1850104-07	Dichlorodifluoromethane, Dichlorofluoromethane and Vinyl chloride
WG2502097	L1850104-08	Dichlorofluoromethane
WG2502097	L1850104-09	Dichlorodifluoromethane, Dichlorofluoromethane and Vinyl chloride
WG2502097	L1850104-10	Dichlorofluoromethane and Vinyl chloride
WG2502097	L1850104-11	Dichlorodifluoromethane, Dichlorofluoromethane and Trichlorofluoromethane
WG2502097	L1850104-13	Dichlorofluoromethane
WG2502097	L1850104-14	Dichlorofluoromethane
WG2502097	L1850104-15	Dichlorodifluoromethane and Dichlorofluoromethane
WG2502097	L1850104-16	Dichlorodifluoromethane and Dichlorofluoromethane
WG2502097	L1850104-18	Dichlorodifluoromethane, Dichlorofluoromethane and Vinyl chloride

The associated batch QC was above the established quality control range for accuracy.

Batch	Lab Sample ID	Analytes
WG2502097	(LCS) R4207086-1, L1850104-01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	Bromomethane and Chloroethane

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 00:31	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 00:31	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 00:31	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 00:31	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 00:31	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 00:31	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 00:31	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 00:31	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 00:31	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 00:31	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 00:31	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 00:31	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 00:31	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 00:31	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 00:31	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 00:31	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 00:31	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 00:31	WG2502097
Acetone	ND		10.0	1	04/29/2025 00:31	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 00:31	WG2502097
Benzene	ND		0.500	1	04/29/2025 00:31	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 00:31	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 00:31	WG2502097
Bromoform	ND		1.00	1	04/29/2025 00:31	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 00:31	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 00:31	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 00:31	WG2502097
Chloroform	ND		1.00	1	04/29/2025 00:31	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 00:31	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 00:31	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 00:31	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 00:31	WG2502097
Dichlorofluoromethane	ND		1.00	1	04/29/2025 00:31	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 00:31	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 00:31	WG2502097
Isopropylbenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 00:31	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 00:31	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 00:31	WG2502097
Styrene	ND		1.00	1	04/29/2025 00:31	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 00:31	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 00:31	WG2502097
Toluene	ND		1.00	1	04/29/2025 00:31	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 00:31	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 00:31	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 00:31	WG2502097

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Xylenes, Total	ND		2.00	1	04/29/2025 00:31	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 00:31	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 00:31	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 00:31	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 00:31	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 00:31	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 00:31	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 00:31	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 00:31	WG2502097
(S) 1,2-Dichloroethane-d4	*123*			*70.0-130*	*04/29/2025 00:31*	WG2502097
(S) Toluene-d8	*97.6*			*75.0-131*	*04/29/2025 00:31*	WG2502097
(S) 4-Bromofluorobenzene	*92.8*			*67.0-138*	*04/29/2025 00:31*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	987.86	ftmsl
pH (On Site)	7.31	su
Specific Conductance (on site)	834	umhos/cm
Temperature (on-site)	9.7	Deg. C
Turbidity (on-site)	0.2	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-203	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 01:10	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 01:10	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 01:10	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 01:10	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 01:10	WG2502097
1,1-Dichloroethane	3.08		1.00	1	04/29/2025 01:10	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 01:10	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 01:10	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 01:10	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 01:10	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 01:10	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 01:10	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 01:10	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 01:10	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 01:10	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 01:10	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 01:10	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 01:10	WG2502097
Acetone	ND		10.0	1	04/29/2025 01:10	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 01:10	WG2502097
Benzene	ND		0.500	1	04/29/2025 01:10	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 01:10	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 01:10	WG2502097
Bromoform	ND		1.00	1	04/29/2025 01:10	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 01:10	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 01:10	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
Chloroethane	ND	C5 J4	1.00	1	04/29/2025 01:10	WG2502097
Chloroform	ND		1.00	1	04/29/2025 01:10	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 01:10	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 01:10	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 01:10	WG2502097
Dichlorodifluoromethane	3.13	C5	1.00	1	04/29/2025 01:10	WG2502097
Dichlorofluoromethane	6.31	C5	1.00	1	04/29/2025 01:10	WG2502097
Ethyl ether	10.4		1.00	1	04/29/2025 01:10	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 01:10	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 01:10	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 01:10	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 01:10	WG2502097
Styrene	ND		1.00	1	04/29/2025 01:10	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 01:10	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 01:10	WG2502097
Toluene	ND		1.00	1	04/29/2025 01:10	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 01:10	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 01:10	WG2502097
Vinyl chloride	0.580	C5	0.0500	1	04/29/2025 01:10	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 01:10	WG2502097
cis-1,2-Dichloroethene	0.106		0.100	1	04/29/2025 01:10	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 01:10	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 01:10	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 01:10	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 01:10	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 01:10	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 01:10	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 01:10	WG2502097
(S) 1,2-Dichloroethane-d4	*120*			*70.0-130*	*04/29/2025 01:10*	WG2502097
(S) Toluene-d8	*100*			*75.0-131*	*04/29/2025 01:10*	WG2502097
(S) 4-Bromofluorobenzene	*93.1*			*67.0-138*	*04/29/2025 01:10*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	995.98	ftmsl
pH (On Site)	7.19	su
Specific Conductance (on site)	412	umhos/cm
Temperature (on-site)	12.3	Deg. C
Turbidity (on-site)	10.2	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-101	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 01:30	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 01:30	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 01:30	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 01:30	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 01:30	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 01:30	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 01:30	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 01:30	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 01:30	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 01:30	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 01:30	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 01:30	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 01:30	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 01:30	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 01:30	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 01:30	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 01:30	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 01:30	WG2502097
Acetone	ND		10.0	1	04/29/2025 01:30	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 01:30	WG2502097
Benzene	ND		0.500	1	04/29/2025 01:30	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 01:30	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 01:30	WG2502097
Bromoform	ND		1.00	1	04/29/2025 01:30	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 01:30	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 01:30	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 01:30	WG2502097
Chloroform	ND		1.00	1	04/29/2025 01:30	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 01:30	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 01:30	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 01:30	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 01:30	WG2502097
Dichlorofluoromethane	ND		1.00	1	04/29/2025 01:30	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 01:30	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 01:30	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 01:30	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 01:30	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 01:30	WG2502097
Styrene	ND		1.00	1	04/29/2025 01:30	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 01:30	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 01:30	WG2502097
Toluene	ND		1.00	1	04/29/2025 01:30	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 01:30	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 01:30	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 01:30	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 01:30	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 01:30	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 01:30	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 01:30	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 01:30	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 01:30	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 01:30	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 01:30	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 01:30	WG2502097
(S) 1,2-Dichloroethane-d4	*123*			*70.0-130*	*04/29/2025 01:30*	WG2502097
(S) Toluene-d8	*98.9*			*75.0-131*	*04/29/2025 01:30*	WG2502097
(S) 4-Bromofluorobenzene	*93.5*			*67.0-138*	*04/29/2025 01:30*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	947.99	ftmsl
pH (On Site)	7.61	su
Specific Conductance (on site)	267	umhos/cm
Temperature (on-site)	7.8	Deg. C
Turbidity (on-site)	15.7	NTU
Dissolved Oxygen (on-site)	0.1	mg/l
eH/ORP (On Site)	-166.5	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 01:50	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 01:50	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 01:50	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 01:50	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 01:50	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 01:50	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 01:50	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 01:50	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 01:50	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 01:50	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 01:50	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 01:50	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 01:50	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 01:50	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 01:50	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 01:50	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 01:50	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 01:50	WG2502097
Acetone	ND		10.0	1	04/29/2025 01:50	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 01:50	WG2502097
Benzene	ND		0.500	1	04/29/2025 01:50	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 01:50	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 01:50	WG2502097
Bromoform	ND		1.00	1	04/29/2025 01:50	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 01:50	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 01:50	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 01:50	WG2502097
Chloroform	ND		1.00	1	04/29/2025 01:50	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 01:50	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 01:50	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 01:50	WG2502097
Dichlorodifluoromethane	ND	C5	1.00	1	04/29/2025 01:50	WG2502097
Dichlorofluoromethane	ND		1.00	1	04/29/2025 01:50	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 01:50	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 01:50	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 01:50	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 01:50	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 01:50	WG2502097
Styrene	ND		1.00	1	04/29/2025 01:50	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 01:50	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 01:50	WG2502097
Toluene	ND		1.00	1	04/29/2025 01:50	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 01:50	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 01:50	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 01:50	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 01:50	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 01:50	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 01:50	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 01:50	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 01:50	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 01:50	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 01:50	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 01:50	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 01:50	WG2502097
(S) 1,2-Dichloroethane-d4	*121*			*70.0-130*	*04/29/2025 01:50*	WG2502097
(S) Toluene-d8	*99.6*			*75.0-131*	*04/29/2025 01:50*	WG2502097
(S) 4-Bromofluorobenzene	*93.8*			*67.0-138*	*04/29/2025 01:50*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	960.4	ftmsl
pH (On Site)	7.32	su
Specific Conductance (on site)	559	umhos/cm
Temperature (on-site)	9.7	Deg. C
Turbidity (on-site)	39	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-197	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 02:10	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 02:10	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 02:10	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 02:10	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 02:10	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 02:10	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 02:10	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 02:10	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 02:10	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 02:10	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 02:10	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 02:10	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 02:10	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 02:10	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 02:10	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 02:10	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 02:10	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 02:10	WG2502097
Acetone	ND		10.0	1	04/29/2025 02:10	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 02:10	WG2502097
Benzene	ND		0.500	1	04/29/2025 02:10	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 02:10	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 02:10	WG2502097
Bromoform	ND		1.00	1	04/29/2025 02:10	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 02:10	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 02:10	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 02:10	WG2502097
Chloroform	ND		1.00	1	04/29/2025 02:10	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 02:10	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 02:10	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 02:10	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 02:10	WG2502097
Dichlorofluoromethane	ND	C5	1.00	1	04/29/2025 02:10	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 02:10	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 02:10	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 02:10	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 02:10	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 02:10	WG2502097
Styrene	ND		1.00	1	04/29/2025 02:10	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 02:10	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 02:10	WG2502097
Toluene	ND		1.00	1	04/29/2025 02:10	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 02:10	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 02:10	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 02:10	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 02:10	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 02:10	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 02:10	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 02:10	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 02:10	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 02:10	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 02:10	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 02:10	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 02:10	WG2502097
(S) 1,2-Dichloroethane-d4	*123*			*70.0-130*	*04/29/2025 02:10*	WG2502097
(S) Toluene-d8	*97.3*			*75.0-131*	*04/29/2025 02:10*	WG2502097
(S) 4-Bromofluorobenzene	*94.5*			*67.0-138*	*04/29/2025 02:10*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	948.75	ftmsl
pH (On Site)	7.38	su
Specific Conductance (on site)	865	umhos/cm
Temperature (on-site)	8.2	Deg. C
Turbidity (on-site)	3.4	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-104	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 02:29	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 02:29	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 02:29	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 02:29	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 02:29	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 02:29	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 02:29	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 02:29	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 02:29	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 02:29	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 02:29	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 02:29	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 02:29	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 02:29	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 02:29	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 02:29	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 02:29	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 02:29	WG2502097
Acetone	ND		10.0	1	04/29/2025 02:29	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 02:29	WG2502097
Benzene	ND		0.500	1	04/29/2025 02:29	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 02:29	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 02:29	WG2502097
Bromoform	ND		1.00	1	04/29/2025 02:29	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 02:29	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 02:29	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 02:29	WG2502097
Chloroform	ND		1.00	1	04/29/2025 02:29	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 02:29	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 02:29	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 02:29	WG2502097
Dichlorodifluoromethane	ND	C5	1.00	1	04/29/2025 02:29	WG2502097
Dichlorofluoromethane	ND		1.00	1	04/29/2025 02:29	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 02:29	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 02:29	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 02:29	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 02:29	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 02:29	WG2502097
Styrene	ND		1.00	1	04/29/2025 02:29	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 02:29	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 02:29	WG2502097
Toluene	ND		1.00	1	04/29/2025 02:29	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 02:29	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 02:29	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 02:29	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 02:29	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 02:29	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 02:29	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 02:29	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 02:29	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 02:29	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 02:29	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 02:29	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 02:29	WG2502097
(S) 1,2-Dichloroethane-d4	*122*			*70.0-130*	*04/29/2025 02:29*	WG2502097
(S) Toluene-d8	*96.1*			*75.0-131*	*04/29/2025 02:29*	WG2502097
(S) 4-Bromofluorobenzene	*90.0*			*67.0-138*	*04/29/2025 02:29*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	951.37	ftmsl
pH (On Site)	7.12	su
Specific Conductance (on site)	868	umhos/cm
Temperature (on-site)	10.6	Deg. C
Turbidity (on-site)	Not Recorded	NTU
Dissolved Oxygen (on-site)	0.1	mg/l
eH/ORP (On Site)	-124	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 02:49	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 02:49	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 02:49	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 02:49	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 02:49	WG2502097
1,1-Dichloroethane	1.54		1.00	1	04/29/2025 02:49	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 02:49	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 02:49	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 02:49	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 02:49	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 02:49	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 02:49	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 02:49	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 02:49	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 02:49	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 02:49	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 02:49	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 02:49	WG2502097
Acetone	ND		10.0	1	04/29/2025 02:49	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 02:49	WG2502097
Benzene	ND		0.500	1	04/29/2025 02:49	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 02:49	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 02:49	WG2502097
Bromoform	ND		1.00	1	04/29/2025 02:49	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 02:49	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 02:49	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 02:49	WG2502097
Chloroform	ND		1.00	1	04/29/2025 02:49	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 02:49	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 02:49	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 02:49	WG2502097
Dichlorodifluoromethane	ND	C5	1.00	1	04/29/2025 02:49	WG2502097
Dichlorofluoromethane	2.18	C5	1.00	1	04/29/2025 02:49	WG2502097
Ethyl ether	6.42		1.00	1	04/29/2025 02:49	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 02:49	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 02:49	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 02:49	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 02:49	WG2502097
Styrene	ND		1.00	1	04/29/2025 02:49	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 02:49	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 02:49	WG2502097
Toluene	ND		1.00	1	04/29/2025 02:49	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 02:49	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 02:49	WG2502097
Vinyl chloride	0.357	C5	0.0500	1	04/29/2025 02:49	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 02:49	WG2502097
cis-1,2-Dichloroethene	0.158		0.100	1	04/29/2025 02:49	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 02:49	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 02:49	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 02:49	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 02:49	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 02:49	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 02:49	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 02:49	WG2502097
(S) 1,2-Dichloroethane-d4	*122*			*70.0-130*	*04/29/2025 02:49*	WG2502097
(S) Toluene-d8	*95.5*			*75.0-131*	*04/29/2025 02:49*	WG2502097
(S) 4-Bromofluorobenzene	*90.7*			*67.0-138*	*04/29/2025 02:49*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	951.21	ftmsl
pH (On Site)	7.26	su
Specific Conductance (on site)	1023	umhos/cm
Temperature (on-site)	10.8	Deg. C
Turbidity (on-site)	5.2	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-130	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 03:09	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 03:09	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 03:09	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 03:09	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 03:09	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 03:09	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 03:09	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 03:09	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 03:09	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 03:09	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 03:09	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 03:09	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 03:09	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 03:09	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 03:09	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 03:09	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 03:09	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 03:09	WG2502097
Acetone	ND		10.0	1	04/29/2025 03:09	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 03:09	WG2502097
Benzene	ND		0.500	1	04/29/2025 03:09	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 03:09	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 03:09	WG2502097
Bromoform	ND		1.00	1	04/29/2025 03:09	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 03:09	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 03:09	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 03:09	WG2502097
Chloroform	ND		1.00	1	04/29/2025 03:09	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 03:09	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 03:09	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 03:09	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 03:09	WG2502097
Dichlorofluoromethane	4.28	C5	1.00	1	04/29/2025 03:09	WG2502097
Ethyl ether	8.35		1.00	1	04/29/2025 03:09	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 03:09	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 03:09	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 03:09	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 03:09	WG2502097
Styrene	ND		1.00	1	04/29/2025 03:09	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 03:09	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 03:09	WG2502097
Toluene	ND		1.00	1	04/29/2025 03:09	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 03:09	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 03:09	WG2502097
Vinyl chloride	0.0836		0.0500	1	04/29/2025 03:09	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 03:09	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 03:09	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 03:09	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 03:09	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 03:09	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 03:09	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 03:09	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 03:09	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 03:09	WG2502097
(S) 1,2-Dichloroethane-d4	*123*			*70.0-130*	*04/29/2025 03:09*	WG2502097
(S) Toluene-d8	*98.3*			*75.0-131*	*04/29/2025 03:09*	WG2502097
(S) 4-Bromofluorobenzene	*91.6*			*67.0-138*	*04/29/2025 03:09*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	951.19	ftmsl
pH (On Site)	7.13	su
Specific Conductance (on site)	1146	umhos/cm
Temperature (on-site)	10.7	Deg. C
Turbidity (on-site)	1	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-154	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 03:29	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 03:29	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 03:29	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 03:29	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 03:29	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 03:29	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 03:29	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 03:29	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 03:29	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 03:29	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 03:29	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 03:29	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 03:29	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 03:29	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 03:29	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 03:29	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 03:29	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 03:29	WG2502097
Acetone	ND		10.0	1	04/29/2025 03:29	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 03:29	WG2502097
Benzene	ND		0.500	1	04/29/2025 03:29	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 03:29	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 03:29	WG2502097
Bromoform	ND		1.00	1	04/29/2025 03:29	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 03:29	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 03:29	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 03:29	WG2502097
Chloroform	ND		1.00	1	04/29/2025 03:29	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 03:29	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 03:29	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 03:29	WG2502097
Dichlorodifluoromethane	1.09	C5	1.00	1	04/29/2025 03:29	WG2502097
Dichlorofluoromethane	4.12	C5	1.00	1	04/29/2025 03:29	WG2502097
Ethyl ether	4.86		1.00	1	04/29/2025 03:29	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 03:29	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 03:29	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 03:29	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 03:29	WG2502097
Styrene	ND		1.00	1	04/29/2025 03:29	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 03:29	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 03:29	WG2502097
Toluene	ND		1.00	1	04/29/2025 03:29	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 03:29	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 03:29	WG2502097
Vinyl chloride	0.389	C5	0.0500	1	04/29/2025 03:29	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 03:29	WG2502097
cis-1,2-Dichloroethene	0.129		0.100	1	04/29/2025 03:29	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 03:29	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 03:29	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 03:29	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 03:29	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 03:29	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 03:29	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 03:29	WG2502097
(S) 1,2-Dichloroethane-d4	*120*			*70.0-130*	*04/29/2025 03:29*	WG2502097
(S) Toluene-d8	*99.3*			*75.0-131*	*04/29/2025 03:29*	WG2502097
(S) 4-Bromofluorobenzene	*90.9*			*67.0-138*	*04/29/2025 03:29*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	952.02	ftmsl
pH (On Site)	6.79	su
Specific Conductance (on site)	1337	umhos/cm
Temperature (on-site)	8.7	Deg. C
Turbidity (on-site)	0.5	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-108	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 03:48	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 03:48	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 03:48	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 03:48	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 03:48	WG2502097
1,1-Dichloroethane	2.44		1.00	1	04/29/2025 03:48	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 03:48	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 03:48	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 03:48	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 03:48	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 03:48	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 03:48	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 03:48	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 03:48	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 03:48	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 03:48	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 03:48	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 03:48	WG2502097
Acetone	ND		10.0	1	04/29/2025 03:48	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 03:48	WG2502097
Benzene	ND		0.500	1	04/29/2025 03:48	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 03:48	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 03:48	WG2502097
Bromoform	ND		1.00	1	04/29/2025 03:48	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 03:48	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 03:48	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 03:48	WG2502097
Chloroform	ND		1.00	1	04/29/2025 03:48	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 03:48	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 03:48	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 03:48	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 03:48	WG2502097
Dichlorofluoromethane	2.03	C5	1.00	1	04/29/2025 03:48	WG2502097
Ethyl ether	10.8		1.00	1	04/29/2025 03:48	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 03:48	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 03:48	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 03:48	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 03:48	WG2502097
Styrene	ND		1.00	1	04/29/2025 03:48	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 03:48	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 03:48	WG2502097
Toluene	ND		1.00	1	04/29/2025 03:48	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 03:48	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 03:48	WG2502097
Vinyl chloride	0.158	C5	0.0500	1	04/29/2025 03:48	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 03:48	WG2502097
cis-1,2-Dichloroethene	0.534		0.100	1	04/29/2025 03:48	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 03:48	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 03:48	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 03:48	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 03:48	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 03:48	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 03:48	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 03:48	WG2502097
(S) 1,2-Dichloroethane-d4	*120*			*70.0-130*	*04/29/2025 03:48*	WG2502097
(S) Toluene-d8	*99.1*			*75.0-131*	*04/29/2025 03:48*	WG2502097
(S) 4-Bromofluorobenzene	*90.5*			*67.0-138*	*04/29/2025 03:48*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	965.76	ftmsl
pH (On Site)	7.6	su
Specific Conductance (on site)	638	umhos/cm
Temperature (on-site)	9.4	Deg. C
Turbidity (on-site)	34.4	NTU
Dissolved Oxygen (on-site)	0.1	mg/l
eH/ORP (On Site)	-101.6	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 04:08	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 04:08	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 04:08	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 04:08	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 04:08	WG2502097
1,1-Dichloroethane	1.38		1.00	1	04/29/2025 04:08	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 04:08	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 04:08	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 04:08	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 04:08	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 04:08	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 04:08	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 04:08	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 04:08	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 04:08	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 04:08	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 04:08	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 04:08	WG2502097
Acetone	ND		10.0	1	04/29/2025 04:08	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 04:08	WG2502097
Benzene	ND		0.500	1	04/29/2025 04:08	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 04:08	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 04:08	WG2502097
Bromoform	ND		1.00	1	04/29/2025 04:08	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 04:08	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 04:08	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 04:08	WG2502097
Chloroform	ND		1.00	1	04/29/2025 04:08	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 04:08	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 04:08	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 04:08	WG2502097
Dichlorodifluoromethane	ND	C5	1.00	1	04/29/2025 04:08	WG2502097
Dichlorofluoromethane	1.25	C5	1.00	1	04/29/2025 04:08	WG2502097
Ethyl ether	1.61		1.00	1	04/29/2025 04:08	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 04:08	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 04:08	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 04:08	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 04:08	WG2502097
Styrene	ND		1.00	1	04/29/2025 04:08	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 04:08	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 04:08	WG2502097
Toluene	ND		1.00	1	04/29/2025 04:08	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 04:08	WG2502097
Trichlorofluoromethane	ND	C5	1.00	1	04/29/2025 04:08	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 04:08	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 04:08	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 04:08	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 04:08	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 04:08	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 04:08	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 04:08	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 04:08	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 04:08	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 04:08	WG2502097
(S) 1,2-Dichloroethane-d4	*124*			*70.0-130*	*04/29/2025 04:08*	WG2502097
(S) Toluene-d8	*96.7*			*75.0-131*	*04/29/2025 04:08*	WG2502097
(S) 4-Bromofluorobenzene	*93.1*			*67.0-138*	*04/29/2025 04:08*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	7.68	su
Specific Conductance (on site)	255	umhos/cm
Temperature (on-site)	10.7	Deg. C
Turbidity (on-site)	2.5	NTU
Dissolved Oxygen (on-site)	0.2	mg/l

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 04:28	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 04:28	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 04:28	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 04:28	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 04:28	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 04:28	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 04:28	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 04:28	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 04:28	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 04:28	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 04:28	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 04:28	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 04:28	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 04:28	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 04:28	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 04:28	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 04:28	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 04:28	WG2502097
Acetone	ND		10.0	1	04/29/2025 04:28	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 04:28	WG2502097
Benzene	ND		0.500	1	04/29/2025 04:28	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 04:28	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 04:28	WG2502097
Bromoform	ND		1.00	1	04/29/2025 04:28	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 04:28	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 04:28	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 04:28	WG2502097
Chloroform	ND		1.00	1	04/29/2025 04:28	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 04:28	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 04:28	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 04:28	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 04:28	WG2502097
Dichlorofluoromethane	ND		1.00	1	04/29/2025 04:28	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 04:28	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 04:28	WG2502097
Isopropylbenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 04:28	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Methylene Chloride	ND		1.00	1	04/29/2025 04:28	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 04:28	WG2502097
Styrene	ND		1.00	1	04/29/2025 04:28	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 04:28	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 04:28	WG2502097
Toluene	ND		1.00	1	04/29/2025 04:28	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 04:28	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 04:28	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 04:28	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 04:28	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 04:28	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 04:28	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 04:28	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 04:28	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 04:28	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 04:28	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 04:28	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 04:28	WG2502097
(S) 1,2-Dichloroethane-d4	*124*			*70.0-130*	*04/29/2025 04:28*	WG2502097
(S) Toluene-d8	*96.7*			*75.0-131*	*04/29/2025 04:28*	WG2502097
(S) 4-Bromofluorobenzene	*92.8*			*67.0-138*	*04/29/2025 04:28*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	963.26	ftmsl
pH (On Site)	7.53	su
Specific Conductance (on site)	672	umhos/cm
Temperature (on-site)	13.1	Deg. C
Turbidity (on-site)	48.6	NTU
Dissolved Oxygen (on-site)	0.1	mg/l

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 04:48	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 04:48	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 04:48	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 04:48	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 04:48	WG2502097
1,1-Dichloroethane	1.02		1.00	1	04/29/2025 04:48	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 04:48	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 04:48	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 04:48	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 04:48	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 04:48	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 04:48	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 04:48	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 04:48	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 04:48	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 04:48	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 04:48	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 04:48	WG2502097
Acetone	ND		10.0	1	04/29/2025 04:48	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 04:48	WG2502097
Benzene	ND		0.500	1	04/29/2025 04:48	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 04:48	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 04:48	WG2502097
Bromoform	ND		1.00	1	04/29/2025 04:48	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 04:48	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 04:48	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 04:48	WG2502097
Chloroform	ND		1.00	1	04/29/2025 04:48	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 04:48	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 04:48	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 04:48	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 04:48	WG2502097
Dichlorofluoromethane	1.14	C5	1.00	1	04/29/2025 04:48	WG2502097
Ethyl ether	7.86		1.00	1	04/29/2025 04:48	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 04:48	WG2502097
Isopropylbenzene	ND		1.00	1	04/29/2025 04:48	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 04:48	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 04:48	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 04:48	WG2502097
Styrene	ND		1.00	1	04/29/2025 04:48	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 04:48	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 04:48	WG2502097
Toluene	ND		1.00	1	04/29/2025 04:48	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 04:48	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 04:48	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 04:48	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 04:48	WG2502097
cis-1,2-Dichloroethene	0.166		0.100	1	04/29/2025 04:48	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 04:48	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 04:48	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 04:48	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 04:48	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 04:48	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 04:48	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 04:48	WG2502097
(S) 1,2-Dichloroethane-d4	*121*			*70.0-130*	*04/29/2025 04:48*	WG2502097
(S) Toluene-d8	*96.4*			*75.0-131*	*04/29/2025 04:48*	WG2502097
(S) 4-Bromofluorobenzene	*89.0*			*67.0-138*	*04/29/2025 04:48*	WG2502097

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	943.72	ftmsl
pH (On Site)	7.45	su
Specific Conductance (on site)	405	umhos/cm
Temperature (on-site)	8	Deg. C
Turbidity (on-site)	1	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-152	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 05:08	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 05:08	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 05:08	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 05:08	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 05:08	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 05:08	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 05:08	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 05:08	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 05:08	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 05:08	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 05:08	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 05:08	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 05:08	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 05:08	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 05:08	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 05:08	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 05:08	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 05:08	WG2502097
Acetone	ND		10.0	1	04/29/2025 05:08	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 05:08	WG2502097
Benzene	ND		0.500	1	04/29/2025 05:08	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 05:08	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 05:08	WG2502097
Bromoform	ND		1.00	1	04/29/2025 05:08	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 05:08	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 05:08	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 05:08	WG2502097
Chloroform	ND		1.00	1	04/29/2025 05:08	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 05:08	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 05:08	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 05:08	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 05:08	WG2502097
Dichlorofluoromethane	ND	C5	1.00	1	04/29/2025 05:08	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 05:08	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 05:08	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 05:08	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 05:08	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 05:08	WG2502097
Styrene	ND		1.00	1	04/29/2025 05:08	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 05:08	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 05:08	WG2502097
Toluene	ND		1.00	1	04/29/2025 05:08	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 05:08	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 05:08	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 05:08	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 05:08	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 05:08	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 05:08	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 05:08	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 05:08	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 05:08	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 05:08	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 05:08	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 05:08	WG2502097
(S) 1,2-Dichloroethane-d4	*121*			*70.0-130*	*04/29/2025 05:08*	WG2502097
(S) Toluene-d8	*98.3*			*75.0-131*	*04/29/2025 05:08*	WG2502097
(S) 4-Bromofluorobenzene	*91.5*			*67.0-138*	*04/29/2025 05:08*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	970.11	ftmsl
pH (On Site)	6.65	su
Specific Conductance (on site)	531	umhos/cm
Temperature (on-site)	10.7	Deg. C
Turbidity (on-site)	17.2	NTU
Dissolved Oxygen (on-site)	0.4	mg/l
eH/ORP (On Site)	-118.1	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 05:27	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 05:27	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 05:27	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 05:27	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 05:27	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 05:27	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 05:27	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 05:27	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 05:27	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 05:27	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 05:27	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 05:27	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 05:27	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 05:27	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 05:27	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 05:27	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 05:27	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 05:27	WG2502097
Acetone	ND		10.0	1	04/29/2025 05:27	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 05:27	WG2502097
Benzene	ND		0.500	1	04/29/2025 05:27	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 05:27	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 05:27	WG2502097
Bromoform	ND		1.00	1	04/29/2025 05:27	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 05:27	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 05:27	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 05:27	WG2502097
Chloroform	ND		1.00	1	04/29/2025 05:27	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 05:27	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 05:27	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 05:27	WG2502097
Dichlorodifluoromethane	ND	C5	1.00	1	04/29/2025 05:27	WG2502097
Dichlorofluoromethane	ND	C5	1.00	1	04/29/2025 05:27	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 05:27	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 05:27	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 05:27	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 05:27	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 05:27	WG2502097
Styrene	ND		1.00	1	04/29/2025 05:27	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 05:27	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 05:27	WG2502097
Toluene	ND		1.00	1	04/29/2025 05:27	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 05:27	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 05:27	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 05:27	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 05:27	WG2502097
cis-1,2-Dichloroethene	0.137		0.100	1	04/29/2025 05:27	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 05:27	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 05:27	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 05:27	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 05:27	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 05:27	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 05:27	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 05:27	WG2502097
(S) 1,2-Dichloroethane-d4	*122*			*70.0-130*	*04/29/2025 05:27*	WG2502097
(S) Toluene-d8	*98.4*			*75.0-131*	*04/29/2025 05:27*	WG2502097
(S) 4-Bromofluorobenzene	*91.3*			*67.0-138*	*04/29/2025 05:27*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	967.5	ftmsl
pH (On Site)	7.3	su
Specific Conductance (on site)	1368	umhos/cm
Temperature (on-site)	11.1	Deg. C
Turbidity (on-site)	6	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-152	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 05:47	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 05:47	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 05:47	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 05:47	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 05:47	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 05:47	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 05:47	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 05:47	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 05:47	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 05:47	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 05:47	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 05:47	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 05:47	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 05:47	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 05:47	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 05:47	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 05:47	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 05:47	WG2502097
Acetone	ND		10.0	1	04/29/2025 05:47	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 05:47	WG2502097
Benzene	ND		0.500	1	04/29/2025 05:47	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 05:47	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 05:47	WG2502097
Bromoform	ND		1.00	1	04/29/2025 05:47	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 05:47	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 05:47	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 05:47	WG2502097
Chloroform	ND		1.00	1	04/29/2025 05:47	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 05:47	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 05:47	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 05:47	WG2502097
Dichlorodifluoromethane	ND	C5	1.00	1	04/29/2025 05:47	WG2502097
Dichlorofluoromethane	2.24	C5	1.00	1	04/29/2025 05:47	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 05:47	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 05:47	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 05:47	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 05:47	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 05:47	WG2502097
Styrene	ND		1.00	1	04/29/2025 05:47	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 05:47	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 05:47	WG2502097
Toluene	ND		1.00	1	04/29/2025 05:47	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 05:47	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 05:47	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 05:47	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 05:47	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 05:47	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 05:47	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 05:47	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 05:47	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 05:47	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 05:47	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 05:47	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 05:47	WG2502097
(S) 1,2-Dichloroethane-d4	*124*			*70.0-130*	*04/29/2025 05:47*	WG2502097
(S) Toluene-d8	*98.2*			*75.0-131*	*04/29/2025 05:47*	WG2502097
(S) 4-Bromofluorobenzene	*92.1*			*67.0-138*	*04/29/2025 05:47*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	957.35	ftmsl
pH (On Site)	7.85	su
Specific Conductance (on site)	325	umhos/cm
Temperature (on-site)	11.4	Deg. C
Turbidity (on-site)	25	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-199	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 06:07	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 06:07	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 06:07	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 06:07	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 06:07	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 06:07	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 06:07	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 06:07	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 06:07	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 06:07	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 06:07	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 06:07	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 06:07	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 06:07	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 06:07	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 06:07	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 06:07	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 06:07	WG2502097
Acetone	ND		10.0	1	04/29/2025 06:07	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 06:07	WG2502097
Benzene	ND		0.500	1	04/29/2025 06:07	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 06:07	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 06:07	WG2502097
Bromoform	ND		1.00	1	04/29/2025 06:07	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 06:07	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 06:07	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 06:07	WG2502097
Chloroform	ND		1.00	1	04/29/2025 06:07	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 06:07	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 06:07	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 06:07	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 06:07	WG2502097
Dichlorofluoromethane	ND		1.00	1	04/29/2025 06:07	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 06:07	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 06:07	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 06:07	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 06:07	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 06:07	WG2502097
Styrene	ND		1.00	1	04/29/2025 06:07	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 06:07	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 06:07	WG2502097
Toluene	ND		1.00	1	04/29/2025 06:07	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 06:07	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 06:07	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 06:07	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 06:07	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 06:07	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 06:07	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 06:07	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 06:07	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 06:07	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 06:07	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 06:07	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 06:07	WG2502097
(S) 1,2-Dichloroethane-d4	*123*			*70.0-130*	*04/29/2025 06:07*	WG2502097
(S) Toluene-d8	*98.6*			*75.0-131*	*04/29/2025 06:07*	WG2502097
(S) 4-Bromofluorobenzene	*92.7*			*67.0-138*	*04/29/2025 06:07*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	957.16	ftmsl
pH (On Site)	7.15	su
Specific Conductance (on site)	933	umhos/cm
Temperature (on-site)	11.5	Deg. C
Turbidity (on-site)	21	NTU
Dissolved Oxygen (on-site)	0	mg/l
eH/ORP (On Site)	-118	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 06:27	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 06:27	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 06:27	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 06:27	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 06:27	WG2502097
1,1-Dichloroethane	3.99		1.00	1	04/29/2025 06:27	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 06:27	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 06:27	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 06:27	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 06:27	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 06:27	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 06:27	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 06:27	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 06:27	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 06:27	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 06:27	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 06:27	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 06:27	WG2502097
Acetone	ND		10.0	1	04/29/2025 06:27	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 06:27	WG2502097
Benzene	ND		0.500	1	04/29/2025 06:27	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 06:27	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 06:27	WG2502097
Bromoform	ND		1.00	1	04/29/2025 06:27	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 06:27	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 06:27	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 06:27	WG2502097
Chloroform	ND		1.00	1	04/29/2025 06:27	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 06:27	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 06:27	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 06:27	WG2502097
Dichlorodifluoromethane	ND	C5	1.00	1	04/29/2025 06:27	WG2502097
Dichlorofluoromethane	3.47	C5	1.00	1	04/29/2025 06:27	WG2502097
Ethyl ether	9.37		1.00	1	04/29/2025 06:27	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 06:27	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 06:27	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 06:27	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 06:27	WG2502097
Styrene	ND		1.00	1	04/29/2025 06:27	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 06:27	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 06:27	WG2502097
Toluene	ND		1.00	1	04/29/2025 06:27	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 06:27	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 06:27	WG2502097
Vinyl chloride	0.647	C5	0.0500	1	04/29/2025 06:27	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 06:27	WG2502097
cis-1,2-Dichloroethene	0.654		0.100	1	04/29/2025 06:27	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 06:27	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 06:27	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 06:27	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 06:27	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 06:27	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 06:27	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 06:27	WG2502097
(S) 1,2-Dichloroethane-d4	*124*			*70.0-130*	*04/29/2025 06:27*	WG2502097
(S) Toluene-d8	*97.1*			*75.0-131*	*04/29/2025 06:27*	WG2502097
(S) 4-Bromofluorobenzene	*90.1*			*67.0-138*	*04/29/2025 06:27*	WG2502097

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Groundwater Elevation	972.27	ftmsl
pH (On Site)	7.05	su
Specific Conductance (on site)	236	umhos/cm
Temperature (on-site)	8.7	Deg. C
Turbidity (on-site)	2	NTU
Dissolved Oxygen (on-site)	0.1	mg/l
eH/ORP (On Site)	-220.4	mV

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	ug/l		ug/l		date / time	
1,1,1,2-Tetrachloroethane	ND		1.00	1	04/29/2025 06:47	WG2502097
1,1,1-Trichloroethane	ND		1.00	1	04/29/2025 06:47	WG2502097
1,1,2,2-Tetrachloroethane	ND		0.500	1	04/29/2025 06:47	WG2502097
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		1.00	1	04/29/2025 06:47	WG2502097
1,1,2-Trichloroethane	ND		0.750	1	04/29/2025 06:47	WG2502097
1,1-Dichloroethane	ND		1.00	1	04/29/2025 06:47	WG2502097
1,1-Dichloroethene	ND		1.00	1	04/29/2025 06:47	WG2502097
1,1-Dichloropropene	ND		1.00	1	04/29/2025 06:47	WG2502097
1,2,3-Trichlorobenzene	ND	C3	1.00	1	04/29/2025 06:47	WG2502097
1,2,3-Trichloropropane	ND		1.00	1	04/29/2025 06:47	WG2502097
1,2,4-Trichlorobenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
1,2,4-Trimethylbenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
1,2-Dibromo-3-Chloropropane	ND	C3	1.00	1	04/29/2025 06:47	WG2502097
1,2-Dibromoethane	ND		1.00	1	04/29/2025 06:47	WG2502097
1,2-Dichlorobenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
1,2-Dichloroethane	ND		0.250	1	04/29/2025 06:47	WG2502097
1,2-Dichloropropane	ND		1.00	1	04/29/2025 06:47	WG2502097
1,3,5-Trimethylbenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
1,3-Dichlorobenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
1,3-Dichloropropane	ND		1.00	1	04/29/2025 06:47	WG2502097
1,4-Dichlorobenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
2,2-Dichloropropane	ND		1.00	1	04/29/2025 06:47	WG2502097
2-Butanone (MEK)	ND		10.0	1	04/29/2025 06:47	WG2502097
4-Methyl-2-pentanone (MIBK)	ND		5.00	1	04/29/2025 06:47	WG2502097
Acetone	ND		10.0	1	04/29/2025 06:47	WG2502097
Allyl chloride	ND		1.00	1	04/29/2025 06:47	WG2502097
Benzene	ND		0.500	1	04/29/2025 06:47	WG2502097
Bromobenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
Bromochloromethane	ND		1.00	1	04/29/2025 06:47	WG2502097
Bromodichloromethane	ND		1.00	1	04/29/2025 06:47	WG2502097
Bromoform	ND		1.00	1	04/29/2025 06:47	WG2502097
Bromomethane	ND	J4	1.00	1	04/29/2025 06:47	WG2502097
Carbon tetrachloride	ND		0.250	1	04/29/2025 06:47	WG2502097
Chlorobenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
Chloroethane	ND	J4	1.00	1	04/29/2025 06:47	WG2502097
Chloroform	ND		1.00	1	04/29/2025 06:47	WG2502097
Chloromethane	ND		1.00	1	04/29/2025 06:47	WG2502097
Dibromochloromethane	ND		1.00	1	04/29/2025 06:47	WG2502097
Dibromomethane	ND		1.00	1	04/29/2025 06:47	WG2502097
Dichlorodifluoromethane	ND		1.00	1	04/29/2025 06:47	WG2502097
Dichlorofluoromethane	ND		1.00	1	04/29/2025 06:47	WG2502097
Ethyl ether	ND		1.00	1	04/29/2025 06:47	WG2502097
Ethylbenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
Hexachloro-1,3-butadiene	ND	C3	0.250	1	04/29/2025 06:47	WG2502097

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	RL ug/l	Dilution	Analysis date / time	Batch
Isopropylbenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
Methyl tert-butyl ether	ND		1.00	1	04/29/2025 06:47	WG2502097
Methylene Chloride	ND		1.00	1	04/29/2025 06:47	WG2502097
Naphthalene	ND	C3	1.00	1	04/29/2025 06:47	WG2502097
Styrene	ND		1.00	1	04/29/2025 06:47	WG2502097
Tetrachloroethene	ND		1.00	1	04/29/2025 06:47	WG2502097
Tetrahydrofuran	ND		5.00	1	04/29/2025 06:47	WG2502097
Toluene	ND		1.00	1	04/29/2025 06:47	WG2502097
Trichloroethene	ND		0.100	1	04/29/2025 06:47	WG2502097
Trichlorofluoromethane	ND		1.00	1	04/29/2025 06:47	WG2502097
Vinyl chloride	ND		0.0500	1	04/29/2025 06:47	WG2502097
Xylenes, Total	ND		2.00	1	04/29/2025 06:47	WG2502097
cis-1,2-Dichloroethene	ND		0.100	1	04/29/2025 06:47	WG2502097
cis-1,3-Dichloropropene	ND		0.500	1	04/29/2025 06:47	WG2502097
n-Butylbenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
n-Propylbenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
o-Chlorotoluene	ND		1.00	1	04/29/2025 06:47	WG2502097
p-Chlorotoluene	ND		1.00	1	04/29/2025 06:47	WG2502097
p-Isopropyltoluene	ND		1.00	1	04/29/2025 06:47	WG2502097
sec-Butylbenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
tert-Butylbenzene	ND		1.00	1	04/29/2025 06:47	WG2502097
trans-1,2-Dichloroethene	ND		1.00	1	04/29/2025 06:47	WG2502097
trans-1,3-Dichloropropene	ND		1.00	1	04/29/2025 06:47	WG2502097
(S) 1,2-Dichloroethane-d4	*120*			*70.0-130*	*04/29/2025 06:47*	WG2502097
(S) Toluene-d8	*96.9*			*75.0-131*	*04/29/2025 06:47*	WG2502097
(S) 4-Bromofluorobenzene	*90.2*			*67.0-138*	*04/29/2025 06:47*	WG2502097

Method Blank (MB)

(MB) R4207086-2 04/28/25 23:16

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
1,1,1,2-Tetrachloroethane	ND		0.0379	0.100
1,1,1-Trichloroethane	ND		0.0369	0.100
1,1,2,2-Tetrachloroethane	ND		0.0278	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		0.0302	0.100
1,1,2-Trichloroethane	ND		0.0239	0.100
1,1-Dichloroethane	ND		0.0196	0.100
1,1-Dichloroethene	ND		0.0242	0.100
1,1-Dichloropropene	ND		0.0324	0.100
1,2,3-Trichlorobenzene	ND	J	0.293	0.500
1,2,3-Trichloropropane	ND		0.0648	0.500
1,2,4-Trichlorobenzene	ND		0.176	0.500
1,2,4-Trimethylbenzene	ND		0.0632	0.200
1,2-Dibromo-3-Chloropropane	ND		0.156	1.00
1,2-Dibromoethane	ND		0.0259	0.100
1,2-Dichlorobenzene	ND		0.0170	0.200
1,2-Dichloroethane	ND		0.0260	0.100
1,2-Dichloropropane	ND		0.0568	0.200
1,3,5-Trimethylbenzene	ND		0.0800	0.200
1,3-Dichlorobenzene	ND		0.0240	0.200
1,3-Dichloropropane	ND		0.0200	0.200
1,4-Dichlorobenzene	ND		0.0280	0.200
2,2-Dichloropropane	ND		0.0552	0.100
2-Butanone (MEK)	ND		2.54	4.00
4-Methyl-2-pentanone (MIBK)	ND		0.0912	1.00
Acetone	ND		1.46	2.00
Allyl chloride	ND		0.160	1.00
Benzene	ND		0.0187	0.0400
Bromobenzene	ND		0.0360	0.500
Bromochloromethane	ND		0.0226	0.200
Bromodichloromethane	ND		0.0290	0.100
Bromoform	ND		0.0468	1.00
Bromomethane	0.238	J	0.0788	0.500
Carbon tetrachloride	ND		0.0359	0.200
Chlorobenzene	ND		0.00840	0.100
Chloroethane	ND		0.0680	0.200
Chloroform	0.0583	J	0.0412	0.100
Chloromethane	ND		0.174	0.500
Dibromochloromethane	ND		0.0245	0.100
Dibromomethane	ND		0.0300	0.200

Method Blank (MB)

(MB) R4207086-2 04/28/25 23:16

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dichlorodifluoromethane	ND		0.0644	0.200
Dichlorofluoromethane	ND		0.0490	0.100
Ethyl ether	ND		0.0356	0.100
Ethylbenzene	ND		0.0295	0.100
Hexachloro-1,3-butadiene	ND		0.0485	0.250
Isopropylbenzene	ND		0.0170	0.100
Methyl tert-butyl ether	ND		0.0140	0.0400
Methylene Chloride	0.282	J	0.266	1.00
Naphthalene	ND		0.195	0.500
Styrene	ND		0.00916	0.500
Tetrachloroethene	ND		0.0358	0.100
Tetrahydrofuran	ND		0.141	0.500
Toluene	0.108	J	0.0520	0.200
Trichloroethene	ND		0.0234	0.0400
Trichlorofluoromethane	ND		0.0331	0.100
Vinyl chloride	ND		0.0462	0.100
Xylenes, Total	ND		0.0352	0.260
cis-1,2-Dichloroethene	ND		0.0294	0.100
cis-1,3-Dichloropropene	ND		0.0303	0.100
n-Butylbenzene	ND		0.210	0.500
n-Propylbenzene	ND		0.0380	0.200
o-Chlorotoluene	ND		0.0346	0.100
p-Chlorotoluene	ND		0.0180	0.200
p-Isopropyltoluene	ND		0.102	0.200
sec-Butylbenzene	ND		0.115	0.500
tert-Butylbenzene	ND		0.0780	0.200
trans-1,2-Dichloroethene	ND		0.0416	0.200
trans-1,3-Dichloropropene	ND		0.0456	0.200
(S) 1,2-Dichloroethane-d4	*114*			*70.0-130*
(S) Toluene-d8	*98.5*			*75.0-131*
(S) 4-Bromofluorobenzene	*97.8*			*67.0-138*

Laboratory Control Sample (LCS)

(LCS) R4207086-1 04/28/25 21:57

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
1,1,1,2-Tetrachloroethane	5.00	4.68	93.6	74.0-129	
1,1,1-Trichloroethane	5.00	5.24	105	69.0-126	

Laboratory Control Sample (LCS)

(LCS) R4207086-1 04/28/25 21:57

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
1,1,2,2-Tetrachloroethane	5.00	4.61	92.2	68.0-128	
1,1,2-Trichloro-1,2,2-trifluoroethane	5.00	5.00	100	61.0-139	
1,1,2-Trichloroethane	5.00	4.61	92.2	78.0-123	
1,1-Dichloroethane	5.00	5.19	104	70.0-127	
1,1-Dichloroethene	5.00	4.62	92.4	65.0-131	
1,1-Dichloropropene	5.00	4.83	96.6	73.0-125	
1,2,3-Trichlorobenzene	5.00	4.03	80.6	59.0-139	
1,2,3-Trichloropropane	5.00	5.07	101	67.0-129	
1,2,4-Trichlorobenzene	5.00	4.25	85.0	62.0-137	
1,2,4-Trimethylbenzene	5.00	4.82	96.4	70.0-126	
1,2-Dibromo-3-Chloropropane	5.00	3.78	75.6	59.0-130	
1,2-Dibromoethane	5.00	4.57	91.4	74.0-128	
1,2-Dichlorobenzene	5.00	4.91	98.2	76.0-124	
1,2-Dichloroethane	5.00	5.62	112	65.0-131	
1,2-Dichloropropane	5.00	5.01	100	74.0-125	
1,3,5-Trimethylbenzene	5.00	4.81	96.2	73.0-127	
1,3-Dichlorobenzene	5.00	4.99	99.8	76.0-125	
1,3-Dichloropropane	5.00	4.97	99.4	80.0-125	
1,4-Dichlorobenzene	5.00	4.97	99.4	77.0-121	
2,2-Dichloropropane	5.00	4.92	98.4	59.0-135	
2-Butanone (MEK)	25.0	29.6	118	30.0-160	
4-Methyl-2-pentanone (MIBK)	25.0	26.7	107	56.0-143	
Acetone	25.0	35.0	140	10.0-160	
Allyl chloride	25.0	25.2	101	70.0-131	
Benzene	5.00	4.83	96.6	70.0-123	
Bromobenzene	5.00	4.97	99.4	73.0-121	
Bromochloromethane	5.00	5.33	107	77.0-128	
Bromodichloromethane	5.00	5.19	104	73.0-121	
Bromoform	5.00	4.34	86.8	64.0-132	
Bromomethane	5.00	8.09	162	56.0-147	J4
Carbon tetrachloride	5.00	4.83	96.6	66.0-128	
Chlorobenzene	5.00	4.98	99.6	76.0-128	
Chloroethane	5.00	6.99	140	61.0-134	J4
Chloroform	5.00	5.32	106	72.0-123	
Chloromethane	5.00	5.13	103	51.0-138	
Dibromochloromethane	5.00	4.65	93.0	74.0-127	
Dibromomethane	5.00	5.35	107	75.0-122	
Dichlorodifluoromethane	5.00	6.63	133	43.0-156	
Dichlorofluoromethane	5.00	6.17	123	65.0-137	

Laboratory Control Sample (LCS)

(LCS) R4207086-1 04/28/25 21:57

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Ethyl ether	5.00	4.89	97.8	64.0-137	
Ethylbenzene	5.00	4.59	91.8	74.0-126	
Hexachloro-1,3-butadiene	5.00	3.53	70.6	57.0-150	
Isopropylbenzene	5.00	4.68	93.6	72.0-127	
Methyl tert-butyl ether	5.00	5.30	106	66.0-132	
Methylene Chloride	5.00	5.11	102	68.0-123	
Naphthalene	5.00	4.06	81.2	59.0-130	
Styrene	5.00	4.51	90.2	72.0-127	
Tetrachloroethene	5.00	4.56	91.2	70.0-136	
Tetrahydrofuran	5.00	5.08	102	37.0-146	
Toluene	5.00	4.71	94.2	75.0-121	
Trichloroethene	5.00	4.88	97.6	76.0-126	
Trichlorofluoromethane	5.00	5.91	118	61.0-142	
Vinyl chloride	5.00	6.52	130	63.0-134	
Xylenes, Total	15.0	13.7	91.3	72.0-127	
cis-1,2-Dichloroethene	5.00	4.61	92.2	73.0-125	
cis-1,3-Dichloropropene	5.00	4.80	96.0	76.0-127	
n-Butylbenzene	5.00	4.84	96.8	68.0-135	
n-Propylbenzene	5.00	5.00	100	74.0-126	
o-Chlorotoluene	5.00	5.16	103	75.0-124	
p-Chlorotoluene	5.00	5.01	100	75.0-124	
p-Isopropyltoluene	5.00	4.62	92.4	72.0-133	
sec-Butylbenzene	5.00	4.74	94.8	74.0-130	
tert-Butylbenzene	5.00	4.65	93.0	75.0-127	
trans-1,2-Dichloroethene	5.00	4.73	94.6	71.0-125	
trans-1,3-Dichloropropene	5.00	4.91	98.2	73.0-127	
(S) 1,2-Dichloroethane-d4			*122*	*70.0-130*	
(S) Toluene-d8			*98.3*	*75.0-131*	
(S) 4-Bromofluorobenzene			*94.9*	*67.0-138*	

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
C5	The reported concentration is an estimate. The continuing calibration standard associated with this data responded high. Data is likely to show a high bias concerning the result.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J4	The associated batch QC was outside the established quality control range for accuracy.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
Quarterly Routine GW-GW STD wells

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program(DOD,RCRA,DW,etc):

Client Project #
200

Lab Project #
WMELKRIVMN-00011

Collected by (print):

Site/Facility ID #
MN02

P.O.#

Collected by (signature):

Immediately Packed on ice N___ Y___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

Analysis / Container / Preservative

Chain of Custody Page 1 of 2

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

SDG # 185010 4
J063

Acctnum: WMELKRIVMN
Template: T261654
Prelogin: P1144770
PM: 364 - T. Alan Harvill
PB: 4/11/25 AK
Shipped Via: FedEX Standard

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	VR250ULLC 40mlAmb-HCl	VR250ULLC 40mlAmb-HCl-Blk	Remarks	Sample # (lab only)
TB		GW				1		X		
P-654477		GW		4/16/25	0930	3	X			-01
P-335L		GW		4/17/25	1045	3	X			-02
P-329L		GW		4/17/25	1130	3	X			-03
P-324L		GW		4/17/25	1405	3	X			-04
P-322L		GW		4/17/25	1310	3	X			-05
P-320L		GW		4/15/25	1335	3	X			-06
P-320C2		GW		4/15/25	1405	3	X			-07
P-320C		GW		4/15/25	1435	3	X			-08
P-314C		GW		4/17/25	1335	3	X			-09
										-10

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 7315 3209 2226

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N
RAD Screen <0.5 mR/hr:		Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	4/18/25	1500	FedEx
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Trip Blank Received: Yes / No
HCL / MeoH
TBR

Temp: 0.6+0.0 °C Bottles Received: 54

Date: 4/11/25 Time: 0845

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
Quarterly Routine GW-GW STD wells

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program (DOD, RCRA, DW, etc):

Client Project #
200

Lab Project #
WMELKRIVMN-00011

Collected by (print):

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y ___

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Analysis / Container / Preservation: VR260ULLC 40mlAmb-HCl	VR260ULLC 40mlAmb-HCl-Blk
P-311L		GW		4/16/25	1413	3	X	
P-311D		GW		4/16/25	1418	3	X	
P-305C		GW		4/16/25	1320	3	X	
~~P-333C~~ P-333C		GW		4/15/25	1130	3	X	
P-301L		GW		4/17/25	1420	3	X	
P-301C		GW		4/16/25	1340	3	X	
P-29D		GW		4/15/25	1510	3	X	
P-29C		GW		4/16/25	1255	3	X	
P-315L		GW		4/16/25	1455	3	X	

Chain of Custody Page 2 of 2

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

SDG # 185104

Table #

Acctnum: WMELKRIVMN
Template: T261654
Prelogin: P1144770
PM: 364 - T. Alan Harvill
PB: 4/11/25 RE
Shipped Via: FedEx Standard

Remarks	Sample # (lab only)
	-11
	-12
	-13
	-14
	-15
	-16
	-17
	-18
	-19

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking #

Sample Receipt Checklist

COC Seal Present/Intact:	Y	N
COC Signed/Accurate:	Y	N
Bottles arrive intact:	Y	N
Correct bottles used:	Y	N
Sufficient volume sent:	Y	N
If Applicable		
VOA Zero Headspace:	Y	N
Preservation Correct/Checked:	Y	N
RAD Screen <0.5 mR/hr:	Y	N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCl / MeoH TBR
	4/18/25	1500	Fedex	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: °C Bottles Received: 3.6+4=1.0 54
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 4/19/25 Time: 0845

If preservation required by Login: Date/Time

Hold:

Condition NCF / OK

FIELD INFORMATION FORM

Site Name: ERL

Site No.: | | | |

Sample Point: P644477 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only Lab ID: L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04/16/25	0830				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record/field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: [Y] or [O]

Purging Device: A — Sampling Device: A — X-Other:

A- Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper/Bottle

Filter Device: [Y] or [N] [0.45 µ] or [ ] µ (circle or fill in)

Filter Type: A-In-line Disposable; B-Pressure; C-Vacuum; X-Other

Sample Tube Type: A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other:

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)
98786 (ft/msl)	4156 (ft)	94636 (ft/msl)

Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
(ft)	(ft)	(in)	

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate (mL/min)	pH (std)	Conductance (SC/EC) (umhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
0850	3 1st	7.43 1st	795 1st	9.8		0.1		
0910	2nd	7.35 2nd	814 2nd	9.8		0.1		
0930	1st	7.31 3rd	834 3rd	9.7	0.2	0.0 - 2.03		
	4th	4th	4th					
Suggested range for 3 consec. readings or site Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site)*

FIELD COMMENTS

Sample Appearance: Odor: None Color: N-a Other:

Weather Conditions (required daily, or as conditions change): Direction/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/16/25	Mike Hone		All-n

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | | Sample Point: P 3 5 4 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 17 25	14:25	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing, Flow Cell and Tubing Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Purging Device: C — A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device: C

X-Other:

Filter Device: Y or (N) 0.45 u or ____ u (circle or fill in)

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other ____

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: ____

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)	Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
995.98 (ft/msl)	49.75 (ft)	946.23 (ft/msl)	(ft)	(ft)	(in)	

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by State Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit L/min	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (nts)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
14:30	0.2	7.11	4.07	12.0		0.2		
14:35		7.18	4.09	12.2		0.0		
14:40		7.19	4.11	12.2		0.0		
14:45		7.19	4.12	12.3	1.07	0.0	-10.1	
:								
:								
:								
:								
:								
:								
:								
Suggested range for 3 consec. readings or your Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State. These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (nts)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State Permit/Site.*

FIELD COMMENTS

Sample Appearance: ____ Odor: None Color: None Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/17/25	Mike Hare		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: GLL

Site No.: | | | | | Sample Point: 0 3 2 9 4 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only (Lab ID): L1950104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (HH:MM)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 17 25	11:10				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: [Y] or [N]

Purging Device: [ ] A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Pistun Pump, F-Dipper Bottle

Sampling Device: [ ]

X-Other: [ ]

Filter Device: [Y] or [N] [0.45 µ] or [ ] µ (circle or fill in)

Filter Type: [ ] A-In-line Disposable, B-Pressure, C-Vacuum, X-Other [ ]

Sample Tube Type: [ ] A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: [ ]

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)	Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
947.99 (ft msl)	4.92 (ft)	945.07 (ft msl)	(ft)	(ft)	(in)	

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit: L/m	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
11:15	0.4	7.54	266	7.8		0.4		
11:20	"	7.56	266	7.8		0.4		
11:25	"	7.59	267	7.8		0.2		
11:30	"	7.61	267	7.8	15.7	0.1	-166.5	
Suggested range for 3 consec. readings or state Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use space on sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

FIELD COMMENTS

Sample Appearance: [ ] Odor: [ ] Color: [ ] Other: [ ]

Weather Conditions (required daily, or as conditions change): Direction/Speed: [ ] Outlook: [ ] Precipitation: [Y] or [N]

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign).

Date	Name	Signature	Company
4 17 25	Kenneth Smith		Alliance

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.:

Sample Point: P3241 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory (Use Only) Lab ID: L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 17 25	13:45				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Filter Device: V or (G) 0.45 µ or _____ µ (choose or fill in)

Purging Device: C
Sampling Device: C
X-Other: _____

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other _____

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other _____

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)
96040 (ft/msl)	1141 (ft)	94899 (ft/msl)

Total Well Depth (from TOC): _____ (ft)
Stick Up (from ground elevation): _____ (ft)
Casing ID: _____ (in)
Casing Material: _____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by State Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate Unit: LPM	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
13:50	04	7.21	576	19.7		0.0		
13:55		7.25	558	9.6		0.0		
14:00		7.28	559	9.7		0.0		
14:05		7.32	559	9.7	3.9	0.0 – 1.9	7	

Suggested range for 3 consec. readings or state Permit/State requirements: | +/- 0.2 | +/- 3% | – | – | +/- 10% | +/- 25 mV | Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: _____ Units _____

First Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

FIELD COMMENTS

Sample Appearance: _____ Odor: None Color: None Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/17/25	Mike Hunt		A&A

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.:

Sample Point: P322L (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only (Lab ID): L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 17 25	12:56	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Filter Device: Y or (N) 0.45 µ or _____ µ (circle or fill in)

Purging Device: C
A- Submersible Pump B-Bailer
B-Peristaltic Pump E-Piston Pump
C-QED Bladder Pump F-Dipper/Bottle

Filter Type: A-In-line Disposable C-Vacuum B-Pressure X-Other

Sampling Device: C

X-Other:

Sample Tube Type: A-Teflon C-PVC X-Other B-Stainless Steel D-Polypropylene

WELL DATA

Well Elevation (at TOC): 948.75 (ft msl)

Depth to Water (DTW) (from TOC): 0.62 (ft)

Groundwater Elevation (site datum, from TOC): 948.13 (ft msl)

Total Well Depth (from TOC): _____ (ft)

Stick Up (from ground elevation): _____ (ft)

Casing ID: _____ (in)

Casing Material: _____

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit L/Min	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (nts)	D.O (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
12:55	0.14	7.56	784	8.4		0.2		
13:00		7.43	833	8.2		0.0		
13:05		7.40	853	8.2		0.0	-104	
13:10		7.38	865	8.2	3.4	0.0		
Suggested range for 3 consec. readings or see Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used when four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (nts)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

FIELD COMMENTS

Sample Appearance: _____ Odor: None Color: Not Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

Pump air/water leaking, still able to sample

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4.17.25	Mike Hess		All-s

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.: | | | |

Sample Point: P 3 2 0 4 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form(s) that accompany the sample container(s) (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only (Lab ID): L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (HH:MM)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 15 25	13:15				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment Dedicated: (Y) or N

Filter Device: Y or (N) 0.45 µ or _____ µ (circle or fill in)

Purging Device: C
A- Submersible Pump B-Bailer
B-Peristaltic Pump E-Piston Pump
C-QED Bladder Pump F-Dipper/Bottle

Filter Type: A-In-line Disposable C-Vacuum B-Pressure X-Other

Sampling Device: C

X-Other

Sample Tube Type: A-Teflon C-PVC X-Other B-Stainless Steel D-Polypropylene

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)
951.37 (ft msl)	1.80 (ft)	949.57 (ft msl)

Total Well Depth (from TOC) (ft)

Stick Up (from ground elevation) (ft)

Casing ID (in)

Casing Material

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by State Forms. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
13:20	0.4 L/M	1 7.20	1 874	10.6		02		
13:25		2 7.17	2 870	10.7		0.0		
13:30		3 7.16	3 873	10.6		0.0		
13:35		4 7.12	4 868	10.6		0.0	-124	
:								
:								
:								
:								
:								
:								
:								
Suggested range for 3 consec. readings or note Permit/State requirements		+/- 0.2	+/- 3%	–	–	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic Format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

FIELD COMMENTS

Sample Appearance: _____ Odor: N Color: N Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4.15.25			

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample; YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | |

Sample Point: P 3 2 0 C 2 (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form(s) that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only Lab ID: L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 15 25	13:45	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record Field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Purging Device: C
Sampling Device: C
X-Other:

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Filter Device: Y or (N) 0.45 µ or ____ µ (circle or fill in)

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other:

WELL DATA

Well Elevation (at TOC): 951.21 (ft msl)
Depth to Water (DTW) (from TOC): 15.9 (ft)
Groundwater Elevation (site datum, from TOC): 949.62 (ft msl)
Total Well Depth (from TOC): ____ (ft)
Stick Up (from ground elevation): ____ (ft)
Casing ID: ____ (in)
Casing Material: ____

Note: Total Well Depth, Stick Up, Casing Id etc. are optional and can be from historical data, unless required by State/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Vol (L/M)	pH (std)	Conductance (SC/EC) (umhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
13:50	0.4 1st	7.30 1st	1024 1st	10.7		0.2		
13:55	2nd	7.29 2nd	1025 2nd	10.8		0.1		
14:00	3rd	7.27 3rd	1024 3rd	10.7		0.0		
14:05	4th	7.26 4th	1023 4th	10.8	5.2	0.0	-130.1	
Suggested range for 3 consec. readings or site Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

FIELD COMMENTS

Sample Appearance: ____ Odor: None Color: None Other: ____

Weather Conditions (required daily, or as conditions change): ____ Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign)

Date	Name	Signature	Company
4.15.25	Mike Howe		All-4

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.:

Sample Point: P3 20 C (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 15 25	14:15	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/: Water Vol in Tubing Flow Cell and Tubing Flow Cell Vols Purged. Mark changes, record field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N

Purging Device: C
Sampling Device: C
X-Other:

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Filter Device: Y or C, 0.45 µ or ____ µ (circle or fill in)

Filter Type:

A-In-line Disposable, B-Pressure, C-Vacuum, X-Other

Sample Tube Type:

A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other:

WELL DATA

Well Elevation (at TOC): 951.19 (ft/msl)

Depth to Water (DTW) (from TOC): 1.60 (ft)

Groundwater Elevation (site datum, from TOC): 949.59 (ft/msl)

Total Well Depth (from TOC): ____ (ft)

Stick Up (from ground elevation): ____ (ft)

Casing ID: ____ (in)

Casing Material: ____

Note: Total Well Depth, Stick Up, Casing Id, etc., are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit (GPM)	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp. (°C)	Turbidity (nts)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
14:20	0.14	7.17	11.40	10.6		0.1		
14:25		7.16	11.40	10.6		0.1		
14:30		7.14	11.45	10.6		0.0		
14:35		7.13	11.46	10.7	1.0	0.0	-154	
:								
:								
:								
:								
:								
:								
Suggested range for 3 consec. readings or per Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (nts)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

FIELD COMMENTS

Sample Appearance: ____ Odor: None Color: None Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4 15 25	Mike Hu		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.: | | | | Sample Point: P-3/4C (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only – Cooler ID: L1990104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:mm)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOL's PURGED
04/17/25	13:15				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, Sr/Sr.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N — Filter Device: Y or (N) — 0.45 µ — or _____ µ (circle or fill in)

Purging Device: C — A-Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device: C

Filter Type: _____ — A-In-line Disposable, B-Pressure, C-Vacuum, X-Other _____

X-Other: _____

Sample Tube Type: _____ — A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: _____

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)
95202 (ft msl)	265 (ft)	94937 (ft msl)

Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
(ft)	(ft)	(in)	

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate Unit: LPM	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
13:20	0.4	6.93	1354	8.4		02		
13:25		6.83	1343	8.0		0.10		
13:30		6.81	1339	8.4		0.0		
13:35		6.79	1337	8.7	0.5	0.0	-108	
Suggested range for 3 consec. readings or state Permit/SOP requirements:		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: _____ Units _____

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site.*

FIELD COMMENTS

Sample Appearance: _____ Odor: None Color: None Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4.17.25	Mike Hunt		A/Lw

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

Site Name: EAL

Site No.: | | | | | Sample Point: P-3 | | | L (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
4/16/25	13:53	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: [Y] or [N] — Filter Device: [Y] or [N] [0.45 µ] or [ ] µ (circle or fill in)

Purging Device: [ ] — A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device: [ ]

X-Other: [ ]

Filter Type: [ ] — A-In-line Disposable, B-Pressure, C-Vacuum, X-Other [ ]

Sample Tube Type: [ ] — A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: [ ]

WELL DATA

Well Elevation (at TOC): 965.76 (ft/msl) — Depth to Water (DTW) (from TOC): 16.93 (ft) — Groundwater Elevation (site datum, from TOC): [ ] (ft/msl)

Total Well Depth (from TOC): [ ] (ft) — Stick Up (from ground elevation): [ ] (ft) — Casing ID: [ ] (in) — Casing Material: [ ]

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit: LPM	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
13:58	0.4	7.65	621	9.6		0.1		
14:03		7.66	633	9.4		0.2		
14:08		7.62	639	9.4		0.1		
14:13		7.60	638	9.4	34.4	0.1	-101.6	
Suggested range for 3 consec. readings or state Permit/Site requirements:		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required (i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site.

FIELD COMMENTS

Sample Appearance: [ ] Odor: NONE Color: NONE Other: [ ]

Weather Conditions (required daily, or as conditions change): Direction/Speed: [ ] Outlook: [ ] Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/16/25	Kenneth Smith		Arcadis

DISTRIBUTION: WHITE-ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: GRL

Site No.: | | | | | Sample Point: MW-10D (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only (Lab ID): L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
4/16/25	1358				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment — Dedicated: [Y] or [N]

Purging Device: [ ] A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device: [ ]

X-Other: [ ]

Filter Device: [Y] or [N] [0.45 µ] or [ ] µ (circle or fill in)

Filter Type: [ ] A-In-line Disposable, B-Pressure, C-Vacuum, X-Other [ ]

Sample Tube Type: [ ] A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other [ ]

WELL DATA

Well Elevation (at TOC) [ ] (ft/msl)

Depth to Water (DTW) (from TOC) [ ] (ft)

Groundwater Elevation (site datum, from TOC) [ ] (ft/msl)

Total Well Depth (from TOC) [ ] (ft)

Stick Up (from ground elevation) [ ] (ft)

Casing ID [ ] (in)

Casing Material [ ]

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1418	1st	1st	1st					
	2nd	2nd	2nd					
	3rd	3rd	3rd					
	4th	4th	4th					
Suggested range for 3 consec. readings or note Permit/State requirements		+/- 0.2	+/- 3%	–	–	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used when four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units
4/16/25	7.68	2555	10.7	2.5	0.2		

First Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site.*

Sample Appearance: [ ] Odor: NONE Color: NONE Other: [ ]

Weather Conditions (required daily, or as conditions change): Direction/Speed: [ ] Outlook: [ ] Precipitation: [Y] or [N]

Specific Comments (including purge/well volume calculations if required):

Purged for 20 min took final reading @ 1418

Tofdlizer 2427250

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/16/25	Kenneth Smith		Alliance

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: GPL

Site No.: | | | | | Sample Point: B305C (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form(s) that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only (Lab ID): L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:mm)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
11/16/15	1300				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N — Filter Device: Y or (N) 0.45 µ or ____ µ (circle or fill in)

Purging Device: C — A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device: C

X-Other: ____

Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other: ____

Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other: ____

WELL DATA

Well Elevation (at TOC): 9632.6 (ft/msl) — Depth to Water (DTW) (from TOC): 13.86 (ft) — Groundwater Elevation (site datum, from TOC): ____ (ft/msl)

Total Well Depth (from TOC): ____ (ft) — Stick Up (from ground elevation): ____ (ft) — Casing ID: ____ (in) — Casing Material: ____

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit: L/M	pH (std)	Conductance (SC/EC) (µmho/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1305	0.4	7.10	430	13.1		0.1		
1310	0.4	7.12	578	13.1		0.1		
1315	0.4	7.61	675	13.1		0.1		
1320	0.4	7.53	672	13.1	48.6	0.1		
Suggested range for Y column: readings to note Permit/State requirements		+/- 0.2	+/- 3%	+/-	+/-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State. These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below, and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ____ Units ____

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site)*

FIELD COMMENTS

Sample Appearance: ____ Odor: None Color: None Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: NW 12mph Outlook: partly cloudy Precipitation: Y or (N)

Specific Comments (including purge/well volume calculations if required): ____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
11/16/15	Kenneth Smith		Alliance

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

Site Name: ERL

Site No.: | | | | | Sample Point: P 3 3 3 L (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form(s) that accompany the sample container(s) (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only (Lab ID): L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
04 18 25	1116				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below:

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: [Y] or [N]

Filter Device: [Y] or [N] [0.45 µ] or [ ] µ (circle) or (fill in)

Purging Device [X]
Sampling Device [X]
X-Other: Drop tube

A- Submersible Pump
B-Peristaltic Pump
C-QED Bladder Pump
D-Bailer
E-Piston Pump
F-Dipper/Bottle

Filter Type: [ ]
A-In-line Disposable
B-Pressure
C-Vacuum
X-Other

Sample Tube Type: [ ]
A-Teflon
B-Stainless Steel
C-PVC
D-Polypropylene
X-Other:

WELL DATA

Well Elevation (at TOC): 943.72 (ft msl)
Depth to Water (DTW) (from TOC): 4.10 (ft)
Groundwater Elevation (site datum, from TOC): 939.62 (ft msl)
Total Well Depth (from TOC): [ ] (ft)
Stick Up (from ground elevation): [ ] (ft)
Casing ID: [ ] (in)
Casing Material: [ ]

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Purge Rate (LPM)	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (ntu)	D.O (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1115	0.2 1st	7.46 1st	3.66 1st	8.0		10.0		
1120	2nd	7.46 2nd	4.07 2nd	7.9		0.6		
1125	3rd	7.46 3rd	4.06 3rd	7.9		9.0		
1130	4th	7.45 4th	4.05 4th	8.0	1.0	9.0	-152	
Suggested range for 3 cons. readings or state Permit/State requirements:		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: / Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site)*

FIELD COMMENTS

Sample Appearance: [ ] Odor: None Color: None Other: [ ]

Weather Conditions (required daily, or as conditions change): [ ] Direction/Speed: [ ] Outlook: [ ] Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): [ ]

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4.18.25	Mike Hess		ALS

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: EBL
Site No.:
Sample Point: P30 1L (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form(s) that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Courtesy Lab ID: L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
4/17/25	1400				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: (Y) or N
Purging Device: C
Sampling Device: C
X-Other:

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Filter Device: Y or (N) 0.45 µ or ____ µ (circle or fill in)
Filter Type: A-In-line Disposable, B-Pressure, C-Vacuum, X-Other
Sample Tube Type: A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other:

WELL DATA

Well Elevation (at TOC): 970.11 (ft/msl)
Depth to Water (DTW) (from TOC): 1.30 (ft)
Groundwater Elevation (site datum, from TOC): 968.81 (ft/msl)
Total Well Depth (from TOC): ____ (ft)
Stick Up (from ground elevation): ____ (ft)
Casing ID: ____ (in)
Casing Material: ____

Note: Total Well Depth, Stick Up, Casing ID, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit: 1pm	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25°C)	Temp (°C)	Turbidity (ntu)	D.O (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1405	0.4 1st	6.73 1st	523	10.7		0.4		
1410	2nd	6.74 2nd	527	10.7		0.4		
1415	3rd	6.70 3rd	530	10.7		0.4		
1420	4th	6.65 4th	531	10.7	1.72	0.4	-118.1	
Suggested range for 3 consec. readings or one Permit/State requirement:		+/- 0.2	+/- 3%	–	–	+/- 10%	+/- 25 mV	Stable

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: / Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State Permit/Site).*

FIELD COMMENTS

Sample Appearance: ____ Odor: ____ Color: ____ Other: ____

Weather Conditions (required daily, or as conditions change): Direction/Speed: ____ Outlook: ____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign).

Date	Name	Signature	Company
4/17/25	Kenneth Smith		Alliance

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | |

Sample Point: P301C (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Form(s) that accompany the sample container(s) (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only (Lab ID): L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
041625	1312				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment — Dedicated: (Y) or N

Purging Device: C — A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle, X-Other

Sampling Device: C

Filter Device: Y or (N) — 0.45 µ or _____ µ (circle or fill in)

Filter Type: — A-In-line Disposable, B-Pressure, C-Vacuum, X-Other

Sample Tube Type: — A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other

WELL DATA

Well Elevation (at TOC) (ft/msl)	Depth to Water (DTW) (from TOC) (ft)	Groundwater Elevation (site datum, from TOC) (ft/msl)
967.50	17.92	949.58

Total Well Depth (from TOC) (ft)	Stick Up (from ground elevation) (ft)	Casing ID (in)	Casing Material

Note: Total Well Depth, Stick Up, Casing Id etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Flow Unit (GPM)	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp (°C)	Turbidity (nts)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1325	0.4	1: 7.65	1: 1959	1: 11.1		1: 0.2		
1330		2: 7.43	2: 1251	2: 11.1		2: 0.1		
1335		3: 7.38	3: 1316	3: 11.1		3: 0.0		
1340		4: 7.30	4: 1368	4: 11.1	6.0	4: 0.0	4: -152	
Suggested range for 3 consec. readings or state Permit/State requirements:		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (nts)	DO (mg/L-ppm)	eH/ORP (mV)	Other: _____ Units _____

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

FIELD COMMENTS

Sample Appearance: _____ Odor: None Color: None Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/16/25	Mike Hero		ALM

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.:

Sample Point: P29P (Sample ID)

This Waste Management Field Information Form is Required. This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: L1950104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL. PURGED (Gallons)	WELL VOL.s PURGED
04 15 25	14:50				

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment: Dedicated: (Y) or N

Purging Device: C

Sampling Device: C

A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

X-Other:

Filter Device: Y or (N) 0.45 µ or _____ µ (circle or fill in)

Filter Type:

A-In-line Disposable, B-Pressure, C-Vacuum, X-Other

Sample Tube Type:

A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other:

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)
957.35 (ft msl)	10.65 (ft)	946.70 (ft msl)

Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
(ft)	(ft)	(in)	

Note: Total Well Depth, Stick Up, Casing Id etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit	pH (std)	Conductance (SU/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
14:55	0.4 LPM	7.65	343	11.6		0.0		
15:00	"	7.80	320	11.5		0.0		
15:05	"	7.82	316	11.4		0.0		
15:10	"	7.85	325	11.4	25	0.0 -	199	
Suggested range for 3 consec. readings or state Permit/State requirements		+/- 0.2	+/- 3%	-	-	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional (i.e. complete stabilization readings for parameters required by WM, Site, or State. These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: _____ Units _____

Final Field Readings are required (i.e. record field measurement, final stabilized readings, passive sample readings before sampling for all field parameters required by State Permit/Site)

Sample Appearance: _____ Odor: None Color: None Other:

Weather Conditions (required daily, or as conditions change): Direction/Speed: Outlook: Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

FIELD COMMENTS

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4.15.25	Mike		

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ERL

Site No.:

Sample Point: P29C (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is information along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only: Lab ID: L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hrs:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOL. PURGED
04 16 25	12:35	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing, Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes; record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment Dedicated: Y or N

Filter Device: Y or N 0.45 µ or _____ µ (circle or fill in)

Purging Device: C
Sampling Device: C
X-Other:

A- Submersible Pump; B-Peristaltic Pump; C-QED Bladder Pump; D-Bailer; E-Piston Pump; F-Dipper/Bottle

Filter Type:

A-In-line Disposable; B-Pressure; C-Vacuum; X-Other

Sample Tube Type:

A-Teflon; B-Stainless Steel; C-PVC; D-Polypropylene; X-Other:

WELL DATA

Well Elevation (at TOC): 957.16 (ft msl)
Depth to Water (DTW) (from TOC): 7.54 (ft)
Groundwater Elevation (site datum, from TOC): 949.62 (ft msl)
Total Well Depth (from TOC): (ft)
Stick Up (from ground elevation): (ft)
Casing ID: (in)
Casing Material:

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit L PM	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
12:40	0.4 1st	7.37 1st	917 1st	11.3		0.4		
12:45	2nd	7.24 2nd	933 2nd	11.4		0.1		
12:50	3rd	7.19 3rd	933 3rd	11.4		0.0		
12:55	4th	7.15 4th	933 4th	11.5	21	0.0	-118	
:								
:								
:								
:								
:								
:								

Suggested range for 3 consec. readings or state Permit/State requirements: ~0.2 | ~3% | ~ | ~ | ~10% | ~25 mV | Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (nts)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State Permit/Site).*

FIELD COMMENTS

Sample Appearance: _____ Odor: None Color: None Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): _____

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign).

Date	Name	Signature	Company
4/16/25	Mike Hess		

DISTRIBUTION: WHITE-ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

FIELD INFORMATION FORM

WASTE MANAGEMENT

Site Name: ERL

Site No.: | | | | |

Sample Point: P3 SW (Sample ID)

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: L1850104

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hr:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED
4/16/25	1435	:			

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes record field data below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: [Y] or [N] — Filter Device: [Y] or [N] [0.45 µ] or [ ] µ (circle or fill in)

Purging Device: [ ] — A- Submersible Pump, B-Peristaltic Pump, C-QED Bladder Pump, D-Bailer, E-Piston Pump, F-Dipper/Bottle

Sampling Device: [ ]

X-Other: [ ]

Filter Type: [ ] — A-In-line Disposable, B-Pressure, C-Vacuum, X-Other [ ]

Sample Tube Type: [ ] — A-Teflon, B-Stainless Steel, C-PVC, D-Polypropylene, X-Other [ ]

WELL DATA

Well Elevation (at TOC)	Depth to Water (DTW) (from TOC)	Groundwater Elevation (site datum, from TOC)
972.27 (ft/msl)	24.03 (ft)	948.24 (ft/msl)

Total Well Depth (from TOC)	Stick Up (from ground elevation)	Casing ID	Casing Material
(ft)	(ft)	(in)	

Note: Total Well Depth, Stick Up, Casing Id, etc. are approved and can be from historical data, unless required by Site Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit	pH (std)	Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
1440	0.4	7.16	231	8.4		0.1		
1445		7.07	237	8.7		0.1		
1450		7.07	235	8.7		0.1		
1455		7.05	236	8.7	7.0	0.1	-220.4	
Suggested range for 3 consec. readings or per Permit/State requirements		+/- 0.2	+/- 3%	–	–	+/- 10%	+/- 25 mV	Stabilize

Stabilization Data Fields are Optional *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. If more fields above are needed, use separate sheet or form.*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (µmhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: Units

Final Field Readings are required *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site).*

FIELD COMMENTS

Sample Appearance: _____ Odor: _____ Color: _____ Other: _____

Weather Conditions (required daily, or as conditions change): Direction/Speed: _____ Outlook: _____ Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required):

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
4/16/25	Kenneth Smith		

DISTRIBUTION: WHITE-ORIGINAL - Stays with Sample, YELLOW - Returned to Client

ORIGINAL COPY

ANALYTICAL REPORT

May 13, 2025

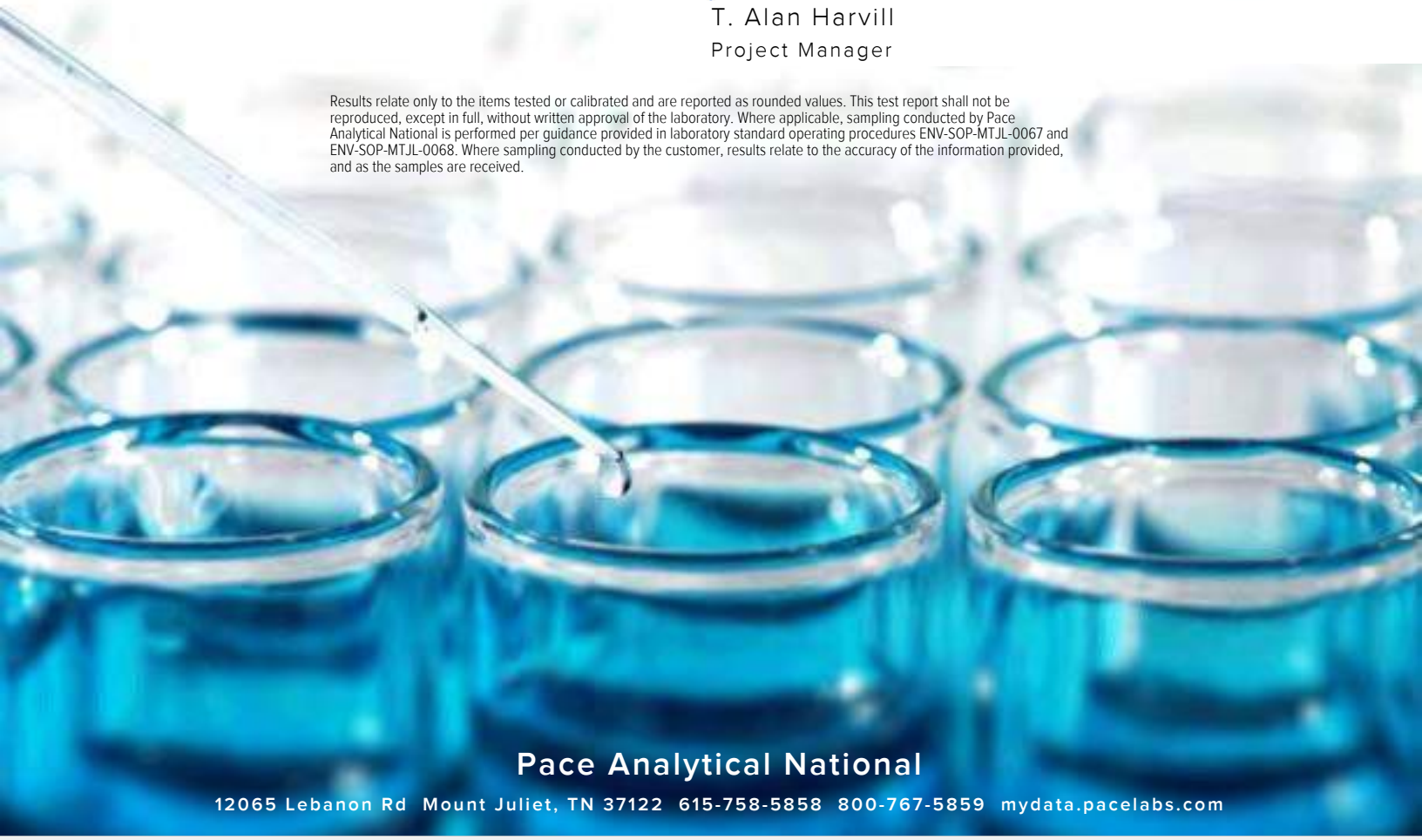
Elk River Landfill

Sample Delivery Group:	L1857297
Samples Received:	05/09/2025
Project Number:	500
Description:	Elk River- Monthly Leachate
Site:	MN02
Report To:	Jim Eidem 4300 MarketPoint Drive Suite 200 Minneapolis, MN 55435

Entire Report Reviewed By:

T. Alan Harvill
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 mydata.pacelabs.com

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SAMPLE SUMMARY

SP-01_Leachate L1857297-01

Collected by: Kenneth Smith
Collected date/time: 05/08/25 09:50
Received date/time: 05/09/25 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 D-2011	WG2512963	1	05/12/25 11:43	05/12/25 18:24	AMG	Mt. Juliet, TN
Wet Chemistry by Method 410.4	WG2513499	5	05/13/25 08:07	05/13/25 14:08	DAM	Mt. Juliet, TN
Wet Chemistry by Method 4500H+ B-2011	WG2512219	1	05/10/25 22:30	05/10/25 22:30	KRB	Mt. Juliet, TN

Unless qualified or notated within the narrative below, all sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



T. Alan Harvill
Project Manager

Project Comments

The requested project specific reporting limits may be less than laboratory standard quantitation limits (PQL) but will be greater than or equal to the laboratory method detection limits (MDL). It is noted that results reported below lab standard quantitation limits (PQLs) may result in false positive/false negative values that may require additional laboratory quality assurance review, if requested. Routine laboratory procedures do not initiate a data review process for detections below the laboratory's PQL unless requested by the client.

Sample Delivery Group (SDG) Narrative

The laboratory analysis was performed from an unpreserved, insufficiently or inadequately preserved sample.

Batch	Method	Lab Sample ID
WG2513499	410.4	L1857297-01

The following samples were prepared and/or analyzed past recommended holding time. Concentrations should be considered minimum values.

Batch	Method	Lab Sample ID
WG2512219	4500H+ B-2011	L1857297-01

Gravimetric Analysis by Method 2540 D-2011

RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Batch	Lab Sample ID	Analytes
WG2512963	(DUP) R4213935-4	Suspended Solids

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	7.72	su
Temperature (on-site)	16.9	Deg C

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Suspended Solids	29.6		4.00	1	05/12/2025 18:24	WG2512963

Wet Chemistry by Method 410.4

Analyte	Result	Qualifier	RL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
COD	3020		15.0	5	05/13/2025 14:08	WG2513499

Wet Chemistry by Method 4500H+ B-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	SU			date / time	
pH	8.07	T8	1	05/10/2025 22:30	WG2512219

Sample Narrative:

L1857297-01 WG2512219: 8.07 at 19.1C

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R4213935-1 05/12/25 18:24

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Suspended Solids	ND		0.350	2.50

L1856950-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1856950-01 05/12/25 18:24 • (DUP) R4213935-3 05/12/25 18:24

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	153	156	1	1.94		10

L1857016-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1857016-01 05/12/25 18:24 • (DUP) R4213935-4 05/12/25 18:24

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	ND	ND	1	15.4	P1	10

Laboratory Control Sample (LCS)

(LCS) R4213935-2 05/12/25 18:24

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Suspended Solids	773	796	103	85.0-115	

Method Blank (MB)

(MB) R4213986-1 05/13/25 13:54

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
COD	8.59		3.00	10.0

L1857370-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1857370-01 05/13/25 14:10 • (DUP) R4213986-7 05/13/25 14:10

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	6780	6710	10	1.08		20

L1857377-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1857377-01 05/13/25 14:10 • (DUP) R4213986-8 05/13/25 14:11

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	860	854	2	0.693		20

Laboratory Control Sample (LCS)

(LCS) R4213986-2 05/13/25 14:03

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
COD	500	497	99.5	90.0-110	

L1857068-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1857068-03 05/13/25 14:04 • (MS) R4213986-3 05/13/25 14:06 • (MSD) R4213986-4 05/13/25 14:06

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
COD	500	48.6	551	560	100	102	1	90.0-110			1.68	20

L1857068-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1857068-04 05/13/25 14:08 • (MS) R4213986-5 05/13/25 14:08 • (MSD) R4213986-6 05/13/25 14:08

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
COD	500	24.7	539	535	103	102	1	90.0-110			0.786	20

L1856044-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1856044-01 05/10/25 22:30 • (DUP) R4212884-2 05/10/25 22:30

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	7.01	7.03	1	0.285		1

Sample Narrative:

OS: 7.01 at 18.4C

DUP: 7.03 at 18.4C

L1857437-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1857437-01 05/10/25 22:30 • (DUP) R4212884-3 05/10/25 22:30

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	8.14	8.16	1	0.245		1

Sample Narrative:

OS: 8.14 at 19.6C

DUP: 8.16 at 19.3C

Laboratory Control Sample (LCS)

(LCS) R4212884-1 05/10/25 22:30

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	su	su	%	%	
pH	10.0	10.0	100	99.0-101	

Sample Narrative:

LCS: 10.03 at 19.9C

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.
T8	Sample(s) received past/too close to holding time expiration.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Elk River Landfill

4300 MarketPoint Drive Suite 200
Minneapolis, MN 55435

Billing Information:
Accounts Payable /
mkostrze@wm.com
P.O. Box 4745
Portland, OR 97208-4745

Pres Chk

Report to:
Jim Eidem 952-832-2893

Email To:
aschneider@barr.com;datamgt@barr.com;jeide

Project Description:
Elk River- Monthly Leachate

City/State Collected:

Please Circle: PT MT CT ET

Regulatory Program (DOD, RCRA, DW, etc):

Client Project #
500

Lab Project #
WMELKRIVMN-00004

Collected by (print):
Kenneth Smith

Site/Facility ID #
MN02

P.O. #

Collected by (signature):

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day ___ STD TAT

Quote #

Date Results Needed

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

SDG # 185729

B019

Acctnum: WMELKRIVMN
Template: T170196
Prelogin: P1144318
PM: 364 - T. Alan Harvill
PB: 4/21/25 AR
Shipped Via: FedEX Ground

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Entrs	COD 250mlHDPE-H2SO4	PH 125mlHDPE-NoPres	TSS 1L-HDPE NoPres	Remarks	Sample # (lab only)
SP-01_Leachate	G	GW		5/18/25	950	3	X	X	X		-01

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 4439 2454 0378

Sample Receipt Checklist
COC Seal Present/Intact: Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCl / MeoH TBR	
	5/18/25	1100	FEDEX		
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 1.4°C Bottles Received: 3	If preservation required by Login: Date/Time
				50f.4=5.4	
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: Time:	Hold: / Condition: NCF /
			Alexa Mitchell	5/19/25 0845	

FIELD INFORMATION FORM

Surface Water, Stormwater and Leachate

WASTE MANAGEMENT

Laboratory Use Only / Lab I.D.: L1857297

Site Name: ERL

Sample I.D.: SP-01

Sampling Method & Equipment

Purge and Sample Equipment:

Sampling Method: [D] D - Direct, I - Indirect, V - Visual

Sampling Equipment: [O] D - Dipper, T - Transfer Vessel, S - Sample Bottle, O - Other [Pump]

Sample Type: [ ] (Grab) / Composite (circle one)

Field Measurements

Sample Date MM/DD/YYYY	Sample Time 24 Hr. Clock	pH (std. Units)	CONDUCTIVITY (umhos/cm @ 25°C)	Temp °C	TURBIDITY (NTUs)	DO mg/L - ppm	eH/ORP (std. Units)
5/8/23	950	7.72	2360	16.9			

Record final stabilized field readings.

Field Observations

Sample Appearance: Odor: yes Color: Green/Black Other:

Sheen Present: [Y] or [N] Foam Present: [Y] or [N] Floating Solids: [Y] or [N]

Weather Conditions: (required daily, or as conditions change):

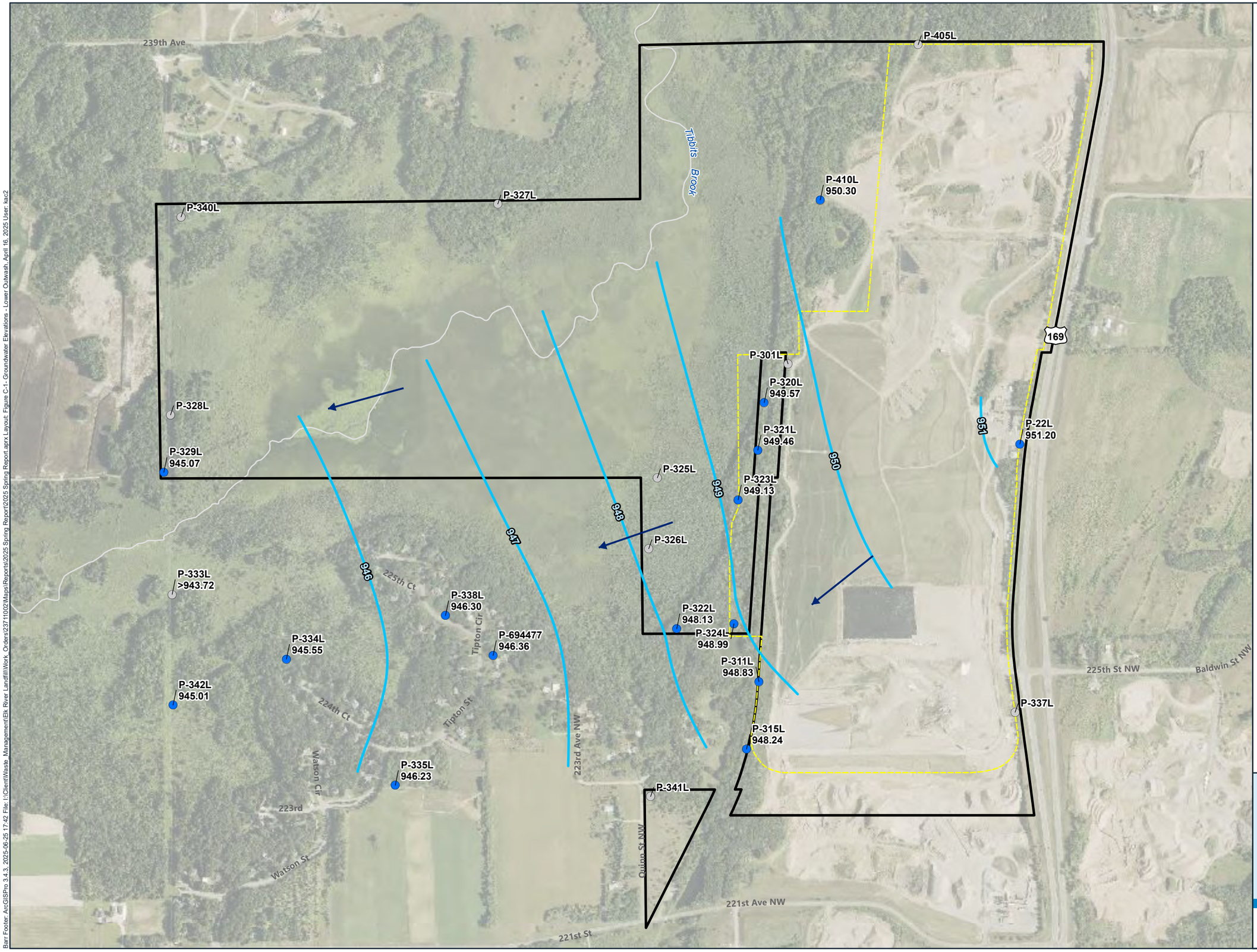
Direction/Speed: South NW/NW Precipitation: [Y] or [N]

Specific Comments:

Date	Name	Signature	Company
5/5/23	Kenneth Smith		Arcadis
/ /			

Appendix C

Groundwater Elevations



Property Boundary

Groundwater Compliance Boundary

Lower Outwash Monitoring Well

Lower Outwash Monitoring Well (Not Used for Groundwater Contours)

Groundwater Contour (feet MSL)

Flow Line

N

0 375 750 1,125

Feet

Imagery Source: USDA-FSA NAIP Imagery (2023)

Groundwater Elevations - Lower Outwash
April 16, 2025
Elk River Landfill
Elk River, Minnesota

FIGURE C-1

BARR

Barr Footer: ArcGISPro 3.4.3, 2025-06-25 17:42, File: I:\Client\Waste_Management\Elk River Landfill\Work_Orders\23711002\Maps\Reports\2025 Spring Report\2025 Spring Report.aprx Layout: Figure C-1: Groundwater Elevations - Lower Outwash, April 16, 2025 User: kac2

EXHIBIT 14

Document #732

Work Plan for 2014 Groundwater Monitoring Network Augmentation

Elk River Landfill
Elk River, Minnesota

Prepared for
Elk River Landfill, Inc.

February 2014

BARR

Work Plan for 2014 Groundwater Monitoring Network Augmentation

Elk River Landfill
Elk River, Minnesota

Prepared for
Elk River Landfill, Inc.

February 2014

BARR

4700 West 77th Street
Minneapolis, MN 55435-4803
Phone: (952) 832-2600
Fax: (952) 832-2601

Work Plan for 2014 Groundwater Monitoring Network Augmentation

February 2014

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Figure 2 Site Map

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Appendix A Cross Sections

Appendix B Groundwater Flow – Lower Outwash, October 16, 2012

1.0 Introduction

This Work Plan describes the planned 2014 groundwater monitoring network augmentation at the Elk River Landfill (ERL; Figure 1). The network augmentation will include installing two monitoring wells on ERL property at locations downgradient of existing monitoring wells.

The planned scope of work is based on the results of ERL's ongoing hydrogeologic investigation of Rice Lake/Tibbits Brook (RL/TB), routine groundwater monitoring results, and discussions/correspondence with the Minnesota Pollution Control Agency (MPCA), Sherburne County, and the City of Elk River.

The following sections of this Work Plan provide a summary of pertinent background information, a description of the approach used to site the planned wells and to determine well screen intervals, a description of the drilling and well installation methods, and the project schedule.

2.0 Background

A summary of pertinent groundwater investigations and routine groundwater monitoring results that were used to scope the monitoring network augmentation work is provided below.

2.1 Previous RL/TB Investigations

Previous groundwater investigations have included advancing direct-push soil borings in RL/TB and the installation of monitoring wells between the ERL and RL/TB. The locations of RL/TB soil borings and current monitoring wells are shown on Figure 2.

In 2004/2005, twelve soil borings and four piezometers were installed in RL/TB (Geomatrix, 2005). The results of these investigations confirmed the following:

- RL/TB is largely covered by floating bog vegetation and is over 30 feet deep in some locations.
- The geologic units beneath RL/TB include lake bottom muck, which is underlain by poorly graded sand (up to 14 feet thick), till (ranging from 4 to 15 feet thick), and the lower outwash (which is monitored by ERL monitoring wells)
- The till beneath RL/TB is softer/less dense and exhibits a more uniform thickness than the hard, over consolidated till that is present at the site. Based on these characteristics, the till beneath RL/TB is interpreted to be an ablation (melt-out) till (which is consistent with the Minnesota Geological Survey's interpretation that RL/TB is an ice-block lake; MGS, 2013).
- The hydraulic head in the lower outwash varied from approximately 8 to 11 feet above the RL/TB ground surface. The hydraulic head measurements equate to an approximate upward vertical gradient or 0.45 between the lower outwash and RL/TB.
- The horizontal hydraulic gradient between the three RL/TB piezometers installed in lower outwash had an easterly component (which contrasted with the westerly gradient consistently measured at the site).
- No volatile organic compounds (VOCs) were detected in groundwater samples collected from PZ3 and PZ6 in 2004. PZ3 and PZ6 were completed at the top of lower outwash unit.

After the 2005 investigation, relatively warm winter seasons prevented further drilling in RL/TB so the groundwater investigation focus shifted to the area between the ERL and RL/TB. In 2006/2007,

monitoring wells P320C, P320C2, and P320L (320 well nest) were installed for the purpose of monitoring vertical gradients and profiling groundwater quality in the lower outwash downgradient of the unlined (Pre-Subtitle D) portion of the landfill. Results from the 320 well nest included:

- Average vertical hydraulic gradients in the lower outwash based on 16 hydraulic head measurement events conducted between 2006 and 2013 (Barr, 2014) are provided in Table 1 and are summarized below:
    - Average vertical hydraulic gradients are upward between the top and middle portions and the top and bottom portions of the lower outwash (as measured by well pairs P320C/P320C2 and P320C/P320L, respectively).
    - Upward gradients were measured between the top and middle portions of the lower outwash during two-thirds of the monitoring events and between the top and bottom portions of the lower outwash during half of the monitoring events. Upward gradients were measured between the middle and bottom portions of the lower outwash during a quarter of the monitoring events.
- VOCs were detected in groundwater at the base of the lower outwash in monitoring well P320L. No VOCs were detected in groundwater at the top of the lower outwash in P320C.

Based on the water quality monitoring results at the 320 well nest, the ERL installed six additional L-series wells to monitor groundwater quality at the base of the lower outwash unit. The installation of the L-series wells provided substantial geologic and water quality data west of the landfill. Cross sections showing the lateral extent and thickness of the lower outwash along the west side of the ERL and beneath the RL/TB are included in Appendix A. Water quality monitoring results are discussed in the following section.

2.2 Routine Groundwater Monitoring Results

Routine groundwater monitoring has been performed in accordance with solid waste permit SW-74 and the permits and agreements with Sherburne County and the City of Elk River since the mid-1980s. Monitoring results are reported in triannual monitoring reports and are evaluated in annual water quality monitoring reports. The details of the current groundwater monitoring program are provided in the Sampling and Analysis Plan (SAP; Barr, 2011).

Below are summaries of 2012 and 2013 HRL exceedences from selected locations downgradient of the ERL.

- **320 Well Nest (including P-29C):** No VOCs were detected above the HRL in the 320 well nest area except for one vinyl chloride detection in the spring 2012 groundwater sample from P320L. No VOCs were detected in groundwater from P320C. Total VOC concentrations in P29C and P320L have decreased from past results (see Appendix F in Barr, 2013).
- **P-321L and P-323L:** Vinyl chloride was detected above the HRL in groundwater at P-321L in 2012 and 2013 and in groundwater at P-323L in 2013.
- **P-304C area:** Vinyl chloride was detected above the HRL in groundwater at P313C and P314C during the three 2012 routine monitoring events and in only one groundwater sample collected from P314C during 2013. Total VOC concentrations in P313C and P314C have demonstrated stabile to decreasing trends over recent years (see Appendix F in Barr, 2013).
- **P-301L, P-322/P324L:** No VOCs have been detected above HRLs in groundwater at P-301L, P-322L, or P-324L. These well delineate the northern and southern extent of groundwater impacts west of the ERL.

3.0 Technical Approach

The planned monitoring wells will be used to define the extent of VOC-impacted groundwater and provide sentinel groundwater monitoring data west of the ERL. The technical approaches for well location and screen placement selection are discussed below.

3.1 Well Locations

The planned well locations are shown on Figure 2. Monitoring wells P-325L and P-326L are located downgradient of monitoring wells P-321L, P-323L, and P-314C (i.e., where VOCs have recently been detected above HRLs).

- Monitoring well P325L will provide groundwater monitoring data west of P-321L and the P-17C area. This location was selected based on the westerly groundwater flow directions inferred from hydraulic head data from the ERL monitoring well network (Barr, 2013).
- Monitoring well P326L will provide groundwater monitoring data southwest of P-321L/P-323L and west of P-313C/P314C. This location was selected based on the southwesterly groundwater flow direction inferred from hydraulic head data from the L-series monitoring wells which are completed at the base of the lower outwash (Appendix B).

The new monitoring wells will provide sentinel groundwater monitoring data that will be used to define the extent of VOC-impacted groundwater downgradient of the ERL.

3.2 Well Screen Placement

The thickness of the lower outwash and the elevation of the underlying bedrock are not fully known at the proposed well locations. The elevation of the top of bedrock (or the top of till directly overlying bedrock) at the L-series well east of the RL/TB ranges from approximately 840 to 860 feet MSL (which equates to 80 to 100 feet below the surface of RL/TB). Due to the uncertainty of the thickness of the lower outwash unit at the proposed well locations, specific well screen intervals will be determined in the field during drilling. However, the following general rationale for well screen interval selection will be employed:

- If the lower outwash is 30 or less feet thick, the bottom of the monitoring well screen will be placed at the base of the lower outwash. The well screen will be no longer than 15 feet. This scenario will result in a monitoring well that is screened in the stratigraphic interval

monitored by wells P-321L and P-323L (and similar to P313C and P314C) where vinyl chloride has been detected above the HRL.

- If the lower outwash is greater than 30 feet thick, well screens may be adjusted and set to the approximate center elevation of the L series wells (P-321L and P-323L). Nested monitoring wells may also be considered but it is noted that achieving a proper well seal given the high hydraulic head differential expected is critical. Nested wells further reduce the likelihood that a proper well seal can be achieved; so nested wells will only be considered if deemed crucial. If nested wells are installed, the lower monitoring well may be set at the base of the lower outwash and the upper nested well will be screened at the elevation of the L-series well located to the east (i.e., the upper well at P-325L will be screened at an elevation consistent with P321L and the upper well P-326L will be screened at an elevation consistent with P323L).

It is important to note that the well screen placement strategy outlined above will insure monitoring in the same screen interval of known groundwater detections at wells P321L, P323L, and P314C. If no significant discharge is occurring to RL/TB then this interval should be ideal for detection monitoring. If discharge is occurring to RL/TB then no detections or very low levels may be evident. In either case this work will result in important information concerning nature and extent VOC-impacted groundwater as well as informing potential corrective actions.

4.0 Methods

The monitoring wells will be constructed in accordance with State of Minnesota Well code by a licensed well contractor. The wells will likely be constructed using rotasonic drilling or equivalent driven casing methods. Geologic samples will be collected and logged by Barr staff. One of the key advantages of driven casing techniques is the improved odds of maintaining a well seal through the relatively thin ablation till that is present beneath RL/TB.

4.1 Well Construction, Development, and Surveying

The boreholes for monitoring wells P325L and P326L will likely be constructed using double-cased well installation methods. At each location, 6-inch inner diameter, permanent steel casing will be set into the till above the lower outwash and grouted in-place. After the grout sets, the borehole will be advanced through the permanent casing to total depth and the monitoring wells will be constructed with 2-inch diameter stainless steel well screens and low carbon steel risers. If feasible, filter pack sand will be placed from the bottom of the borehole to two feet above the top of the well screen and the remainder of the borehole annulus will be sealed with neat cement grout. Based upon previous experience with well construction in RL/TB, strong upward gradients are expected as well as heaving sands. These conditions challenge well construction and especially seal placement. If the upward gradient/flowing conditions prevent the placement of filter pack sand, a natural sand pack (i.e., lower outwash) will be used and the remainder of the borehole annulus will be sealed with neat cement grout. Each monitoring well will be water tight and completed above grade with a lockable well cover.

The wells will be developed after construction to remove fines from the screened interval and to ensure a good hydraulic connection between the screen and the surrounding geologic media.

A licensed land surveyor will survey the horizontal location, ground surface elevation, and top of casing elevation.

4.2 Background Monitoring

The monitoring wells will be sampled for background parameters in accordance with the Sampling and Analysis Plan (SAP; Barr, 2011) during the 2014 routine monitoring events. Background monitoring data will be submitted in quarterly monitoring reports and summarized in the 2014 Annual Water Quality Report. The ERL will provide a recommendation regarding the inclusion of

P325L and P326L in the groundwater monitoring network in the 2014 Annual Water Quality Monitoring Report.

5.0 Schedule

The monitoring well installation work is planned for as soon as ice road conditions allow safe access (anticipated to be February 2014) and is anticipated to take approximately 4 weeks.

Please note, the RL/TB is covered by floating bog vegetation and winter ice conditions have been variable in the past due to apparent water upwelling. The implementation of this work plan is contingent on the driller's verification that conditions are sufficient to safely support the drill rig, ancillary equipment, and the crew. If unforeseen circumstances that could jeopardize the safety of the crew arise, work will be stopped.

6.0 References

Barr, 2014. Fall 2014 Quarterly Report, Elk River Landfill.

Barr, 2013. 2012 Annual Water Quality Monitoring Report, Elk River Landfill.

Barr, 2011. Sampling and Analysis Plan, Elk River Landfill (SW-74).

Geomatrix, 2007. Groundwater Investigation Progress Report, P-304C and P-29C Areas, Elk River Landfill, Elk River, Minnesota.

Geomatrix, 2005. Final Report of Rice Lake/Tibbits Brook Groundwater Discharge Investigation, Elk River Landfill, Elk River, Minnesota.

MGS, 2013. Personal Communication with Barbara Lusardi, Minnesota Geological Survey.

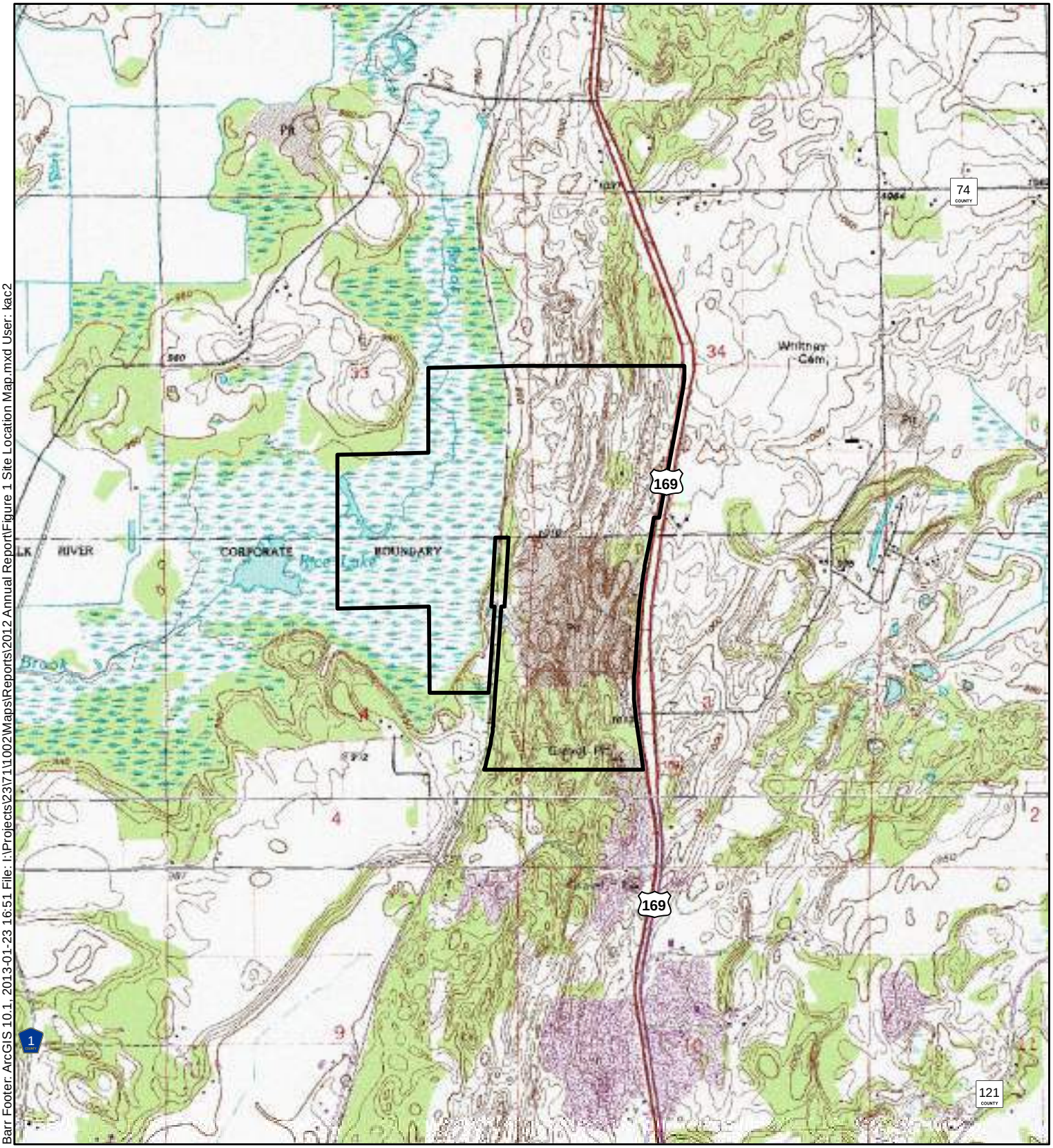
Tables

Table 1
Summary of Vertical Hydraulic Head Gradients - 320 Well Nest (2006 - 2013)
Elk River Landfill
Elk River, Minnesota

Well Pairs	Well Pair Screen Placement in Lower Outwash	2006 - 2013				
		Number of Water Level Measurement Events	Number of Events with Upward Hydraulic Gradients	Average Upward Hydraulic Gradient[1]	Ave Downward Hydraulic Gradient[1]	Overall Average Hydraulic Gradient[1]
P320C/P320C2	Top/Middle	15	10	-0.0028	0.0023	-0.0011
P320C2/P320L	Middle/Bottom	16	4	-0.0107	0.0055	0.0014
P320C/P320L	Top/Bottom	16	8	-0.0031	0.0026	-0.0002

Notes:
Negative values indicate an upward vertical gradient.
Hydraulic head data included in the 2013 Fall Quarterly Monitoring Report (Barr, 2014).

Figures



Barr Footer: ArcGIS 10.1, 2013-01-23 16:51 File: I:\Projects\23\71\002\Maps\Reports\2012 Annual Report\Figure 1 Site Location Map.mxd User: kac2

Figure 1

Site Boundary

N

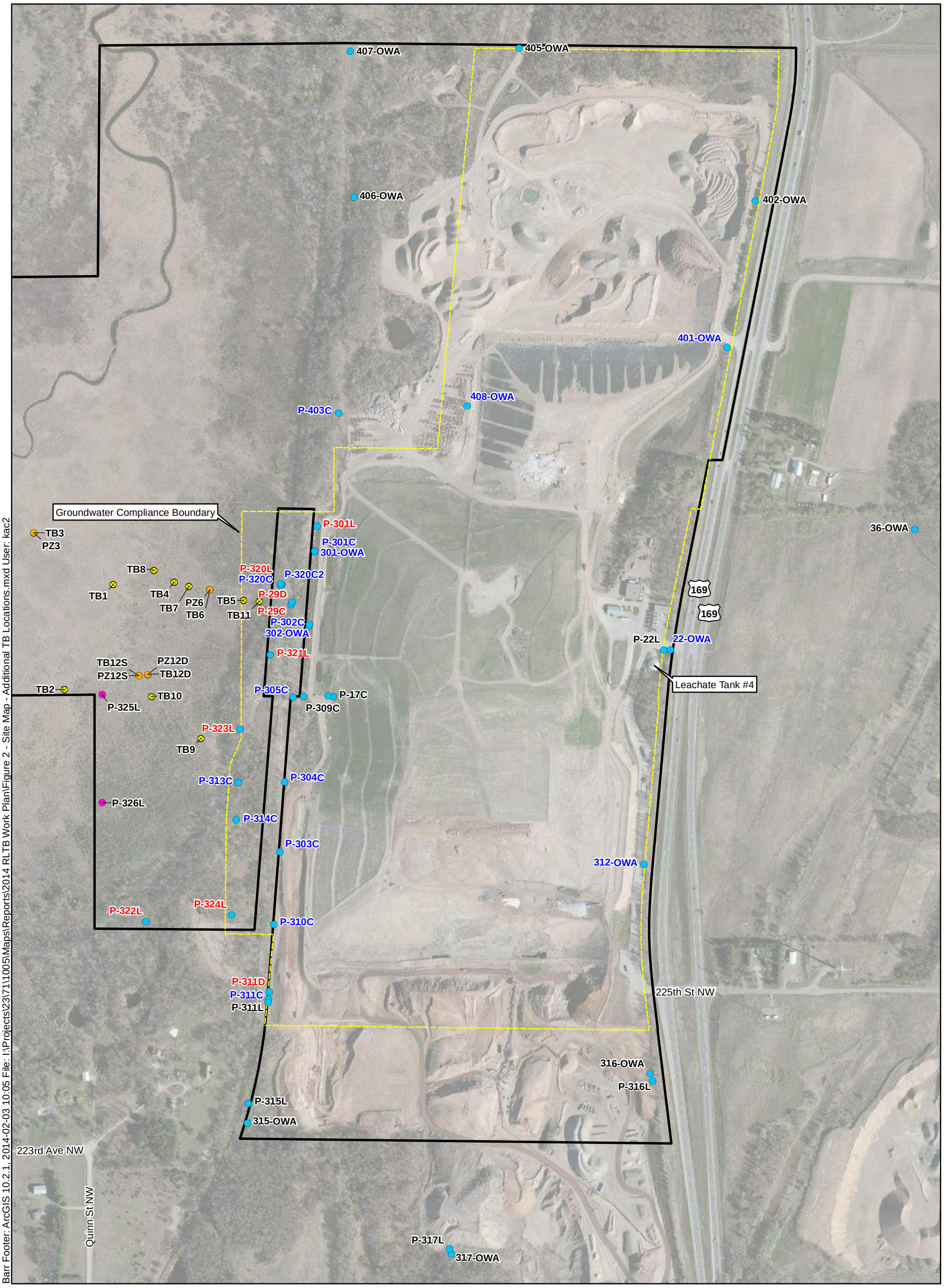
Feet

0 2,000 4,000

SITE LOCATION MAP
Elk River Landfill
Elk River, Minnesota

BARR

Background Source: USGS 7.5 Minute Quadrangle



Barr Footer: ArcGIS 10.2.1, 2014-02-03 10:05 File: I:\Projects\23\71\1005\Maps\Reports\2014 RLTB Work Plan\Figure 2 - Site Map - Additional TB Locations.mxd User: kac2

- Monitoring Well
- Monitoring Well (Sealed)
- Boring Location
- Proposed Monitoring Well
- Site Boundary

P320C Blue Well ID indicates well has surface water-based intervention limits

P320L Red Well ID indicates well has groundwater-based intervention limits

P 302B Black Well ID indicates well is not used for compliance monitoring

N

Feet
0 500 1,000

Figure 2

SITE MAP
Elk River Landfill
Elk River, Minnesota

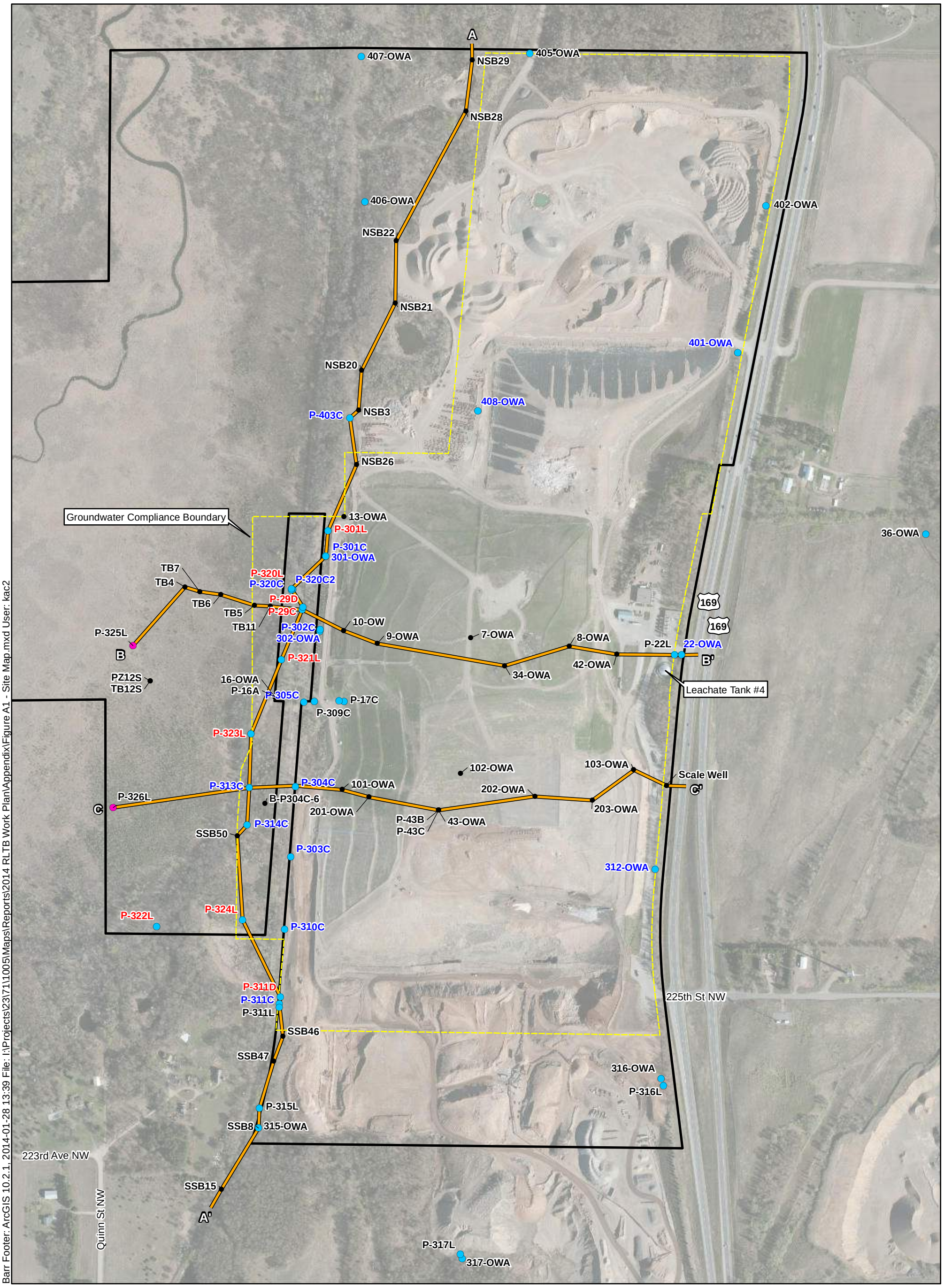
Background Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community (March 2012)
Data Source: Barr, Wenck, MN DOT

BARR

Appendices

Appendix A

Cross Sections



Barr Footer: ArcGIS 10.2.1, 2014-01-28 13:39 File: I:\Projects\23\71\1005\Maps\Reports\2014 RLTB Work Plan\Appendix\Figure A1 - Site Map.mxd User: kac2

- Monitoring Well
- Proposed Monitoring Well
- Monitoring Location
- Cross Section Transect
- Site Boundary

P320C Blue Well ID indicates well has surface water-based intervention limits

P320L Red Well ID indicates well has groundwater-based intervention limits

P 302B Black Well ID indicates well is not used for compliance monitoring

N

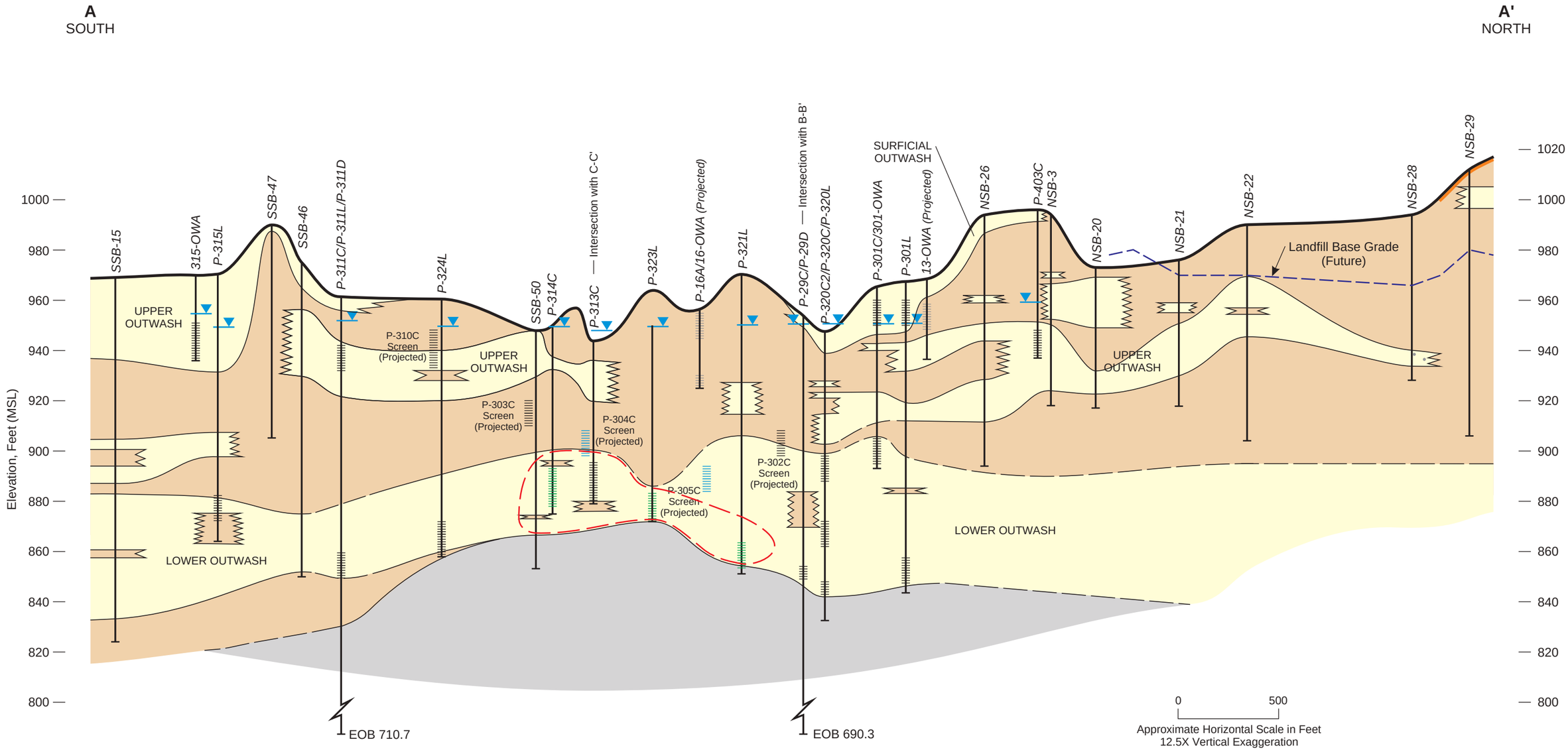
Feet
0 500 1,000

Figure A1

SITE MAP
Elk River Landfill
Elk River, Minnesota

Background Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community (March 2012)
Data Source: Barr, Wenck, MN DOT

BARR



EXPLANATION

OUTWASH — Includes the following soil types:
- SP: Sand with <5% fines; thin/discontinuous gravel lenses rare to common.
- SM: (Where in contact with SP); Silty sand; silt content approximately 30 to 50%.

TILL/LACUSTRINE — Includes the following soil types:
- ML: Sandy silt - diamict with approximately 10 to 50% Sand and Gravel; firm to very hard.
- CL: Clay textured diamict with varying amounts of sand and gravel; firm to hard.
- SM: (Where bounded by ML or CL); Silty sand; silt content approximately 30 - 50%
- ML/CL: Silt or clay, <5% sand, massive to thinly bedded

BEDROCK — Fine-grained sandstone/siltstone with shale partings present locally.

GROUNDWATER CRITERIA EXCEEDENCES - 2013

- Estimated Extent of Groundwater-Based Intervention Limit Exceedences
- HRL Exceedence
- Surface Water-Based Intervention Limit Exceedences (Excluding Chloride and Iron)

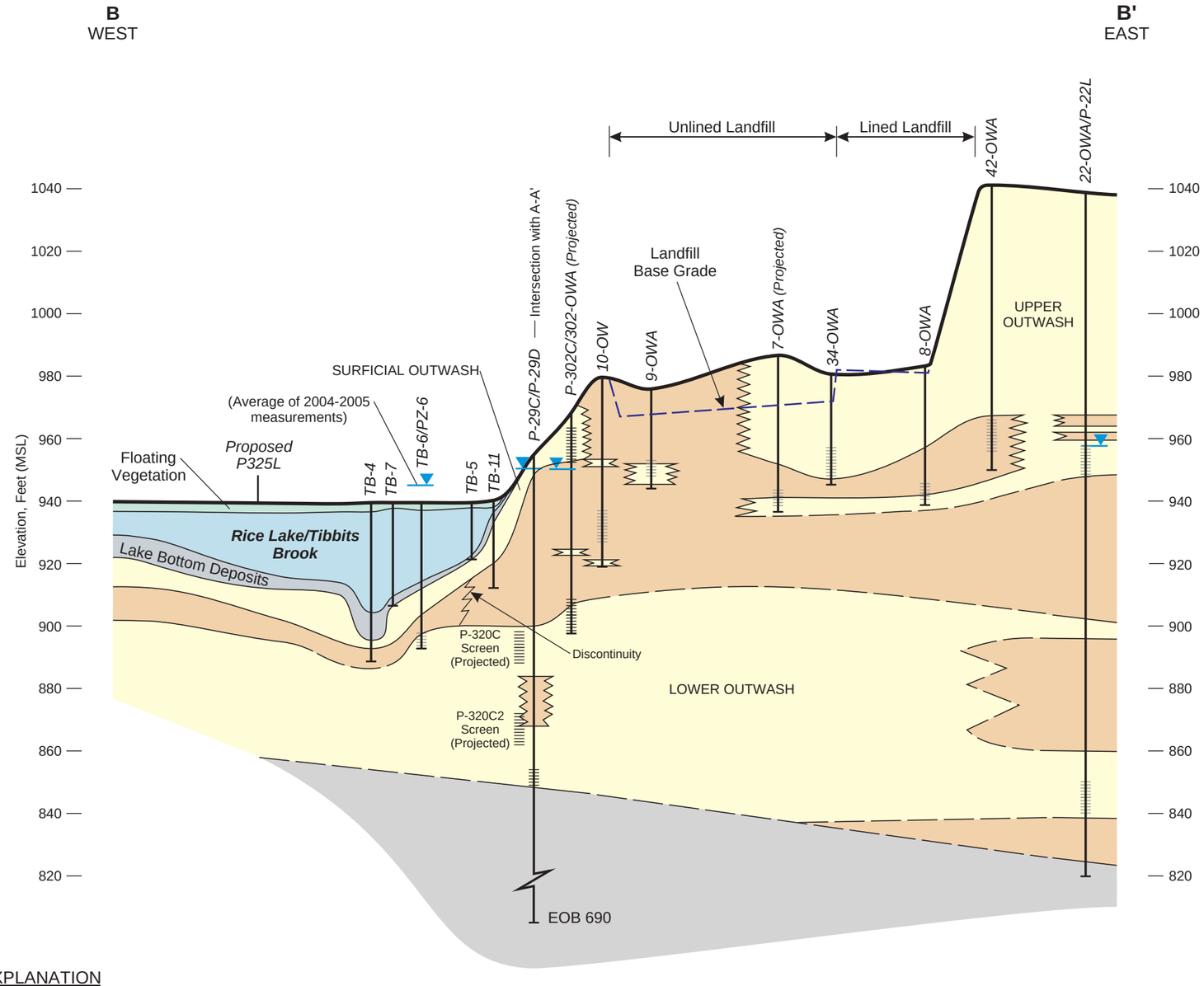
LEGEND

- Ground Surface (Approximate)
- Geologic Contact (Dashed where approximate)
- 2011 Groundwater Elevations (Measured in deepest nested well)
- Future Landfill Base Grade (Approximate)
- Existing Well Screen
- Former Well Screen or Gas Probe

Figure A2

HYDROGEOLOGIC CROSS SECTION A-A'
Elk River Landfill
Elk River, Minnesota

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EXPLANATION

OUTWASH	Includes the following soil types: SP: Sand with <5% fines; thin/discontinuous gravel lenses rare to common. SM: (Where in contact with SP); Silty sand; silt content approximately 30 to 50%.
TILL/LACUSTRINE	Includes the following soil types: ML: Sandy silt - diamict with approximately 10 to 50% Sand and Gravel; firm to very hard. CL: Clay textured diamict with varying amounts of sand and gravel; firm to hard. SM: (Where bounded by ML or CL); Silty sand; silt content approximately 30 - 50% ML/CL: Silt or clay, <5% sand, massive to thinly bedded
BEDROCK	Fine-grained sandstone/siltstone with shale partings present locally.

GROUNDWATER CRITERIA EXCEEDENCES - 2013

- Estimated Extent of Groundwater-Based Intervention Limit Exceedences
- HRL Exceedence
- Surface Water-Based Intervention Limit Exceedences (Excluding Chloride and Iron)

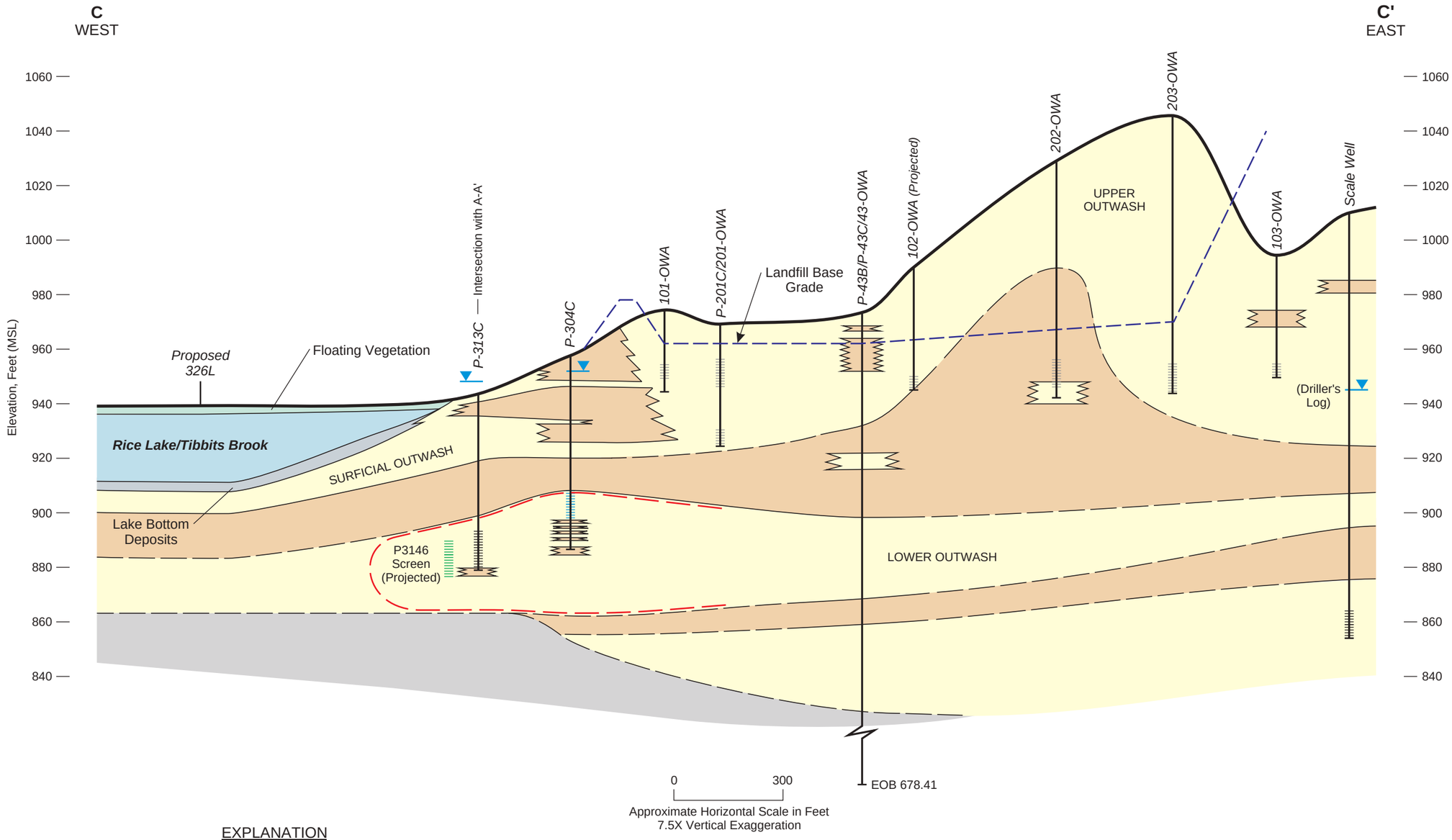
LEGEND

- Ground Surface (Approximate)
- Geologic Contact (Dashed where approximate)
- 2011 Groundwater Elevations (Measured in deepest nested well)
- Landfill Base Grade (Approximate)
- Existing Well Screen
- Former Well Screen or Gas Probe

Figure A3

HYDROGEOLOGIC CROSS SECTION B-B'
Elk River Landfill
Elk River, Minnesota

P:\Mpls\23 MN\71\2371100S\WorkFiles\2014 RLTB Work\Work Plan\Figures\Source File\HydrogeologiocCross Section B-B' CDR RLG 01-28-14



EXPLANATION

OUTWASH — Includes the following soil types:
- SP: Sand with <5% fines; thin/discontinuous gravel lenses rare to common.
- SM: (Where in contact with SP); Silty sand; silt content approximately 30 to 50%.

TILL/LACUSTRINE — Includes the following soil types:
- ML: Sandy silt - diamict with approximately 10 to 50% Sand and Gravel; firm to very hard.
- CL: Clay textured diamict with varying amounts of sand and gravel; firm to hard.
- SM: (Where bounded by ML or CL); Silty sand; silt content approximately 30 - 50%
- ML/CL: Silt or clay, <5% sand, massive to thinly bedded

BEDROCK — Fine-grained sandstone/siltstone with shale partings present locally.

GROUNDWATER CRITERIA EXCEEDENCES - 2013

- Estimated Extent of Groundwater-Based Intervention Limit Exceedences
- HRL Exceedence
- Surface Water-Based Intervention Limit Exceedences (Excluding Chloride and Iron)

LEGEND

- Ground Surface (Approximate)
- Geologic Contact (Dashed where approximate)
- 2011 Groundwater Elevations (Measured in deepest nested well)
- Landfill Base Grade (Approximate)
- Existing Well Screen
- Former Well Screen or Gas Probe

Figure A4

HYDROGEOLOGIC CROSS SECTION C-C'
Elk River Landfill
Elk River, Minnesota

P:\Mpls\23 MN\71\23711005\WorkFiles\2014 RLTB WorkWork Plan\Figures\Source File\HydrogeologiocCross Section C-C'.CDR RLG 01-28-14

Appendix B

Groundwater Flow – Lower Outwash, October 16, 2012

P-301L
949.57

P-320L
949.36

P-321L
949.24

P-323L
948.83

Groundwater Compliance Boundary

P-322L
947.69

P-324L
948.68

949.5

949

948.5

P-315L
948.05

P-316L
949.7

P-317L
948.65

169

169

225th St NW

223rd Ave NW

Quinn St NW

Notes:
1. Only the wells used for the lower outwash groundwater contours are shown.

Lower Outwash Monitoring Well
Groundwater Contour
Flow Line
Site Boundary
Pre-Subtitle D Area

N

Feet
0 500 1,000

GROUNDWATER FLOW - LOWER OUTWASH
October 16, 2012
Elk River Landfill
Elk River, Minnesota

BARR

Background Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community (March 2012)
Data Source: Barr, Wenck, MN DOT

Barr Footer: ArcGIS 10.2.1, 2014-01-27 13:21 File: I:\Projects\23\71\1005\Maps\Reports\2014 RLTB Work Plan\Appendix\Groundwater Flow - Lower Outwash.mxd User: kac2

EXHIBIT 15

Doc. ID #1002

Groundwater Corrective Action Evaluation Report

Elk River Landfill (SW-74)
Elk River, Minnesota

Prepared for
Elk River Landfill, Inc.

June 2020

4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
952.832.2600
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Groundwater Corrective Action Evaluation Report

June 2020

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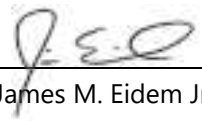
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Appendix E Cost Estimate Details
Appendix F Monitoring Well Network Considerations

Certifications

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Geologist under the Laws of the State of Minnesota.



June 1, 2020

James M. Eidem Jr.
PG #: 44064

Date

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the Laws of the State of Minnesota.



June 1, 2020

Anthony D. Neuens
PE #: 50822

Date

Acronyms

Acronym	Description
bgs	below ground surface
CAAR	Corrective Actions Alternatives Screening Report
cDCE	cis-1,2-dichloroethylene
COC	constituent of concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DCE	1,2-cis-dichloroethylene
ERL	Elk River Landfill
gpm	gallons per minute
HRL	health risk limits
IL	Intervention Limit
lbs	pounds
MCY	million cubic yards
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
µg/l	micrograms per liter
mg/l	milligrams per liter
MNA	Monitored Natural Attenuation
MPCA	Minnesota Pollution Control Agency
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPV	Net Present Value
PCE	tetrachloroethylene
POET	point-of-entry treatment
POTW	publicly owned treatment works
PRB	Permeable Reactive Barrier
RCRA	Resource Conservation and Recovery Act
RL/TB	Rice Lake/Tibbits Brook
TCE	trichloroethylene

Executive Summary

On behalf of Elk River Landfill, Inc., Barr Engineering Co. has prepared this Corrective Action Evaluation Report to evaluate options for addressing groundwater quality downgradient of the unlined (Pre-Subtitle D) portion of the Elk River Landfill (ERL or Site). The evaluation has been prepared in accordance with Minnesota Pollution Control Agency's (MPCA) process for implementing corrective actions at solid waste facilities. The report appendices include supporting documentation and preliminary estimates of natural attenuation rates and feasibility-study level cost estimates for alternatives comparison purposes.

ERL has developed an extensive groundwater monitoring network that is based on numerous hydrogeologic investigations and groundwater quality monitoring activities that have taken place over the last 40+ years. These investigations have included the installation/placement of approximately 277 monitoring wells and borings at and around the Site (Appendix B, B-5; Barr, 2018 and 2015a). ERL placed final cover over the unlined portion of the landfill and installed an active gas extraction system in the early to mid-1990s as part of groundwater corrective actions that stemmed from the detection of a leachate (slug) release from the Pre-Subtitle D portion of the landfill. Since then, groundwater investigations have included the evaluation of hydrogeologic conditions and water quality in the areas north, south, and west of the landfill to better understand the fate and transport of organics in groundwater. ERL incorporated low level reporting methods for vinyl chloride in 2015 and for other organics in 2017. Results attained from the low level reporting methods led to ERL completing a remedial investigation in 2018 that largely defined the extent and concentration of vinyl chloride in groundwater at, and downgradient of, the Site (Barr, 2018). Vinyl chloride has been detected in groundwater samples at concentrations above Minnesota Department of Health (MDH) groundwater criteria known as Health Risk Limits (HRLs) in wells located approximately 1,100 feet from the unlined portion of the landfill and sporadically at lesser concentrations in samples collected from a distal monitoring well located approximately 4,600 feet from the unlined portion of the landfill. Based on groundwater monitoring data and delineation results, the estimated mass of vinyl chloride in the groundwater downgradient of ERL is approximately 1 pound (lb) and the estimated vinyl chloride flux from the landfill at present is 0.07 lbs/year (Appendix C).

This report builds on prior alternatives and natural attenuation screening reports (Barr, 2019 and 2020b, respectively) and evaluates the feasibility, costs, risks / benefits of the following corrective action alternatives designed to address vinyl chloride in groundwater at and downgradient of the ERL:

- Alternative #1, Monitored Natural Attenuation (MNA) and Residential Water Supply Replacement
- Alternative #2, Groundwater Extraction and Treatment with Focused MNA and Residential Water Supply Replacement
- Alternative #3, Pre-Subtitle D Landfill Excavation and Placement on Liner
- Alternative #4, Groundwater Extraction (on and off-site) and Treatment

Each of the alternatives described below is considered protective of human health and the environment and are judged potentially capable of meeting applicable groundwater criteria[1].

Alternative #1 – Monitored Natural Attenuation and Residential Water Supply Replacement

This alternative includes the development of a monitored natural attenuation (MNA) program to evaluate and document the natural attenuation of organics. Additional monitoring wells would be established on privately-owned land (contingent on access) to provide further definition of organics and data necessary to better understand attenuation processes, rates and organics migration over time. The MNA approach has on-site and off-site components based on the refined natural attenuation analysis appended to this report. This alternative also includes replacing the lower outwash water supply wells that are located downgradient or near sidegradient of the projected migration pathway of organics with deeper wells screened in the Mt. Simon aquifer to eliminate the risk of exposure to downgradient residents. Alternatives to well replacement are also discussed should residents prefer a different option. The estimated total cost (capital plus 30 year operation and maintenance, Net Present Value [NPV]) for this alternative ranges from $590,000 to $1,300,000.

Alternative #2 – Groundwater Extraction and Treatment with Focused MNA and Residential Water Supply Replacement

This alternative includes the construction and operation of a groundwater extraction system along the west side of the landfill, treating and discharging the extracted groundwater at the Site, development of a focused MNA program, and replacing residential water supply wells. Under this alternative, extracted groundwater would be treated for organics and re-infiltrated at the Site. Groundwater extraction systems present unique challenges to the attainment of groundwater criteria, result in the withdrawal of significant volumes of groundwater to remove little mass, and require the long-term management of extracted groundwater. The MNA component would focus on documenting the efficacy of MNA in areas along the west side of the landfill where applicable. Residential water supply replacement would be consistent with Alternative #1. The estimated total cost (NPV) for this alternative ranges from $3,400,000 to $7,000,000.

Alternative #3 – Pre-Subtitle D Landfill Excavation/Placement on Liner

This alternative evaluated at the request of MPCA and includes excavation of the unlined pre-Subtitle D landfill and placement on new liner at ERL. This alternative would include the excavation of approximately 4.9 million cubic yards (MCY) of in-place waste, including volumes in overlying lined phases and adjoining lined cells, and approximately 1 MCY of excavated (non-waste) fill as needed. This alternative would require an expansion of the ERL to accommodate the

[1] MPCA requested the alternatives consider meeting Intervention Limits (ILs) at the ERL groundwater compliance boundary. The application of ILs are unique to the solid waste program in Minnesota and are intended to trigger assessment monitoring and/or corrective actions. ERL has moved to corrective action, therefore, ILs are not applicable. The subject release is from the Pre-Subtitle D portion of the landfill which, in accordance with Minnesota Rule 7035.2815 Subpart 4 (H)(2), may necessitate the establishment of appropriate groundwater criteria.

excavated Pre-Subtitle D waste. Identification and feasibility planning for significant construction, geotechnical, interim leachate management, oxygen intrusion, odor/landfill gas management, unknown/restricted waste management, and other issues related to implementing this alternative is beyond the scope of this document. Operation of a groundwater extraction/treatment system and replacement of residential water supply wells would be required to mitigate risk to downgradient residents and control releases to the groundwater system as a result of waste excavation activities. The preliminary estimated total cost for this alternative is based on an estimated feasibility-study level cost estimate from a similar project at a non-operating facility in the Twin Cities area and ranges from $63,000,000 to $140,000,000.

Alternative #4 – Groundwater Extraction (on and off-site) and Treatment

This alternative was evaluated at the request of MPCA and includes constructing and operating a groundwater extraction system along the west side of the landfill and a second groundwater extraction system on private property (contingent upon access), near the downgradient end of the vinyl chloride plume. The combined flow from both systems would be treated and discharged at ERL. This alternative would require the installation and ongoing operation and maintenance of a groundwater extraction system on privately-owned land west of ERL. Challenges to this alternative include the lack of ownership of the property where the off-site system would be implemented and the long distance that groundwater forcemain piping would need to be installed for extracted groundwater conveyance. The preliminary estimated total cost for this alternative ranges from $6,400,000 to $14,000,000.

The corrective action alternatives were evaluated against seven criteria that are based on Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance (USEPA, 1988). Consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the selected alternative must meet two threshold criteria and achieve the best balance of trade-offs with respect to the balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost) in a cost-effective manner. The NCP says, "a remedy shall be cost-effective if its costs are proportional to its overall effectiveness."

Alternative #1, MNA and Residential Water Supply Replacement achieves the threshold criteria and is the most cost-effective alternative that achieves the best balance of the evaluation criteria, assuming further evaluation demonstrates MNA is occurring sufficiently and applicable alternative groundwater requirements are met. Based on the refined preliminary analysis presented here, MNA is anticipated to sufficiently reduce the toxicity, mobility, and volume of vinyl chloride via natural processes and protectiveness to human health would be addressed with water supply well replacements. Alternative #1 would be equally protective in the short-term and long-term, reasonably implementable, and is the lowest cost alternative evaluated in this report. Alternative #1 is consistent with the MPCA Closed Landfill Program strategy for understanding if there is risk to human health and addressing it using a risk based approaches (MPCA, 2020).

Alternative #2, Groundwater Extraction and Treatment with Focused MNA and Residential Water Supply Replacement is equally protective to downgradient residents as Alternative #1 but is not a cost-effective

alternative due to the operation of the groundwater extraction and treatment system. Alternative #2 provides a means to make progress towards achieve groundwater criteria at the compliance boundary (above and beyond natural processes) by intercepting the migration of groundwater with vinyl chloride along the west side of the landfill, however, preliminary estimates suggest that, on an annual basis, an extraction system would remove approximately 0.2 pounds (lbs) of vinyl chloride from approximately 21,000,000 gallons of extracted groundwater on an annual basis. This alternative could be considered in the future if MNA is not demonstrated to be protective.

Alternative #3, Pre-Subtitle D Landfill Excavation/Placement on Liner best addresses long-term effectiveness and permanence but is not cost effective. This alternative is not feasible because lined waste is present in cells adjacent to and overlying the Pre-Subtitle D area and capacity does not exist to accommodate the excavated waste. The alternative is not judged to be effective in the short-term due to the long lead time required to plan and implement it and because excavation of the unlined waste will require removing the landfill cap, resulting increased contaminant flux to the groundwater system. Incomplete waste removal and/or residual impacts below the closed Pre-Subtitle D area would require long-term operation of a groundwater treatment system and residential water supply well replacements would be needed to protect the downgradient residents to the same extent in Alternatives #1 and #2.

Alternative #4, Groundwater Extraction (on and off-site) and Treatment is equally protective of downgradient residents as Alternatives #1 and #2 but offers less certainty than residential water supply well replacement. Implementation of this alternative is considered difficult given the need to negotiate access to construct, operate, and maintain a groundwater extraction system on privately-owned land. This alternative will also entail extracting groundwater with low vinyl chloride concentrations (e.g., at or below the reporting limit), pumping the groundwater to ERL for treatment, and discharging at the Site. The estimated range of combined flows from the two extraction systems would also be challenging to discharge at the Site. Preliminary estimates suggest that, on an annual basis, the removal of approximately 0.21 lbs of vinyl chloride from approximately 42,000,000 gallons of extracted groundwater (assuming a rate of 80 gallons per minute [gpm]).

Upon receiving concurrence with MPCA on Alternative #1, a work plan including implementation steps and schedule will be submitted under separate cover to MPCA for review and approval. Implementation would prioritize the installation of replacement water supply wells and the installation of additional MNA monitoring network points downgradient of the ERL.

1.0 Introduction

On behalf of Elk River Landfill, Inc., Barr Engineering Co. has prepared this Corrective Action Evaluation Report to evaluate options for addressing groundwater quality downgradient of the unlined (Pre-Subtitle D) portion of the Elk River Landfill (ERL or Site; Figure 1). The content of this report is based on Minnesota Solid Waste Rules; a corrective action alternatives screening report (Barr, 2019); an informational report assessing groundwater natural attenuation conditions at the Site (Barr, 2020b); feedback from MPCA, Sherburne County, and City of Elk River staff; Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance (USEPA, 1988) and MPCA Closed Landfill Program's strategy for understanding and addressing groundwater impacts (MPCA, 2020). The following sections summarize background information, describe the contemplated corrective action technologies and approaches, and evaluate corrective action alternatives to address groundwater quality at and downgradient of the ERL. The report appendices include supporting documentation and preliminary estimates of natural attenuation rates (based on comments received on prior submittals) and feasibility-study level cost estimates for alternatives comparison purposes.

2.0 Background

2.1 Facility Description

ERL is authorized for operation as a solid waste disposal facility by the MPCA under Solid Waste Permit SW-74 and licenses and permits from Sherburne County and the City of Elk River. The ERL was initially permitted for waste disposal in 1972. A portion of the landfill, including landfill cells 1 through 5, 7, 9, and the northern portion of cell 6 (6N) was constructed prior to the effective date of Resource Conservation and Recovery Act (RCRA) Subtitle D regulations. Landfill cells 1 through 5, 7, and 9 are unlined and capped (closed) with final cover (or covered with lined construction and demolition debris disposal cells DC-1 through DC-3). Cell 6N was constructed with a Pre-Subtitle D liner consisting of 80-millimeter-thick, high-density polyethylene and a leachate collection system. The other landfill cells, including construction and demolition debris disposal cells DC-4A and DC-5A, were constructed with composite liners and leachate collection systems. The leachate collected from the lined cells is disposed off-site at a publicly owned treatment facility. Figure 2 shows the Site layout and groundwater monitoring locations. MPCA Permit SW-74 provides additional details on the ERL's construction and operating history.

2.2 Site Hydrogeology

The geology at the ERL includes 100 to 200 feet of glacial deposits overlying Paleozoic bedrock. The predominant glacial deposits include two outwash units, referred to as the upper and lower outwash that are separated by sandy-silt textured till deposited from ice advances from the northeast (predominantly Cromwell and older Pre-Wisconsinan tills) (Barr, 2015a). The till is inferred to be discontinuous or leaky in the Pre-Subtitle D area based on downward migration of organics and the presence of organics in the lower outwash downgradient of the landfill (Barr, 2015b). The lower outwash, which is present from approximately 60 to 100+ feet below ground surface (bgs) west of the landfill, is laterally continuous beneath the ERL and Rice Lake/Tibbits Brook (RL/TB) (Barr, 2018) and is the focus of contemplated corrective actions based on the presence of organics in groundwater. Along the west side of the landfill, the lower outwash grades from fine/medium sand at the top of the unit to coarse sand with discontinuous gravel lenses near the base of the unit. The coarsest intervals of lower outwash have been observed near the base of the unit at wells P-325L and P-326L in RL/TB and at well P334L. The lower outwash is confined along the west side of the landfill by till of the Late-Wisconsinan, Cromwell Formation (Barr, 2015a).

The lower outwash extends to the west across the investigation area at/around elevation 860 feet MSL. The thickness of the lower outwash varies from approximately 60 feet thick west of the Pre-Subtitle D portion of the landfill to approximately 25± feet west and southwest of the landfill (Barr, 2018). Recent investigations have shown the lower outwash is continuous beneath and beyond RL/TB with the exception of one boring location south of well P-333L (Barr, 2018). RL/TB, the large wetland complex located west of the landfill, is with covered with floating bog vegetation with the exception of small areas of open water. The floating bog makes for difficult/unsafe access, especially to equipment traffic. The RL/TB is underlain with loose organic silt/clay (i.e., lake sediments). Water and mucky lake sediment depths near 30 feet have been encountered during past drilling operations in RL/TB.

The groundwater flow direction in the lower outwash unit is to the west beneath the Pre-Subtitle D portion of the Site and west-southwest beneath RL/TB (Figure 3). The groundwater velocity at the lower outwash unit (where organics mass transport is predominantly occurring west of ERL) is estimated to be between 60 and 112 feet/year, based on aquifer parameter estimates (Barr, 2020b) and the observed extent of organics downgradient of the landfill. Groundwater velocity may be higher in portions of the lower outwash unit due to heterogeneity, particularly beneath RL/TB.

The Eau Claire Formation, a regional confining unit, is the uppermost continuous bedrock unit at the Site. The Eau Claire Formation forms a local bedrock high in the southwestern portion of the Site and, in places, is capped by clayey, Pre-Wisconsinan till and/or a thin mantle of fine sandstone/siltstone from the basal Wonewoc Formation (Barr, 2015a). The Mt. Simon Sandstone is the uppermost bedrock aquifer in the area and is underlain by crystalline Pre-Cambrian bedrock. Prior groundwater investigation has shown the Mt. Simon does not contain modern (i.e., tritiated) water (Geomatrix, 1998), indicating that it does not receive recharge at or near the Site.

2.3 Groundwater Quality

ERL is committed to preventing exposure to organic compounds from the landfill in nearby water supply wells. ERL has developed an extensive groundwater monitoring network that is based on numerous hydrogeologic investigations that have been conducted over the past 20+ years (Barr, 2015a, 2018). The 2019 groundwater monitoring network included 39 monitoring wells and 11 piezometers (Figure 2). Additional monitoring network information is provided in the 2019 Annual Water Quality Monitoring Report (Barr, 2020a).

Routine monitoring includes sampling and analysis of organic and inorganic compounds including metals and general chemistry parameters. ERL began low level reporting for vinyl chloride in 2015 and for nine other organic compounds (including trichloroethylene [TCE]) in 2017.

A summary of the 2018 through 2020 (April) data is included in Appendix A and vinyl chloride concentration trend plots are included in Appendix B. No organics have been detected above their respective HRL in wells located off of ERL Property[2]. On ERL property, no organics have been detected above their respective HRL in wells located at or beyond the groundwater compliance boundary except for vinyl chloride and TCE. Vinyl chloride was detected above the HRL (0.2 µg/L) in twelve monitoring wells (and above the Intervention Limit [IL] of 0.050 µg/L in five additional monitoring wells). TCE was detected above the HRL (0.4 µg/L) in one monitoring well (P-323L) (and above the IL in two other monitoring wells). The highest vinyl chloride concentration detected in groundwater in 2019 was at non-compliance well P-308L (1.9 µg/L) located approximately 20 feet from the western edge of the fill. The highest detected TCE concentration in 2019 was at well P-323L (1.3 µg/L). Vinyl chloride concentrations are typically not detected in leachate samples, although reporting limits usually elevated due to sample matrix effects.

[2] Vinyl chloride was detected in one sample collected from investigation borings B330 and B331 in 2016 (Barr, 2018). These data are considered in the vinyl chloride delineation included in this report.

Other confirmed organics detections in groundwater at concentrations below HRLs (if established) in monitoring wells located at or beyond the compliance boundary included cis-1,2-dichloroethylene (cDCE), 1,1-dichloroethane, 1,2-dichloroethane, chloroethane, dichlorodifluoromethane (Freon-12), dichlorofluoromethane (Freon-21), ethyl ether, and tetrahydrofuran (Appendix A). Of these, only 1,2-dichloroethane was detected above the IL (and was in the presence of vinyl chloride). Organic compounds (other than vinyl chloride) in groundwater at distal wells P-334L and P-694477 include 1,1-dichloroethane (unconfirmed), dichlorodifluoromethane, dichlorofluoromethane, and ethyl ether. The 2019 groundwater quality data are described in more detail in the 2019 Annual Water Quality Monitoring Report (Barr, 2020a).

Vinyl chloride and TCE are the constituents of concern (COCs) and the drivers for consideration of corrective actions at the Site.

2.4 Vinyl Chloride Extent and Mass in Groundwater

Recent groundwater investigations have focused on defining the extent of COCs in the groundwater at and downgradient of the ERL (Barr, 2016 and 2018). Because TCE was detected above the HRL in only one well (P-323L), the following discussion focuses on vinyl chloride.

The estimated width of the vinyl chloride plume above the HRL on the west side of the landfill (i.e., roughly transverse to the groundwater flow direction) is approximately 1,500 feet and is defined by wells P-301L and P-324L, respectively (Figure 4). Farther west, the plume is defined to the south by wells P-322L, P-324L, and P-335L. The southern edge of the vinyl chloride plume is located near monitoring well P-694477 based on the initial detection of vinyl chloride slightly above the IL (0.05 µg/L) but below the HRL in September and December 2019. The northern extent of vinyl chloride has been defined approximately by past sampling of well P-327L (non-detect). The maximum extent of vinyl chloride at concentrations at or above the IL shown on Figure 4 is based on an evaluation of lower outwash groundwater contours from 2014 through 2019.

The western extent of vinyl chloride is depicted on Figure 4 and is estimated to be near well P-334L based on detections at or slightly above the IL (but below the HRL). Vinyl chloride was not detected in April 2020 sample from well P-334L (Appendix A). This western (leading) edge of vinyl chloride is approximately 3,500 feet from the nearest downgradient residential well located farther west/southwest (Figure 5). Based on the estimated of groundwater flow rate (112 feet per year), the travel time from well P-334L to the nearest residential well is estimated to be between 25 to 35 years based on advective transport using recent monitoring results; however, uncertainties regarding outwash heterogeneities make it difficult to develop a prediction with a high degree of certainty.

Vinyl chloride can be produced as a daughter product via reductive dechlorination from cDCE. Since the 1990s, the reductive dechlorination pathway of chlorinated compounds has been well studied. The sequential dechlorination pathway (stepwise removal of a chlorine atom and replacement with hydrogen atom), that includes cDCE and vinyl chloride, is commonly from more highly chlorinated compounds tetrachloroethylene (PCE) and TCE:

PCE → TCE → cDCE → VC → Ethene

Because vinyl chloride is a daughter product of cDCE dechlorination, the extent of vinyl chloride in groundwater is directly related to where cDCE degrades to vinyl chloride along the flowpath. For example, 1 µg/L of cDCE degrades to an equivalent micromolar mass of vinyl chloride with a concentration 0.6 µg/L (lower concentration because molecular weight of vinyl chloride is lower than cDCE); therefore, the low concentrations of cDCE that are observed in groundwater can degrade to vinyl chloride concentrations well above the reporting limit (0.05 µg/L). This process masks the overall magnitude of vinyl chloride degradation along the flowpath and gives the false appearance of more tempered vinyl chloride degradation because the cDCE plume overlaps the vinyl chloride plume.

As shown on Figure 4, cDCE is present in groundwater at wells P-325L and P-326L and not present in groundwater at P-334L. The limited extent of cDCE, coupled with decreasing vinyl chloride concentrations with distance, provides evidence that degradation is occurring and that the extent of vinyl chloride may be extended downgradient due to sequential dechlorination reactions and not from limited degradation of vinyl chloride. TCE in groundwater at wells located along the compliance boundary and upgradient of P-325L and P-326L and not in downgradient wells also supports evidence of degradation and may further add to the downgradient extent of cDCE and vinyl chloride.

Routine monitoring and prior groundwater investigation that included vertical water quality profiling showed that the vertical extent of vinyl chloride is limited to the lower outwash (Barr, 2020a and 2018; Figures 6, 7, and 8). Vinyl chloride is present in groundwater in the lower outwash downgradient of the Site and not detected in groundwater samples from in the upper outwash or the Mt. Simon sandstone (beneath the Eau Claire Formation). West of the landfill, near vertical aquifer profile borings B-330 and B-331, vinyl chloride was detected in the lower outwash and not detected in the outwash deposits that were encountered above (i.e., shallower than) or below (i.e., deeper than) the lower outwash or in the underlying Eau Claire Formation (uppermost bedrock) (Figure 8; Barr, 2018).

Based on groundwater monitoring data and estimated flow rates, the total mass of vinyl chloride present in the lower outwash unit west of the landfill is calculated to be approximately 1 lb. The estimated current mass flux of vinyl chloride from ERL through the cross sectional plane represented in Figure 8 is 0.07 lbs/year, which is approximately 42% lower that the estimates vinyl chloride mass flux from April 2010 (Appendix C). These low total mass and mass flux estimates reflect the relatively low vinyl chloride concentrations in groundwater downgradient of ERL. The vinyl chloride mass estimates/calculation details are included in Appendix C.

2.5 Area Water Supply

The ERL and surrounding area are not serviced by public utilities (i.e., no City water or sewer). Water at the ERL office is provided by a 360-foot well (unique ID #420558) referred to as the ERL Shop Well (Barr, 2020a). Downgradient of the Site, with the exception of the Ridges of Rice Lake Development community supply well (unique well ID #626766) and the water supply well at 22447 Tipton Street (unique ID #813437), residences have individual domestic water supply wells that are known or assumed to be

completed in the lower outwash unit. The Ridges of Rice Lake well is completed in an outwash near the base of buried bedrock valley between 294 and 325 feet bgs (approximate elevations 699-668 feet relative to mean sea level [MSL]) and the 22447 Tipton Street well is completed in the Mt. Simon Aquifer between depths of 254 and 300 (elevations 732 and 686 feet MSL). The nearby residential wells are routinely monitored per ERL permits and licenses and no organics have been detected in the existing residential wells. Appendix D includes a summary of the water supply wells located west of the Site and past residential water well monitoring data.

The ERL routinely samples 11 nearby water supply wells, including nine domestic wells, one community water supply well (Ridges of Rice Lake development), and the ERL Shop well per Permit SW-74. Nine additional residential wells have been sampled as part of recent hydrogeologic investigations (Barr, 2018). The locations of the monitored residential wells are shown on Figure 5.

2.6 Prior Corrective Actions

In response to increased concentrations of organics in groundwater, ERL completed a Corrective Action Investigation (Camp, Dresser, & McKee, 1994) and a series of groundwater investigations to investigate the organics source and extent (Geomatrix, 1998, 1999, and 2000). A spike in organics loading to groundwater at the top of the lower outwash unit was demonstrated near the southwest corner of the Pre-subtitle D portion of the landfill in 1991. Total organics concentrations at monitoring well P-17C increased from less than 1 to more than 24 milligrams per liter (mg/L) between 1992 and 1994, subsequently concentrations rapidly decreased to less than 1 mg/L by 1997 (Barr, 2015a). In this same timeframe, other wells located southeast of P-17C (i.e., beneath the future landfill footprint), such as P-43B, also had relatively high concentrations of organics in groundwater (Appendix B, Chart and Figure B-5) (e.g., vinyl chloride at 12 µg/L; Camp, Dresser, & McKee, 1994; Barr, 2015b). A

These organic detections and trends prompted the enactment of facility improvements designed to mitigate organics in groundwater and consisted of final cover installation and active gas extraction. ERL placed final cover over much of the unlined portion of the landfill, starting with cell 2 (which is adjacent to well P17C); by 1997 over cells 1, 3, 4, 5, and 7 were also covered. The active landfill gas extraction system was installed and became operational in March 1996 and was augmented in 1997 and 2001 specifically to address organics in groundwater at the landfill. Vinyl chloride concentrations in landfill gas samples collected from 2008 to 2010 ranged from 220 to 670 part per billion by volume which equates to approximately 30 to 90 lbs of vinyl chloride removal annually via landfill gas extraction applying the average LFG extraction volume between 2015 and 2019.

Groundwater investigations and isotopic sample analysis concluded that the organics spike in the P-17C Area was the result of leachate from the Pre-subtitle D portion of the landfill (Geomatrix, 1998). Due to the elevated reporting limits and sample matrix interference issues, the concentrations of chlorinated ethylene compounds (such as vinyl chloride and trichloroethylene) were largely reported as non-detect in leachate samples and from well P-17C. Despite the elevated reporting limits, based on total organics concentrations of up to 24 mg/L, it is reasonable to assume that the chlorinated ethylene inputs to groundwater from the unlined portion of the landfill were higher at that time. As discussed in this report,

vinyl chloride and TCE are the only organics detected in groundwater above their respective HRLs at ERL, concentrations of both these parameters have been low (i.e., non-detect to approximately 2 micrograms per liter [µg/L]) or decreasing since the implementation of prior corrective actions, and the extent of TCE is limited compared to vinyl chloride. In response to the slug of leachate affected groundwater observed at P-17C, an oxygen diffusive system was installed in the P-17C area to deliver oxygen to groundwater at the top of the lower outwash to spur the rapid degradation of the targeted compounds (e.g., methyl ethyl ketone, acetone, etc.) via a cometabolic degradation. The system was operated from 2003 to 2008 and, during monitoring data collected demonstrated that the operation of the system increased dissolved oxygen and decreased organics concentrations in groundwater in the P-17C area. System operation was discontinued to allow groundwater to return to reducing conditions and the target compound concentrations remained low.

2.7 Conceptual Release Model

The evidence points to both leachate and landfill gas from the pre subtitle D fill area as the source area for organic impacts to groundwater at the ERL (Barr, 2015a; Geomatrix, 1998). The pre subtitle D unlined area consists of 28.1 acres and approximately 5 million cubic yards of waste that was placed from 1972 to approximately 1990. Waste Management acquired the site in late 1995 after unlined filling had ceased. Evidence for the release of leachate to groundwater is described in the above Section 2.6. Gas migration is also attributed to be a source of impacts to groundwater (Barr, 2015; Geomatrix, 1998; Camp, Dresser & McKee, 1994) based on the fact that vinyl chloride is a relatively more common constituent of landfill gas than leachate. Since Minnesota Rules require the separation between waste and groundwater of at least 5 feet and sand exists under the liner, a potential unsaturated conduit exists between the composite liner system and groundwater. These conditions may trap landfill gas that potentially migrates from the Pre-subtitle D area allowing it to partition into groundwater.

Releases of leachate and landfill gas from the unlined waste have resulted in organics concentrations beneath, upgradient, and south of the Pre-Subtitle D area at ERL (Barr, 2015a and 2015b). A leachate (slug) release was well documented in the P-17C Area and was characterized by high concentrations of non-chlorinated organics that masked the concentrations of chlorinated organics. Elevated chlorinated organics concentrations were quantified southeast of P-17C Area prior to the construction of landfill cells 13 and 14 at monitoring well P-43B (e.g., vinyl chloride concentrations of 12 µg/L in 1996; See Appendix B, Figure B-5 for historical trend charts for wells P-17C, P-43B, P-304C, P-313C, and P-326L) (Camp, Dresser & McKee, 1994; Barr, 2015b). These chlorinated (and other) organics have migrated west (downgradient) with groundwater and have decreased in concentrations due to natural attenuation processes; however, the attenuation processes have not occurred at a rate sufficient to meet applicable regulatory criteria in areas along the compliance boundary.

Past corrective actions including final cover placement and the installation of an active gas extraction system appear to have significantly reduced the magnitude of the release from the Pre-Subtitle D, and the high concentrations at documented at P-17C and P-43B in the early to mid-1990s are no longer present in groundwater along the western side of the landfill (Barr, 2020a). Currently, organic concentration trends along the west side of the landfill include predominantly decreasing trends south of the P-17C Area and a

mix of stable, increasing, and decreasing trends to the north. Concentrations of chlorinated ethenes along the centerline of the plume evidence attenuation by reductive dechlorination with distance from the Pre-Subtitle D area (Appendix B). The current vinyl chloride concentration trends and related projections may underestimate the degree and rate of attenuation with distance (or time) due to the reductive dechlorination reactions that transform parent compounds TCE and, more prominently, cDCE to vinyl chloride.

Water quality data from 2019 and early 2020 indicate the fringe of the vinyl chloride plume is present near monitoring wells P-334L and P-694477. The first time detections of vinyl chloride in samples from these wells in 2019, coupled with some non-detect results, suggest more data is needed to determine whether the vinyl chloride plume is migrating or stable. Based on Site history the leading edge of the plume is anticipated to result from higher vinyl chloride concentration flux from the 1990s (or prior) and current vinyl chloride flux appear to be substantially lower, likely as a result of past groundwater corrective actions (i.e., final cover and active gas extraction). Based on the estimated vinyl chloride mass flux, the plume is anticipated to be stable or shrink in the future as a result of natural attenuation processes; however, additional wells and data collect are needed to substantiate this model and document the mass/concentration decreases.

3.0 Corrective Action Objectives

This section presents groundwater corrective action objectives for ERL.

3.1 Corrective Action Goals

The primary and near-term goal for implementing corrective action at the ERL is to protect human health by preventing exposure to of organic compounds in water supply wells[3]. Recent residential water supply well monitoring data indicate that this goal is being achieved under current/natural conditions; however, ERL is committed to proactively protect residential water wells by taking appropriate actions to improve future protectiveness.

The secondary, longer-term corrective action goal is to increase the certainty of protectiveness to nearby water supply wells by meeting appropriate groundwater criteria. ERL is addressing impacts related to the closed, Pre-Subtitle D portion of the landfill, so the establishment of alternative limits under Minnesota Rule 7035.2815, Subpart (H)(2) may be appropriate (see Section 5.1).

It should be noted, that achieving corrective action objective #1 satisfies a risk-based remedial approach and additional effort beyond verifying that corrective action objective #1 is achieved and risk to human health is mitigated is unwarranted from a technical standpoint.

3.2 Constituents of Concern

As described in Section 2.4 of this report, vinyl chloride and TCE are the COCs at the Site.

3.3 Potential Exposure Pathways and Receptors

The potential exposure pathway for COCs in groundwater at ERL is ingestion by a water well user. Municipal water is not available near ERL so nearby residents use groundwater as their water supply. Based on a search of the Minnesota Well Index, approximately 23 residential water supply wells are located within 8,500 feet of the ERL in the southwest/west direction. With a few exceptions, these wells are known or assumed to be completed in unconsolidated outwash that correlates to the lower outwash unit at the Site (Figure 5; Appendix D).

ERL has routinely collected and analyzed water samples from the residential water supply wells nearest to the landfill (Appendix D). Water samples from an extended residential well network were collected and analyzed between 2015 and 2017 as part of past groundwater investigations (Barr, 2018). Organics attributed to the landfill have not been detected in samples from water supply wells near the ERL with one

[3] This corrective action objective includes the COCs and other organic compounds in groundwater attributable to the ERL.

exception that was addressed by ERL in 2014[4]. ERL has also developed a monitoring well network to provide early warning detection upgradient of nearby water well users.

Groundwater discharge to RL/TB is possible given the upward hydraulic gradients between the lower outwash and the surface water elevation. However, organics concentrations are generally below surface-water criteria established by the MPCA (see Permit SW-74) and, based on the lateral extent of vinyl chloride and the vertical extent of vinyl chloride (Barr, 2018), groundwater discharge to RL/TB from the lower outwash does not appear to be significant.

[4] ERL arranged for the installation of a point-of-entry water treatment system at a Tipton Street residence in late 2014 as a result of a confirmed organic compound detection (at a concentration below the HRL) and arranged for the installation of a deeper replacement water supply well in 2015.

4.0 Corrective Action Technologies

The following sections describe corrective action technologies identified as potentially viable in the Groundwater Corrective Actions Alternatives Screening Report (CAAR; Barr, 2019):

1) Alternate Residential Water Supply
2) Monitored Natural Attenuation
3) Groundwater Extraction and Treatment
4) In-Situ Groundwater Treatment

At the request of MPCA, evaluation of the excavation and relining of Pre-Subtitle D portion of the landfill and off-site groundwater extraction are also included in this report. No additional action and air sparging technologies were previously screened out in the CAAR (Barr, 2019) and are not considered in this evaluation. Specific correction action alternatives for the ERL are described in Section 5 of this report.

4.1 Alternate Residential Water Supply

Eliminating the groundwater pathway between the landfill and residential water supply wells will eliminate the risk of vinyl chloride (and other organics) exposure to residents (i.e., groundwater users) and will achieve the primary and near-term goal of protecting human health by preventing the migration of organic compounds to water supply wells.

Alternative water supply options include the installation of point-of-entry treatment (POET) systems that treat groundwater at individual residences upstream of use or replacing existing individual water supply wells completed in the lower outwash and located downgradient of the plume with individual water supply wells screened in deeper geologic units. POET systems are commonly deployed in private residences and the treatment media / technology is selected based on specific treatment needs. POETs require ongoing maintenance for effective long-term treatment and the installation/maintenance requires work inside individual residences. The installation of replacement water supply wells for use at residences downgradient of the existing organics detections is an option given that organics are limited to the lower outwash and the Mt. Simon is accessible. The use of deeper wells is preferred by ERL (compared to POETs) provided water quality standards are met in the deeper units.

The installation of deeper replacement wells (or POETs) require owner permission to access, install, connect, and test the installations. ERL has a successful track record for open communication and developing mutually acceptable access agreements with individuals (without complaint to State, County, or City).

4.2 Monitored Natural Attenuation

Natural attenuation includes destructive processes (biodegradation and abiotic degradation) and nondestructive processes (e.g., dispersion, diffusion, and sorption) that affect the fate and transport of organic compounds in groundwater systems (USEPA, 1998). The application of a monitored natural

attenuation (MNA) remedy to address organics in groundwater, in whole or as part of a combined remedy, is common at groundwater sites in Minnesota and throughout the United States.

The Groundwater Natural Attenuation Report (Barr, 2020b) provided an updated screening evaluation of geochemical conditions in the lower outwash at the ERL to inform the potential application of natural attenuation as a corrective action strategy and an evaluation of geochemical conditions, terminal electron acceptors, distance-concentration plots, and estimates of degradation rates downgradient of the landfill. These evaluations showed that conditions in the P-17C area provide evidence that reductive dechlorination of chlorinated compounds is occurring. Farther downgradient (near and beyond the ERL property boundary) prevailing geochemical conditions are iron-reducing (which is suitable for the natural attenuation of vinyl chloride through other destructive and nondestructive processes).

Recent data have shown sporadic detections of low concentrations of vinyl chloride at monitoring wells P-334L and P-694477. Vinyl chloride concentrations in µg/L at well P-334L between the 2019 and 2020 spring sampling events have been 0.050 h, <0.050, 0.050, 0.10, and <0.050. Over this same period, vinyl chloride concentrations (in µg/L) at well P-694477 have been <0.050, <0.050, 0.10, 0.075, and <0.23. These data demonstrate that both wells are located near the fringe of the vinyl chloride plume. Further monitoring and new MNA monitoring locations upgradient and downgradient of P-334L would provide insight on vinyl chloride plume stability and attenuation rates downgradient of the landfill.

In effort to provide additional context and address feedback from the MPCA and others, additional/refined evaluation of vinyl chloride natural attenuation is provided in Appendix C. The evaluation is based on existing data through 2019 and is based on the assumption that the plume is stable. Specifically, Appendix C presents:

- Refined velocities for groundwater flow and vinyl chloride migration.
- Vinyl chloride attenuation rates based on data from individual wells and the resulting estimated timeframes to achieve the ILs at those wells - well specific attenuation rates ranged from 0.081 (at P-326L) to 0.269 (at P-314C) and projected timeframes to achieve groundwater criteria ranged from approximately 4 years (at P-314C) to 28 years (at P-326L).
- Bulk vinyl chloride attenuation rates based on vinyl chloride data and total molar concentrations (which incorporate vinyl chloride parent products) - bulk vinyl chloride attenuation rates varied from 0.045 to 0.145/yr.
- Estimated vinyl chloride concentrations that are projected to attenuate between the compliance boundary and the nearest residential well downgradient of monitoring well P-334L - 7 µg/L (average) with a range of 1 to 90 µg/L.
- Estimated ranges of vinyl chloride concentrations that are projected to attenuate between monitoring well P-334L and the nearest downgradient residential well - 0.54 µg/L (average) with a range of 0.21 to 1.8 µg/L.

- Estimated distance vinyl chloride is projected to travel downgradient from the compliance boundary - 5,400 feet (average) with a range of 3,500 to 9,000 feet.
- Estimated vinyl chloride mass and mass flux downgradient of ERL – estimated vinyl chloride mass is approximately 1 lb and the estimated vinyl chloride mass flux is 0.07 lbs/yr.

The 2019 and April 2020 vinyl chloride concentrations in groundwater along the compliance boundary and at monitoring wells P-334L and P-694477 are less than the estimated range of concentrations expected to attenuate before reaching the nearest down gradient residential well, suggesting vinyl chloride at these wells will attenuate before reaching downgradient receptors. It should be noted, however, that peak vinyl chloride concentrations are projected to reach well P-334L between 2026 and 2034 due to the leachate slug that was released in the P-17C area in the early to mid-1990s.

Based on this refined analysis, natural attenuation in the lower outwash at and downgradient of the landfill appears to be sufficient to eliminate the risk to nearby residents and can achieve the primary and near-term goal of protecting human health by preventing the migration of vinyl chloride to water supply wells; however, the given the uncertainty of plume stability, the presence of other organics at P-334L and P694477 (prior to vinyl chloride), and the lack of additional monitoring wells downgradient of P-334L, ERL does not intend to propose MNA as a standalone remedy.

In regard to natural attenuation being capable of meeting the longer-term goal of increasing protectiveness to nearby water supply wells by meeting appropriate groundwater criteria, data are mixed. The three southernmost wells located along the compliance boundary within the organics plume (P-314C, P-313C, and P-323L) have shown decreasing vinyl chloride concentration trends since 2011 (Appendix B; Barr, 2020b) and the refined analysis indicates that criteria may be achieved in these wells within 11 years; however, the presence of parent compound cDCE at these wells (and TCE at P-323L) adds a degree of uncertainty to these projections. In areas in the northern portion of the delineated organics area, projections for natural attenuation to achieve groundwater criteria were not made due to mixed vinyl chloride concentration trends (including decreasing trends at wells P-320L/P320C2, stable/no-trends in the other wells located closest to the groundwater compliance boundary, and closer to the landfill at the top of the lower outwash increasing trend is present at wells P-301C and P-302C) (Appendix B).

4.3 Groundwater Extraction and Treatment

Groundwater extraction and treatment is a corrective approach that has been applied to intercept the migration of groundwater constituents and provide treatment with physical, chemical, or biological processes. Applications include the installation and operation of a groundwater extraction well(s) to remove impacted groundwater from the subsurface for discharge with or without treatment depending on a number of site-specific factors. The application details and ultimate effectiveness of a groundwater extraction approach is a function of site hydrogeologic conditions (e.g., unconfined vs. confined groundwater conditions, etc.), placement and construction of extraction wells relative to the source, operation of the system (e.g., steady pumping vs. pulsing), and the requirements for treating and discharging the extracted groundwater. Groundwater extraction physically removes groundwater around and upgradient of the extraction well(s) and lowers the hydraulic head/potentiometric surface in the

vicinity of pumping which in turn reduces the gradient and groundwater velocity and/or can result in localized flow stagnation on the downgradient side of the extraction system. The performance of a groundwater system is primarily a function of the hydrogeologic properties of the targeted and overlying/underlying geologic units, subsurface/geologic unit heterogeneities, and physical and chemical processes in the geologic unit and extraction wells (e.g., COC back diffusion from the aquifer matrix, well fouling, etc.). For these reasons, reliable estimates of achieving groundwater criteria are difficult (or not feasible) to make and are typically made either by reviewing multiple years of water chemistry monitoring data after groundwater extraction has been occurring or grossly with the assistance of a calibrated groundwater flow model and simplifying assumptions.

Although the concept of extracting groundwater to remove COCs is straightforward, groundwater extraction systems present unique challenges in the attainment of groundwater performance standards due to asymptotic COC response as a result of physical and chemical processes in the subsurface and result in a significant withdrawal of groundwater volume that may affect surrounding groundwater users or surface water habitats while producing a steady stream of effluent that requires management (typically under a discharge permit). Furthermore, the efficiency of COC removal on a mass per volume of water basis is often low and can decrease with continued pumping. At ERL, assuming a groundwater extraction system is implemented west of the Pre-Subtitle D area, it is estimated that the current annual flux of vinyl chloride (0.2 lbs) will be removed via treatment of 21,000,000 gallons (at an average withdrawal rate of 40 gpm) of groundwater in one year.

Given the hydrogeologic conditions and nature of the Pre-Subtitle D source, groundwater extraction is an option that could be employed to help achieve the secondary corrective action objective (meeting applicable groundwater criteria) by using a groundwater extraction well(s) located along the western edge of the landfill for the targeted removal of groundwater from the lower outwash unit. The lower outwash unit is confined unit which may be favorable for gradient control purposes but can present unique geochemical challenges. Existing wells P-308L (6-inch dia.), P-321L or P-324L (4-inch dia.) may be viable options. The preliminary estimated total pumping rate along the western side of the landfill ranges from 20 to 60 gallons per minute (gpm). Groundwater extraction in this range will require groundwater appropriations permitting with the Minnesota Department of Natural Resources (MDNR).

Options for managing the extracted groundwater include treatment via an on-site water treatment system with discharge to and infiltration system or into RL/TB. Both options require permitting, design, pilot testing, construction, start-up, and long-term system operation and maintenance. Discharge to a publicly owned treatment works (POTW) is not considered in this report due to the high disposal costs and concerns regarding long-term viability of discharge of impacted groundwater.

At MPCA's request, a corrective action alternative involving the construction of an off-site groundwater extraction is also evaluated in Section 5 of this report.

4.4 In-Situ Treatment

In-situ treatments involve the introduction of amendments that are intended to foster or enhance the attenuation, fixation, or destruction of COCs in the subsurface. In-situ treatment agents are applied to the

subsurface to contact/interact with COCs and have the benefit of not generating waste streams that require ongoing management.

The hydrogeologic conditions (heaving sands), vinyl chloride plume size and depth, and the size and nature of the source limits the practicality of in-situ treatment at ERL to targeted applications of injections via appropriately spaced permanent wells, injection via soil borings, or diffusive technologies. Implementation of in-situ remedies downgradient of the ERL (off-site) to address low COC concentrations is inefficient and presents several challenges including access to privately-owned land and safety concerns with working in RL/TB. For these reasons, in-situ treatment is not evaluated as a plume-wide treatment in this report; however, two in-situ treatment approaches, enhanced natural attenuation and permeable reactive barrier, could be considered in the future to help achieve the second corrective action objective in targeted areas under an Adaptive Site Management strategy. Overviews of conceptual approaches for each option are described below:

Enhanced natural attenuation can promote the increased biodegradation of vinyl chloride via the addition of electron donors, nutrients, and microbes to the aquifer. Vinyl chloride can attenuate under aerobic and anaerobic conditions and the rate and efficiency of the attenuation processes can be enhanced by carefully altering geochemical conditions in the aquifer through in-situ delivery of treatment agents or dissolved gases. General and proprietary treatment agents can be used to stimulate the microbial community in the aquifer and promote conditions to support aerobic or anaerobic biodegradation. These or other commonly available products may be used individually, or in combination, to enhance biodegradation rates at some sites provided field and aquifer conditions are suitable.

Permeable Reactive Barriers (PRBs) are installations of reactive materials that can attenuate dissolved phase contaminants in groundwater by sorption or transformation as they flow through the reactive zone under a natural or induced gradient. Various materials (e.g., zero-valent iron or carbon-based products) can be used. The effectiveness of the injection media in addressing vinyl chloride is highly dependent on direct contact, geochemical conditions, small scale hydraulic properties (e.g., hydraulic conductivities), and uniform placement of the media.

Permitting through the Minnesota Department of Health and U.S. Environmental Protection Agency may be required for the use of inject treatment agents.

4.5 Pre-Subtitle D Landfill Excavation and Placement on Liner

This technology is included in this report at the request of MPCA. The legacy waste in the unlined, Pre-Subtitle D closed portion of the landfill is the source of organics in leachate-impacted groundwater at the ERL. Waste removal from the unlined portion of the landfill and placement in a lined cell would eliminate the original source of organics in groundwater; however, the flux of remaining impacted groundwater, leaching from residual source material, back diffusion of organics sorbed onto geologic units, or leaching from unlined wastes that may not feasibly be excavated is expected to continue after excavation and relining is completed. The flux of impacted groundwater from the residual/remaining source materials would end significantly sooner if the area was excavated but would likely require groundwater corrective action downgradient of the landfill during and after implementation as leachate leakage rates to the

groundwater system would likely increase as a result of increased infiltration and disturbance of the unlined waste.

The ERL has approximately 4 million cubic yards (MCY) of remaining permitted airspace. The Pre-Subtitle D waste (approx. 4.9 MCY of waste) would be excavated to the extent feasible and would require transport to another lined cell for which there is not sufficient capacity. Safe excavation would require removal of significant volumes of wastes that are currently on lined areas to provide adequate factor of safety for slope stability. This approach would also require existing, overlying, or abutting lined cells (DC-1, DC-2, 6S, 10, and 11) to be partially excavated for access to the unlined legacy waste plus the excavation of an estimate 1 MCY of non-waste soils. Identification and planning for significant construction, geotechnical, interim leachate management, oxygen intrusion, odor/landfill gas management, unknown/restricted waste management, and other issues associated with implementation of this option is beyond the scope of this document.

5.0 Corrective Action Alternatives Evaluation

The following corrective action alternatives for organics in groundwater at and downgradient of the ERL are evaluated below:

- Alternative #1: Monitoring Natural Attenuation and Residential Water Supply Replacement
- Alternative #2: Groundwater Extraction and Treatment with Focused MNA and Residential Water Supply Replacement
- Alternative #3: Pre-subtitle D Landfill Excavation and Placement on Liner
- Alternative #4: Groundwater Extraction (on and off-site) and Treatment

Each corrective action alternative is evaluated individually against the corrective action objectives and additional criteria based on CERCLA guidance (USEPA, 1988) below and a summary is provided in Table 1.

5.1 Alternative #1: Monitored Natural Attenuation and Residential Water Supply Replacement

Alternative #1 would involve preventing exposure to downgradient residents by replacing residential water supply wells and the development of a groundwater monitoring network and program to evaluate and document the effects of natural attenuation. Under this alternative, ERL would replace lower outwash water supply wells that are located downgradient or near sidegradient of the projected migration pathway of organics with deeper wells completed in a hydraulically separated unit (assuming Mt. Simon aquifer for the purposes of this report). Subject to the owner's acceptance, at no cost to the resident, ERL would arrange for the permitting, drilling, installation, and well development. In addition, ERL would sample the well to evaluate groundwater quality. If the water is free of organics and analyte concentrations meet HRLs and USEPA Maximum Contaminant Levels, a new submersible pump would be installed and the well would be connected to the house and put into service. The former residential well would be sealed. The work would be conducted under an access agreement with the owner and performed by a licensed well contractor with knowledge of the area.

This alternative assumes that ten replacement wells will be installed. If a resident does not accept the well replacement offer, the installation POET system or, if feasible, installation and monitoring of a sentinel well on their property will be offered. If a resident insists on a "no action until organics detected approach," a response that includes follow-up actions (e.g., providing bottled drinking water, expedited verification resampling, communications, and an anticipated timeframe for establishing an alternate water supply) will be prepared and implemented.

The MNA component would include installing additional monitoring wells, determining the status of the organics plume (in terms of stability), estimating the organics mass reductions that are occurring as a result of natural attenuation processes, refining the estimates of point-specific and bulk attenuation rates (and related projections) with additional data, and documenting changes in organics concentrations

versus time at locations in the plume. A monitoring plan would be developed and monitoring wells would routinely be analyzed for MNA parameters.

MNA would have on-site and off-site components that build on the details described in Appendix C. The on-site component involves tracking vinyl chloride concentration trends and monitoring geochemical conditions for changes in wells near the compliance boundary. The off-site (distal) component includes the installation and monitoring of monitoring wells up and downgradient of well P-334L to allow better understanding of attenuation and plume stability over time, evaluation of geochemical conditions, and evaluating vinyl chloride and parent compound ratios and concentration trends versus time and distance.

Overall Protection of Human Health and the Environment

Alternative #1 provides the highest degree of protectiveness to the health of nearby residents (i.e., groundwater users) by replacing lower outwash supply wells with deeper water supply wells. Eliminating the groundwater pathway between the landfill and the water supply wells will eliminate the risk of exposure to vinyl chloride (and other organics). Based on prior vertical delineation efforts, completing wells in the Mt. Simon provides a high degree of confidence that the pathway will be incomplete. Using a licensed well contractor, requiring well construction materials and methods that comply with the State well code, sealing the former wells, and conducting periodic monitoring will also support the protectiveness of this alternative.

In regards to MNA, the refined analyses presented in this report adds to the weight of evidence that natural attenuation processes are occurring to a degree that supports further evaluation of this alternative to demonstrate its future protectiveness. Recent evaluations have utilized existing wells to update screening evaluations and generate the preliminary estimates of attenuation rates and vinyl chloride travel distances. Additional monitoring points along the plume centerline and additional data to better evaluate trends and parent compound concentrations will help to better evaluate, demonstrate, and document the effectiveness of natural attenuation downgradient of the landfill.

Meeting Applicable Requirements

The primary goal of the corrective action objectives evaluated in this report is to protect human health and the environment and the secondary goal is to meet applicable groundwater criteria to improve the protectiveness of the implemented corrective action. ERL will request the MPCA establish alternative limits for the Pre-Subtitle D portion of the landfill per Minnesota Rule 7035.2815 Subp. 4 (H)(2). The request will be submitted under separate cover and will provide the proposed approach and technical basis for development of the alternative limits. The envisioned approach includes completing the MNA evaluation and, if appropriate, applying technically sound natural attenuation rates to back calculate protective alternative limits to apply at the Site. This approach is consistent with MPCA Closed Landfill Program's consideration of risk to human health, evaluation of plume stability, and strategy to collect necessary data to if environmental response actions are needed to further reduce risk (MPCA, 2020).

Alternative #1 relies on the natural processes that affect water quality at and downgradient of ERL. Given the weight of evidence that natural attenuation processes are occurring, the projections in this report

suggest natural attenuation may be a feasible approach to develop and meet alternate limits that are established under Minnesota solid waste rules.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative #1 relies on the natural processes that are occurring at and downgradient of the ERL for the reduction of toxicity, mobility, or volume of vinyl chloride. The reduction in toxicity of vinyl chloride occurs as a result of sequential dechlorination or via other destructive attenuation reactions (Barr, 2019) which, when completed, results in non-toxic daughter products. Other organics detected in groundwater downgradient of the landfill are below HRLs, indicating the concentrations are considered non-toxic. The mobility and volume of vinyl chloride and other organics would be the subject of the MNA evaluation effort; however, recent water quality data demonstrate that distal wells P-334L and P-694477 are located near the fringe of the vinyl chloride plume and increasing concentration trends are not confirmed[5]. Additional data would be required to further refine the calculation of the mobility and volume of vinyl chloride in groundwater downgradient of ERL.

Under this alternative, organics would remain in groundwater in the lower outwash until attenuating via destructive or non-destructive processes. The migration of these organics are not anticipated to pose a threat to human health or the environment.

Short-Term and Long-Term Effectiveness

Alternative #1 provides a high degree of both short-term and long-term effectiveness/permanence for protecting human health by eliminating the exposure pathway with water supply well replacements. The vinyl chloride and other organics in the lower outwash unit are anticipated to continue to decrease in concentration with distance from the landfill as a result of destructive and non-destructive natural attenuation processes. Preliminary projections suggest vinyl chloride may migrate through the lower outwash from 5,400 to 9,000 feet from the unlined portion of the landfill (Appendix C); however, risk to groundwater receptors will be mitigated with deeper replacement wells and routine monitoring. Replacement wells provide long-term protection and would be installed within 2 to 3 years, including access coordination and agreement finalization, which is considerably sooner than the estimated time of travel to the downgradient residences.

The long-term effectiveness may be bolstered with the establishment of institutional controls preventing the future installation of water supply wells in the lower outwash the area downgradient from the landfill; however, prior conversation with Minnesota Department of Health staff suggest conditions do not warrant a Special Well and Boring Construction Area (i.e., well advisory). Nevertheless, local communities may consider adopting ordinance restricting well installation for consumptive use.

[5] Preliminary projections suggest peak organics concentrations are anticipated to reach well P-334L between 2026 and 2034 due to higher organics inputs at the landfill in the early 1990s (Appendix C).

Implementability

Alternative #1 is considered highly implementable. The installation of deeper water supply wells is highly implementable from the construction and permitting standpoints. Domestic well construction is allowed in the Mt. Simon aquifer in Sherburne County and water quality is anticipated to be suitable for consumption without treatment provided concentrations of naturally occurring elements or compounds unrelated to the landfill are below drinking water criteria. ERL has a successful track record for open communication with area neighbors and developing mutually acceptable access agreements with individuals (without complaint to State, County, or City).

Scoping and implementing a natural attenuation evaluation is also considered highly implementable. MNA applications are widely accepted in Minnesota and throughout the United States and guidance from State, Federal, and non-governmental organizations is readily available. ERL has access to both internal and external technical expertise capable of developing an MNA evaluation and the MPCA has the expertise to review and comment on plans and evaluation results. The locations of new monitoring wells would require the development of an agreement(s) to access to private property for the installation and subsequent monitoring.

Cost

The primary Alternative #1 cost components include capital costs for replacement well/pump installation, connection, and sealing the existing well. There are no operation and maintenance costs associated with Alternative #1 because the residents will assume ownership of the new wells and pumps (which are low maintenance items). The primary MNA cost components include monitoring well installations and long-term monitoring and evaluation costs. The estimated total cost (30 Year, Net Present Value [NPV]) for Alternative 1 – MNA and Residential Water Supply Replacement ranges from $590,000 to $1,300,000 (Table 1). Cost estimate details are included as Appendix E.

5.2 Alternative #2: Groundwater Extraction and Treatment with Focused MNA and Residential Water Supply Replacement

Alternative #2 includes constructing and operating a groundwater extraction system along the west side of the landfill, in the northern portion of the vinyl chloride plume, and on-site water treatment and discharge, in addition to a focused MNA evaluation and replacement of residential water supply wells (as detailed in Alternative #1). Alternative #2 assumes that three extraction wells would be installed, equipped with submersible pumps, and connected to groundwater forcemains to transmit groundwater to an on-site system for organics treatment and discharge to an infiltration basin located on the east side of the landfill in the extraction system capture zone. For the purpose of this report, the groundwater treatment is assumed to include pre-filtration and air stripping/carbon fixation depending on discharge requirements. Seasonal discharge to RL/TB may be a viable alternative if groundwater extraction is focused between the compliance boundary and property boundary.

Based on the challenges presented by the hydrogeologic conditions, the depth of the organics plume, and the nature of the release from the closed Pre-Subtitle D area, the implementation of this alternative would utilize an observational approach to evaluate performance and Adaptive Site Management

principles that allow for adjustments over the Site's life cycle as new site information and technologies become available (ITRC, 2017). This flexible approach would allow for a more expedient start up to groundwater extraction compared to a 30%/60%/90% design progression and would allow flexibility for ERL to propose modifications to the corrective action approach, adjust the treatment technologies or discharge locations, or to incorporate an alternate corrective action approach as performance data is reviewed and new information or technologies become available. This type of flexible approach is inherent to managing large, ongoing remediation projects and is compatible with the existing reporting cycle.

The replacement of residential water supply wells (as described in Alternative #1) is critical to the protectiveness of this alternative, and would be the initial priority for implementation. The MNA component would be focused on the southern portion of the vinyl chloride plume where decreasing concentrations are present along the compliance boundary (Appendix B).

Overall Protection of Human Health and the Environment

Alternative #2 provides an equally high degree of protectiveness to the health of nearby residents (i.e., groundwater users) and confidence that the groundwater pathway from the landfill to residential wells will be incomplete due to the replacement of water supply wells. Discharge of treated water to RL/TB would potentially affect ground conditions/stability of the floating bog in the discharge area and exacerbate health and safety issues related to accessing the area for monitoring, maintenance, or other reasons (including trespassers).

Meeting Applicable Requirements

Alternative #2 would provide additional means to meet applicable groundwater criteria along the compliance boundary by intercepting and/or stagnating impacted groundwater migrating from the Pre-Subtitle D area. The extraction well(s) zone of influence would extend upgradient (beneath the Pre-Subtitle D portion of the landfill) and to the west to a lesser degree. Long-term operation of the extraction system will remove impacted groundwater and allow for fresh groundwater to in fill west of the extraction area. As previously discussed, the timeframe to meet applicable groundwater criteria is based on many factors and may take decades.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative #2 will provide reduction of toxicity, mobility, or volume with a combination of engineered groundwater extraction/treatment system and natural attenuation processes. South and west of the extraction system, the toxicity, mobility, and volume of vinyl chloride would be reduced by either destructive or non-destructive natural attenuation processes that are occurring in the subsurface. The toxicity of the vinyl chloride (and other organics) in the extracted groundwater would be addressed by a phase change to vapor which would transfer the organics to the air at very low concentrations or by being bound to a carbon media which would be disposed of or thermally regenerated. The mobility of organics in groundwater upgradient of the extraction system would be reduced by intercepting the migration pathway between the unlined portion of the landfill and either the compliance boundary or property boundary. The operation of the groundwater extraction and treatment system would provide a minimal

reduction of the volume of vinyl chloride in the groundwater system. Preliminary annual estimates using existing data and applying an average pumping rate of 40 gpm, approximately 0.2 lbs of vinyl chloride would be treated from approximately 21,000,000 gallons of groundwater. For comparison purposes, the current active gas extraction system is estimated to remove approximately 60 lbs of vinyl chloride from the landfill annually.

Under Alternative #2, the organics in groundwater downgradient of the extraction system would remain in groundwater in the lower outwash until attenuating via destructive or non-destructive processes. The migration of these organics is not anticipated to pose a threat to human health or the environment.

Short-Term and Long-Term Effectiveness

Alternative #2 provides a high degree of short-term and long-term effectiveness/permanence for protecting human health due to the residential well replacements. Alternative #2 is expected to achieve applicable groundwater criteria in the southern portion of the vinyl chloride plume along the landfill via natural attenuation and in the northern portion of the vinyl chloride plume along the landfill via groundwater extraction. For the reasons explained in Section 4.3, providing a reliable timeframe for achieving groundwater criteria at wells along the northern portion of the landfill is not appropriate at this time. In general terms, the anticipated timeframe for achieving criteria may be decades and, should groundwater extraction be maintained as the long-term corrective action approach, it is anticipated to continue until either the source is depleted, another approach or technology is employed using Adaptive Site Management principles, or natural attenuation is demonstrated to be a protective corrective action approach.

Implementability

Alternative #2 is considered moderate to low in terms of implementability based on anticipated challenges regarding discharge of the extracted groundwater and permitting. Pumping along the west side of the landfill would extract groundwater with elevated concentrations of certain compounds that may require a waiver to discharge limits or a higher degree of treatment which would increase the treatment system costs and/or operation and maintenance needs. On-site discharge would also require the construction of an appropriately sized infiltration basin or other infrastructure (e.g., injection wells) to discharge the treated groundwater.

Pumping in RL/TB near the landfill could be conducted seasonally. Pumping would be achieved using the natural hydraulic heads in the lower outwash beneath RL/TB. The concentration of inorganic compounds would not be as high as those encountered closer to the landfill (at least at start-up) but would also likely require a wavier for discharge. Further, discharge of a constant flow of water in RL/TB may adversely affect ground/floating bog conditions in the discharge area and further complicate access.

An engineered onsite groundwater treatment system would require permitting, design, pilot testing, construction, start-up, and long-term system operation and maintenance. Prior to start-up of the groundwater extraction system, discharge to an infiltration basin would likely require National Pollutant Discharge Elimination System (NPDES) permitting with the MPCA. Direct discharge to RL/TB may require a

waiver for certain inorganic constituents, permitting with the MDNR and the U.S. Army Corps of Engineers (401 Certification and 404 Discharge of Fill to Wetlands).

Cost

The primary cost components of Alternative #2 (in addition to those detailed in Alternative #1) include capital costs for installing and connecting the groundwater extraction, conveyance, and treatment system infrastructure and piloting/start-up activities. Operation and maintenance costs include regular well and forcemain maintenance activities; long term monitoring costs; and components previously described in Alternative #2. The estimated total cost (30 Year, NPV) for Alternative #2 – Groundwater Extraction and Treatment with Focused MNA and Residential Water Supply Replacement ranges from $3,400,000 to $7,000,000 (Table 1). Cost estimate details are included as Appendix E.

5.3 Alternative #3: Pre-subtitle D Landfill Excavation and Placement on Liner

Alternative #3 is being evaluated at the request of the MPCA and includes excavation of the unlined pre-Subtitle D landfill and abutting waste followed by placement on new liner at ERL. This scenario would include the excavation of approximately 4.9 MCY of in-place waste and 1 MCY non-waste soils.

For protectiveness purposes, this alternative would also include the installation and operation of an on-site groundwater extraction/treatment system to manage the anticipated increased leachate flux rate to groundwater during the excavation project and the replacement of residential water supply wells to be protective to downgradient residents because excavating the Pre-Subtitle D portion of the landfill is not expected to improve downgradient water quality in the foreseeable future.

Overall Protection of Human Health and the Environment

Alternative #3 provides an equally high degree of protectiveness to the health of nearby residents (i.e., groundwater users) and confidence that the groundwater pathway from the landfill to residential wells will be incomplete due to the replacement of water supply wells. The excavation of the unlined Pre-Subtitle D portion of the landfill and placement on a lined landfill cell at ERL adds to the high degree of overall protection in the long-tern by eliminating the source of organics; however, the introduction and migration of organics in groundwater would likely be increased in the short-term due to removing the final cover and increased leakage during excavation. Longer-term sources to groundwater would include leaching from residual source materials, residual impacts beneath the landfill, and back diffusion from the organics that are sorbed to the aquifer matrix.

Meeting Applicable Requirements

Alternative #3 would provide additional means to meet applicable groundwater criteria along the compliance boundary by intercepting and/or stagnating impacted groundwater migrating from the excavated Pre-Subtitle D area via operation of the groundwater extraction/treatment. The groundwater extraction/treatment system operation would be similar to that in Alternative #2 but would likely not need to be operated as long and the mass of vinyl chloride removed would be anticipated to be higher.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative #3 will not result in a reduction of toxicity because the waste not being treated. A temporary but sustained increase of organics mobility and volume in the groundwater system would be expected during and for some time after waste excavation activities were completed. In the long-term (likely decades), the mobility of organics from the source would be eliminated or greatly reduced by removal of unlined waste.

Under Alternative #3, the organics in groundwater downgradient of the extraction system would remain in groundwater in the lower outwash until attenuating via destructive or non-destructive processes. The migration of these organics is not anticipated to pose a threat to human health or the environment.

Short-Term and Long-Term Effectiveness

Alternative #3 provides a low degree of short-term effectiveness and a high degree of long-term effectiveness/permanence for protecting human health due to the residential well replacements. Alternative #3 is expected to result in moderate to low short-term effectiveness as a result of the long lead time it would take to plan and construct and high degree of long-term effectiveness/permanence due to unlined waste removal.

Implementability

The excavation of the Pre-Subtitle D portion of the landfill is presently infeasible given that space does not exist in the currently permitted landfill for the excavated waste. In addition, lined landfill cells are built over and adjacent to the unlined waste. Removal of material in the unlined landfill must either be limited to maintain the integrity of the adjacent lined portions or include the excavation of the neighboring lined waste for purposes of stability. If a portion of the unlined waste remains in place, it will remain as source material and long-term groundwater corrective actions may be required. Additional implementability challenges may include: odors and emissions during excavation, increased levels of dust and noise; prolonged exposure of waste to the environment which would lead to generation of additional leachate and landfill gas emissions; and disruption of neighboring lined landfill cells.

Cost

The unit rates used for the cost estimate are based on feasibility study costs for a similar project involving the excavation and relining of a different landfill in the Twin Cities area. It is noted that the excavation at ERL is considered more challenging due to overlying lined phases and adjoining lined waste areas. This cost may underestimate the actual cost, however, detailed cost estimated for this alternative is beyond the scope of this report.

Primary capital costs items include the constructing a new lined footprint to accept the Pre-Subtitle D waste and associated infrastructure to accept the unlined waste, construction costs to excavate and place the waste on liner, increased leachate management, etc. The estimated total cost (30 Year, NPV) for Alternative #4: Pre-subtitle D Landfill Excavation and Placement on Liner ranges from $64,000,000 to $140,000,000 (Table 1). Cost estimate details are included as Appendix E. However, again it is important to

note that the ERL does not have enough remaining capacity for MSW waste to accommodate waste from this exhumation.

5.4 Alternative #4: Groundwater Extraction (on and off-site) and Treatment

Alternative #4 is being evaluated at the request of the MPCA and includes constructing and operating an on-site groundwater extraction system, an off-site groundwater extraction system, and a water treatment discharge structure at ERL. This alternative assumes that, in addition to the system discussed in Alternative #2, two extraction wells are installed downgradient of well P-334L and utilized for groundwater extraction. These extraction wells would be equipped with submersible pumps and connected to a groundwater forcemain that conveys water back to the landfill for treatment and discharge at ERL. For the purpose of this report, it is estimated that a combined pumping rate of 80 gpm would be sufficient. Conveying groundwater to the ERL for discharge is considered more implementable than permitting, constructing, operating, and discharging from a groundwater treatment system on privately owned property.

Because the groundwater extraction system is operating downgradient of well P-334L and upgradient of residential wells, replacement residential water supply wells and documenting natural attenuation downgradient of well P-334L would not be included in this alternative. Groundwater extraction at the Site would be required to achieve applicable groundwater criteria.

Overall Protection of Human Health and the Environment

Alternative #4 provides a high to moderate degree of protectiveness to the health of nearby residents (i.e., groundwater users) with less certainty that the groundwater pathway from the landfill to residential wells will be incomplete as compared to Alternative #1.

Meeting Applicable Requirements

Alternative #4 will improve water quality at monitoring wells located along the compliance boundary by intercepting and/or stagnating leachate-impacted groundwater migrating from the northern portion of vinyl chloride plume along the west side of the ERL. The capture zone for the extraction wells will extend upgradient (beneath the Pre-Subtitle D portion of the landfill) and to the west to a lesser degree. Long-term operation of the extraction system will remove leachate-impacted groundwater and allow for fresh groundwater to in fill west of the groundwater extraction area. As previously discussed, the timeframe to meet applicable groundwater criteria is based on many factors and may take decades.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative #4 will provide reduction of toxicity, mobility, or volume in addition to the natural processes already occurring. The mobility and volume/mass of organics in the groundwater system will be reduced by cutting off the pathway both downgradient of the landfill and between well P-334L and the residential wells. Toxicity of organic compounds is addressed through treatment. Preliminary estimates using existing data and applying an average annual pumping rate of 80 gpm, approximately 0.2 lbs of vinyl chloride from approximately 42,000,000 gallons of groundwater.

Alternative #4, is intended to remove the organics in groundwater downgradient of the landfill.

Short-Term and Long-Term Effectiveness

Alternative #4 will provide a moderate degree of short-term effectiveness and a high long-term effectiveness/permanence protecting human health. Alternative #4 has a moderate degree of short-term effectiveness because the implementation timeframe is anticipated to be longer than Alternative #1 due to the need to design and pilot test such a system, negotiate access agreements for installing and operating remedial system components and the time it will take to implement well and forcemain construction activities on privately-owned property. Alternative #4 is expected to achieve applicable groundwater criteria in the long-term.

Implementability

Off-site groundwater extraction with off-site treatment has a low degree of implementability due to the lack of ownership of the property where the alternative would be implemented, the long distance that groundwater forcemain piping would need to be installed for extracted groundwater conveyance, and permitting. The groundwater extraction approach is reliable and effective in the long term if target pumping rates are continuously achieved in a well-maintained and monitored system. After the groundwater extraction system is established, modifications to pumping schemes will be employed to optimize recovery, however the combined flow of the on-site and off-site extraction systems may present unique challenges.

Cost

Major cost components of Alternative #4 (in addition to those detailed associated with on-site groundwater extraction and treatment in Alternative #2) include capital costs for installing and connecting the groundwater extraction and conveyance system to infrastructure from the off-site groundwater extraction wells to the ERL. Significant operation and maintenance costs include third-party treatment fees for the combined flow of the on-site and off-site systems; regular well and forcemain maintenance activities; and long term monitoring costs. The estimated total cost (30 Year, NPV) for Alternative #4 – Groundwater Extraction (on and off-site) and Treatment i ranges from $6,400,000 to $14,000,000 (Table 1). Cost estimate details are included as Appendix E.

6.0 Comparison of Alternatives

This section presents a relative comparison of the corrective action alternatives described in Section 5.

The alternatives were evaluated against seven evaluation criteria that are based on CERCLA guidance (USEPA, 1988). Consistent with the NCP, the selected alternative must meet two threshold criteria and achieve the best balance of trade-offs with respect to the balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost) in a cost-effective manner. The NCP says, "a remedy shall be cost-effective if its costs are proportional to its overall effectiveness."

Alternative #1, MNA and Residential Water Supply Replacement achieves the threshold criteria and is judged to be the most cost-effective alternative that achieves the best balance of the evaluation criteria assuming that further evaluation demonstrates MNA is occurring sufficiently and applicable groundwater requirements are met. Based on the refined preliminary analysis presented herein, MNA is anticipated to sufficiently reduce the toxicity, mobility, and volume of vinyl chloride via natural processes and protectiveness to human health would be addressed with water supply well replacements. Alternative #1 would be equally protective in the short-term and long-term, reasonably implementable, and is the lowest cost alternative evaluated in this report.

Alternative #2, Groundwater Extraction and Treatment with MNA and Residential Water Supply Replacement is equally protective as Alternative #1 but is not a cost-effective alternative due to the operation of the groundwater extraction and treatment system. Alternative #2 provides a means to make progress towards achieving groundwater criteria at the compliance boundary (above and beyond natural processes) by intercepting the migration of groundwater with vinyl chloride along the west side of the landfill, however, preliminary estimates suggest that, on an annual basis, removal of 0.2 lbs of vinyl chloride from approximately 21,000,000 gallons of extracted groundwater. This alternative could be considered in the future if MNA is not demonstrated to be protective.

Alternative #3, Pre-Subtitle D Landfill Excavation/Placement on Liner best addresses long-term effectiveness and permanence but is not cost effective. This alternative is not feasible because lined waste is present in cells adjacent to and overlying the Pre-Subtitle D area and capacity does not exist to accommodate the excavated waste.

This alternative is not judged to be effective in the short-term due to the long lead time required to plan and implement it and because excavation of the unlined waste will require removing the landfill cap, resulting in increased contaminant flux to the groundwater system. Incomplete waste removal and/or residual impacts below the closed Pre-Subtitle D area would require long-term operation of a groundwater treatment system and residential water supply well replacements would be needed to protect the downgradient residents to the same extent in Alternatives #1 and #2.

Alternative #4, Groundwater Extraction (on and off-site) and Treatment is equally protective of Alternatives #1 and #2 but offers less certainty than residential water supply well replacement. Implementation of this alternative is considered difficult given the need to negotiate access to construct, operate, and maintain a groundwater extraction system on privately-owned land. This alternative will also entail extracting groundwater with low vinyl chloride concentrations (e.g., at or below the reporting limit), pumping the groundwater to ERL for treatment, and discharge at the Site. The estimated range of combined flows from the two extraction systems would also be challenging to discharge at the Site. Preliminary estimates suggest that, on an annual basis, the removal of approximately 0.21 lbs of vinyl chloride from approximately 42,000,000 gallons of extracted groundwater (assuming a rate of 80 gpm).

All four alternatives meet the threshold criteria of protecting human health and the environment and have the ability to meet appropriate groundwater criteria at the ERL. Alternative #1, MNA and Residential Water Supply Replacement, is judged to achieve the best balance of the other criteria in a cost-effective manner. The components of Alternative #1 are discussed below:

- Residential water supply replacement: replacing lower outwash supply wells with deeper wells will eliminate the exposure pathway and be protective of downgradient receptors. This component is critical to Alternative #1, provides the greatest value for the cost because it will mitigate risk to downgradient residents (i.e., groundwater users) with a high degree of certainty. Replacement of water supply wells would be the initial priority for implementation for this alternative.

- Monitored natural attenuation (on-site): the results of the evaluation in Appendix C project that the groundwater criteria may be achieved in areas along the west side of the landfill in a reasonable timeframe via naturally occurring attenuation processes. One of these areas is southern portion of the vinyl chloride plume in the vicinity of monitoring wells P-314C, P-313C, and P-323L. The focus along the west side of the landfill would include collecting additional data to track vinyl chloride trends and continue to assess geochemical conditions on a regular basis.

- Monitored natural attenuation (off-site): the focus of this compound would be to conduct additional evaluation of MNA to build on the recent screening update (Barr, 2020b). The off-site evaluation would focus on the areas up and downgradient of well P-334L, including installation of additional MNA monitoring points and collecting additional data to evaluate the stability of the vinyl chloride plume, assess daughter-parent compound relationships, and to refine the attenuation rate estimates and the preliminary projections presented in Appendix C of this report. Provided MNA proves to be a fully appropriate corrective action alternative, the data will be used to support a proposal for the establishment of appropriate alternative groundwater criteria for the Pre-Subtitle D portion of the landfill consistent with Minnesota Solid Waste Rules.

7.0 Summary and Next Steps

This report summarizes four corrective action alternatives identified to address vinyl chloride in groundwater at and downgradient of the ERL. Alternative #1, MNA and Residential Water Supply Replacement meets the threshold criteria and is judged to achieve the best balance of the other criteria in a cost-effective manner. Upon receiving concurrence with MPCA on Alternative #1, a work plan including implementation steps and schedule will be submitted under separate cover to MPCA review and approval. Implementation would prioritize the installation of replacement water supply wells and the installation of additional MNA monitoring network points downgradient of the ERL.

8.0 References

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USEPA, 1998. Technical Protocol for Evaluating NA of Chlorinated Solvents in Ground Water. United States Environmental Protection Agency, EPA/600/R-89/128, September 1998.

USEPA, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. United States Environmental Protection Agency, EPA/540/G-89/004, October 1988.

Tables

Table 1
Corrective Action Evaluation Summary
Elk River Landfill

CERLCA Criteria		Threshold Criteria	Threshold Criteria	Balancing Criteria	Balancing Criteria	Balancing Criteria	Balancing Criteria	Balancing Criteria	Comments
Alternatives		Overall Protection of Human Health and the Environment	Meeting Applicable Requirements[1]	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Long-Term Effectiveness and Permanence	Implementability	Cost Range (Capital + 30 Year NPV for O&M, +50% / -30%)	
		(CAO #1 - Priority/Initial Objective)	(CAO #2 - Long Term Objective)						
#1	Monitored Natural Attenuation + Residential Water Supply Replacment	Provides the highest degree of protectiveness for human health based on the replacement of water supply wells. Preliminary evaluation / weight of evidence suggest MNA is a protective approach.	Based on preliminary evaluation, this alternative is anticipated to meet applicable alternate groundwater criteria established under MN Rules.	Based on preliminary evaluation, this alternative is anticipated to reduce toxicity and volume of organics upgradient of groundwater users via destructive and non-destructive natural attenuation processes. Relies on natural processes occurring the subsurface for reductions of toxicity, mobility, or volume.	High degree of short-term effectiveness and permanence in protecting human health with well replacements implemented within 2 to 3 years. Provides additional monitoring locations upgradient of residential wells. Provides data required to evaluate plume stability, refine estimate, verify geochemical conditions, and document mass destruction.	High degree of long-term effectiveness and permanence in protecting human health. Provides additional monitoring locations upgradient of residential wells. Provides data required to evaluate plume stability, refine estimate, and verify geochemical conditions. Documents mass reductions via natural attenuation using methods developed by, applied, and accepted by regulatory agencies.	Residential well replacements are highly implementable with owner acceptance and alternatives to well replacements are available. Natural attenuation evaluation and implementation is highly implementable. Preliminary data / weight of evidence suggest MNA is a protective approach.	$ 590,000 to $1,300,000	This approach achieves the threshold criteria as discussed in the report, is cost-effective, and is judged to achieve the best balance of the evaluation criteria. If MNA evaluation does not prove to be adequate, additional measures can be considered in the future.
#2	Groundwater Extraction with Treatment with Focused MNA and Residential Water Supply Replacement	Same degree of protectiveness to downgradient residents as Alt. #1 due to replacement of water supply wells. If discharge occurs to RL/TB, the volume of water may affect the ground conditions in the discharge area (e.g., ponding water) and exacerbate health and safety issues relating to access for monitoring, maintenance, and/or trespassers.	This alternative provides additional means to achieve alternate groundwater criteria. The timeframe to meet criteria and may be on the order of decades (but would be better understood after the system is installed and performance data and water quality trend data is generated).	In addition to Alt. #1, vinyl chloride mobility would be reduced at the landfill via groundwater extraction. Toxicity of organic compounds would be reduced by treatment. The operation of the extraction system is estimated to marginally reduce volume of vinyl chloride in the groundwater system. Treatment system wastes (if generated) would require disposal/management.	Permitting, extraction and treatment system design, construction, and start-up would be required prior to starting the extraction and treatment system operations. Well replacement and MNA implementation would be the same as Alt. #1.	Same as Alt. #1 with regard to protecting human health. If MNA proves to be effective, long term (>30 years) pumping and treating would not increase effectiveness and permanence.	Moderately implementable due to water discharge challenges. Infiltration east of landfill may be hindered due to space needed for infiltration basin. Discharge to RL/TB could be conducted seasonally if permitted but access may become problematic. Groundwater extraction along the west side of the landfill would be anticipated to extract groundwater with high inorganic compound concentrations. These concentrations may necessitate discharge waivers or a higher degree of treatment which would substantially increase costs and/or operation and maintenance needs.	$ 3,400,000 to $7,000,000	This approach is not cost effective and does not provide additional protection to human health or the environment to a degree greater than Alternative #1. Using an average groundwater extraction rate of 40 gpm, approximately 21,000,000 gallons of groundwater would be extracted annuallyand treatment would remove approximately 0.2 pounds/year of vinyl chloride.

Table 1
Corrective Action Evaluation Summary
Elk River Landfill

CERLCA Criteria		Threshold Criteria	Threshold Criteria	Balancing Criteria	Balancing Criteria	Balancing Criteria	Balancing Criteria	Balancing Criteria	Comments
Alternatives		Overall Protection of Human Health and the Environment	Meeting Applicable Requirements[1]	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Long-Term Effectiveness and Permanence	Implementability	Cost Range (Capital + 30 Year NPV for O&M, +50% / -30%)	
		(CAO #1 - Priority/Initial Objective)	(CAO #2 - Long Term Objective)						
#3	Pre-subtitle D Landfill Excavation and Placement on Liner	Same degree of protectiveness to downgradient residents as Alt. #1 due to replacement of water supply wells. Provides the highest degree of overall protection of human health in the long-term due to removal of unlined waste.	Expected to meet alternate groundwater criteria in the long term but not likely in the foreseeable future due to a long lead time for planning/implementation, increased organics flux during implementation. The possibility of incomplete waste removal or continued organics flux from residual impacts (in addition to increased organics flux during implementation) requires the addition of additional groundwater corrective actions (i.e. gw extraction) for the foreseeable future. The timeframe to meet applicable groundwater criteria would be dependent on completeness of source removal (i.e., waste and residuals) and physical processes (e.g., advective transport, matrix rebound, etc.).	Anticipated to increase mobility in the short-term / foreseeable future due to waste disturbance, increased infiltration, cover removal, etc. (generation of leachate and LFG emissions). Increased mobility would require additional groundwater corrective measures (i.e., gw extraction).	Timeline for planning and implementation would be protracted due to magnitude of the project and need to permit and construct new lined area. High degree of short-term effectiveness and permanence in protecting human health with well replacements implemented within 2 to 3 years.	Provides highest degree of long term effectiveness / permanence. Excavation of the unlined pre-Subtitle D landfill and placement on a lined landfill cell is reliable and effective in the long term provided the entire source is removed.	Infeasible given space for the excavated waste does not exist in the currently permitted landfill. Difficult implementation due to lined phases with leachate collection are built over and adjacent to the Pre-Subtitle D area. Difficulties in removing all off the unlined waste, managing leachate and contact water, managing landfill gas/odors/emmission and dust are anticipated.	$ 63,000,000 to $ 140,000,000	This alternative is not not feasible given sufficient permitted air space is not available at ERL to accept excavated waste. This alternative is not considered to be cost effective. The detailed estimation of costs for this alternative and consideration of the are beyond the scope of this evaluation. This alternative would require implementation of groundwater extraction/treatment and water supply replacement to manage anticipated increase in flux to groundwater from implementation. The operation of a groundwater extraction/treatment system (or an alternate technology would be expected to be shorter than without waste removal.
#4	Groundwater Extraction (on and off-site) and Treatment	Provides high degree of protectiveness for human health but less certainty than residential well replacements.	Same as Alt. #2.	Vinyl chloride mobility would be reduced at and downgradient of the landfill via groundwater extraction. Toxicity of organic compounds at and downgradient of the landfill would be reduced by treatment.	Timing based on negotiating access agreements with private property owners. Negotiating access for an active system that would require regular operation and routine maintenance is anticipated to be more difficult than access for monitoring. High degree of short-term effectiveness in protecting human health assuming full plume interception.	If MNA proves to be effective, long term (>30 years) pumping and treating would not increase effectiveness and permanence. Long-term operation would require long-term access agreement with private land owner.	Judged to have low degree of implementability due private property ownership by others, permitting, rate of discharge required, and issues of operating and maintaining a system in RL/TB. Moderate to low implementability assuming seasonal extraction/ treatment/discharge is permitted in RL/TB on ERL property. Infiltration east of landfill may be hindered due to space needed for infiltration basin.	$ 6,400,000 to $ 14,000,000	This approach is not cost effective and does not provide additional protection to human health or the environment to a degree greater than Alternative #1. Using an average groundwater extraction rate of 80 gpm , approximately 42,000,000 gallons of groundwater would be extracted annually and treatment would remove approximately 0.2 pounds/year of vinyl chloride.

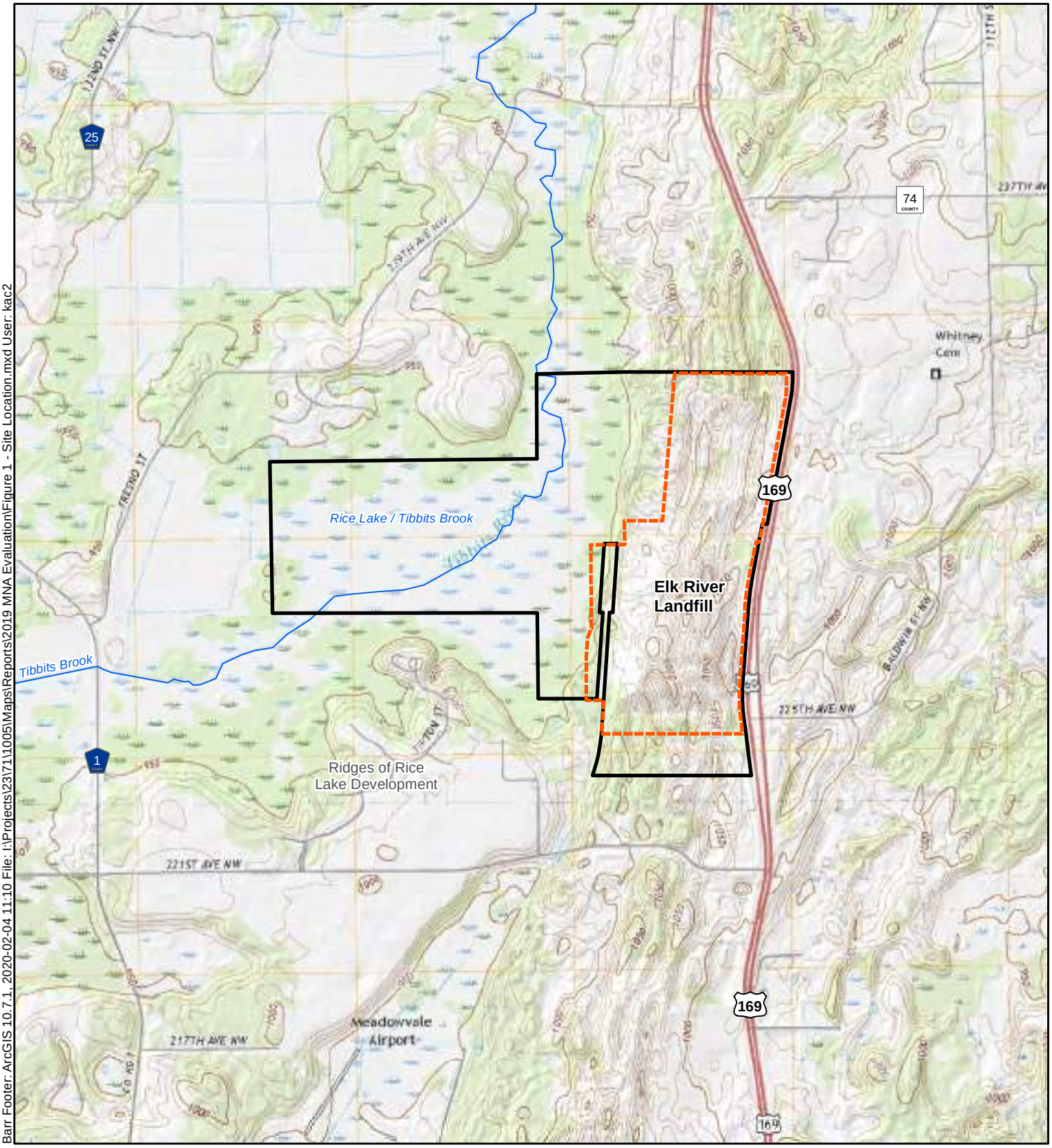
Notes:

[1] MPCA requested the evaluation to consider meeting Intervention Limits at the Compliance Boundary. ERL is addressing impacts related to the Pre-Subtitle D portion of the site which may necessitate the establishment of alternate limits under 7035.2815 Subpart 4 (H) (2).

Color Key for this chart is provided to indicate relative degree of achieving listed criteria and/or relative ranking of favorability. Gradient color fills indicate uncertainty.

- Favorable / High
- Neutral / Moderate
- Less Favorable / Low

Figures



Barr Footer: ArcGIS 10.7.1, 2020-02-04 11:10 File: I:\Projects\23\71\1005\Maps\Reports\2019 MNA Evaluation\Figure 1 - Site Location.mxd User: kac2

Property Boundary

Groundwater Compliance Boundary

N

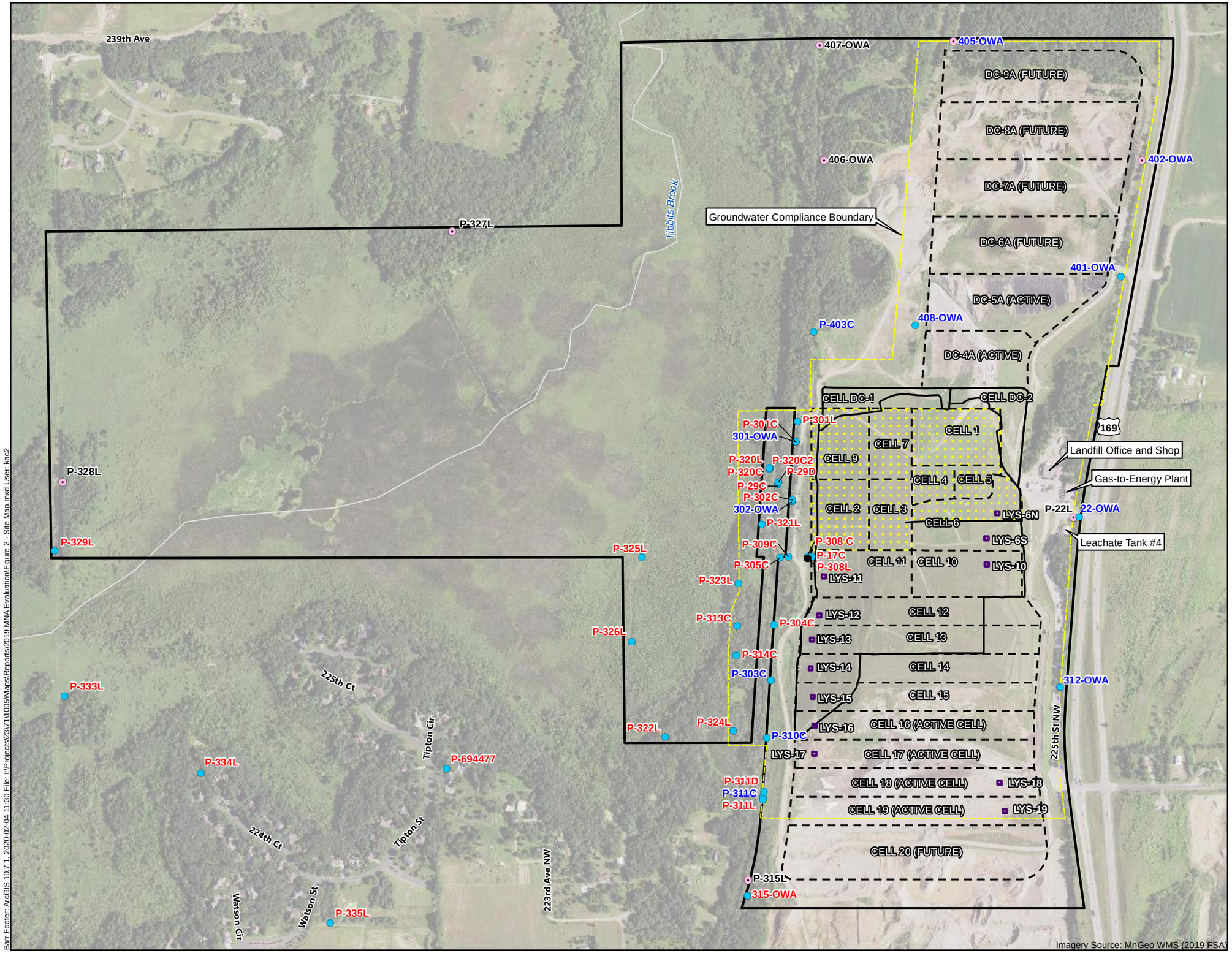
Feet

0 2,000 4,000

Figure 1

SITE LOCATION
Elk River Landfill
Elk River, Minnesota

Background Source: USGS 7.5 Minute Quadrangle
Data Source: Barr, Wenck, MNDOT, MNDNR



Property Boundary

Pre-Subtitle D Area

Cell Boundary

Lysimeter

Monitoring Well

Piezometer

Test Well

P320C — Blue ID indicates well has surface water-based intervention limits

P320L — Red ID indicates well has groundwater-based intervention limits

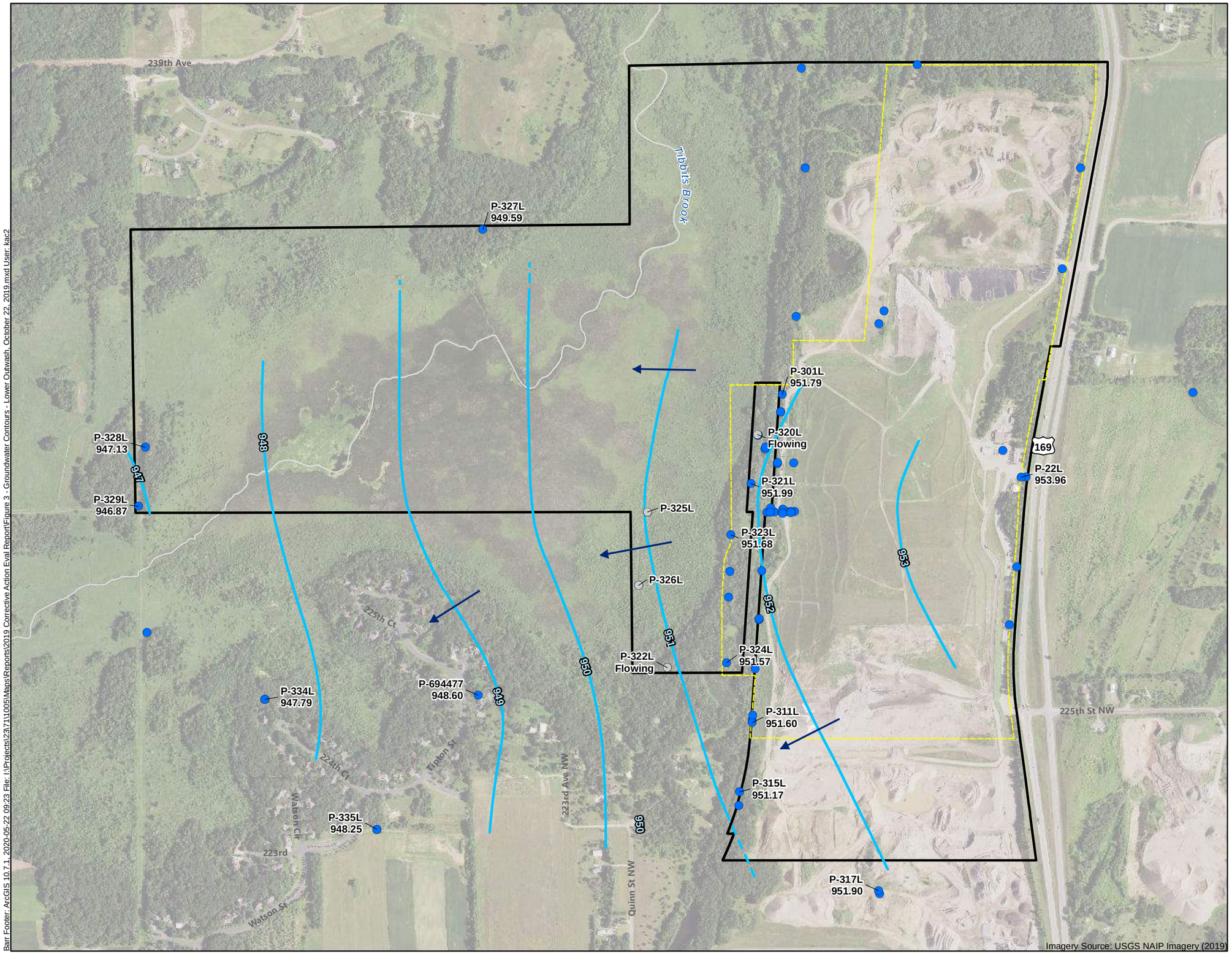
Notes:
(1) Piezometers 36-OWA (east) and 317-OWA/P-317L (south) are not shown.

Feet
0 650 1,300

Figure 2

SITE MAP
Elk River Landfill
Elk River, Minnesota

Barr Footer: ArcGIS 10.7.1, 2020-02-04, 11:30 File: I:\Projects\23171\1005\Maps\Reports\2019 MNA Evaluation\Figure 2 - Site Map.mxd User: kac2



Property Boundary

Groundwater Compliance Boundary

Lower Outwash Monitoring Well

Lower Outwash Monitoring Well (Not Used for Groundwater Contours)

Groundwater Contour (feet MSL)

Flow Line

Feet

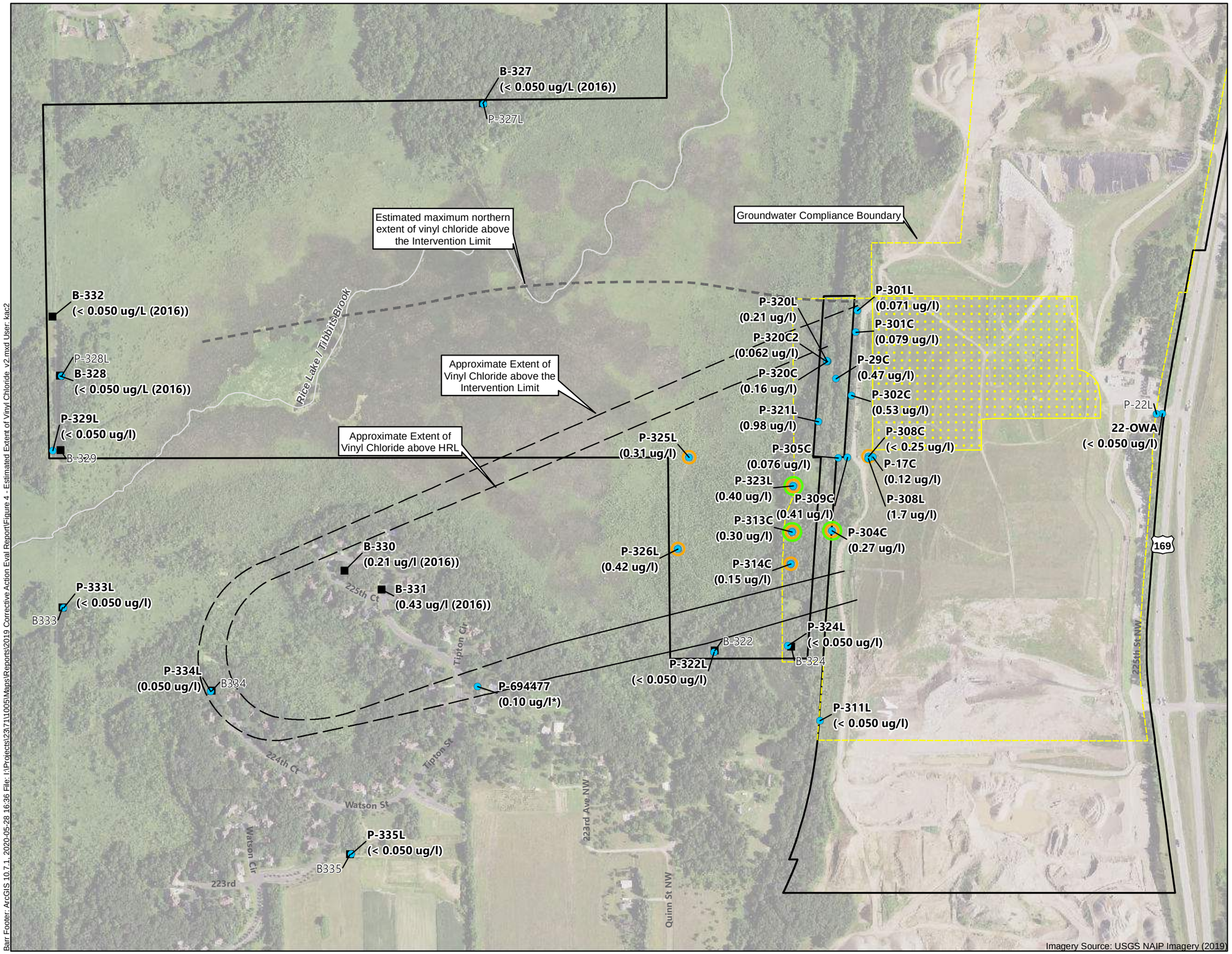
0 750 1,500

Figure 3

GROUNDWATER CONTOURS - LOWER OUTWASH
October 22, 2019
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.7.1, 2020-05-22 09:23 File: I:\Projects\23711\005\Maps\Reports\2019 Corrective Action Eval Report\Figure 3 - Groundwater Contours - Lower Outwash, October 22, 2019.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Monitoring Well

Vertical Groundwater Profile Boring (2016/2018)

TCE detected (>1.0 ug/L) since 2018

cDCE detected (>1.0 ug/L) since 2018

Note:
- Vinyl chloride extents based on 2019 data and investigation data (Barr, 2018).
* October 2019 data shown for P-694477 (first detection of vinyl chloride at this location).
- Vinyl chloride was not detected at P-334L (<0.050 ug/L), P-694477 (<0.231) and P-301L (<0.050 ug/L) in April 2020 samples.
- Estimated extents based on lower outwash groundwater contours (2014-2019) and water quality data.
- Locations of vinyl chloride parent product detections shown with green and red circles.

N

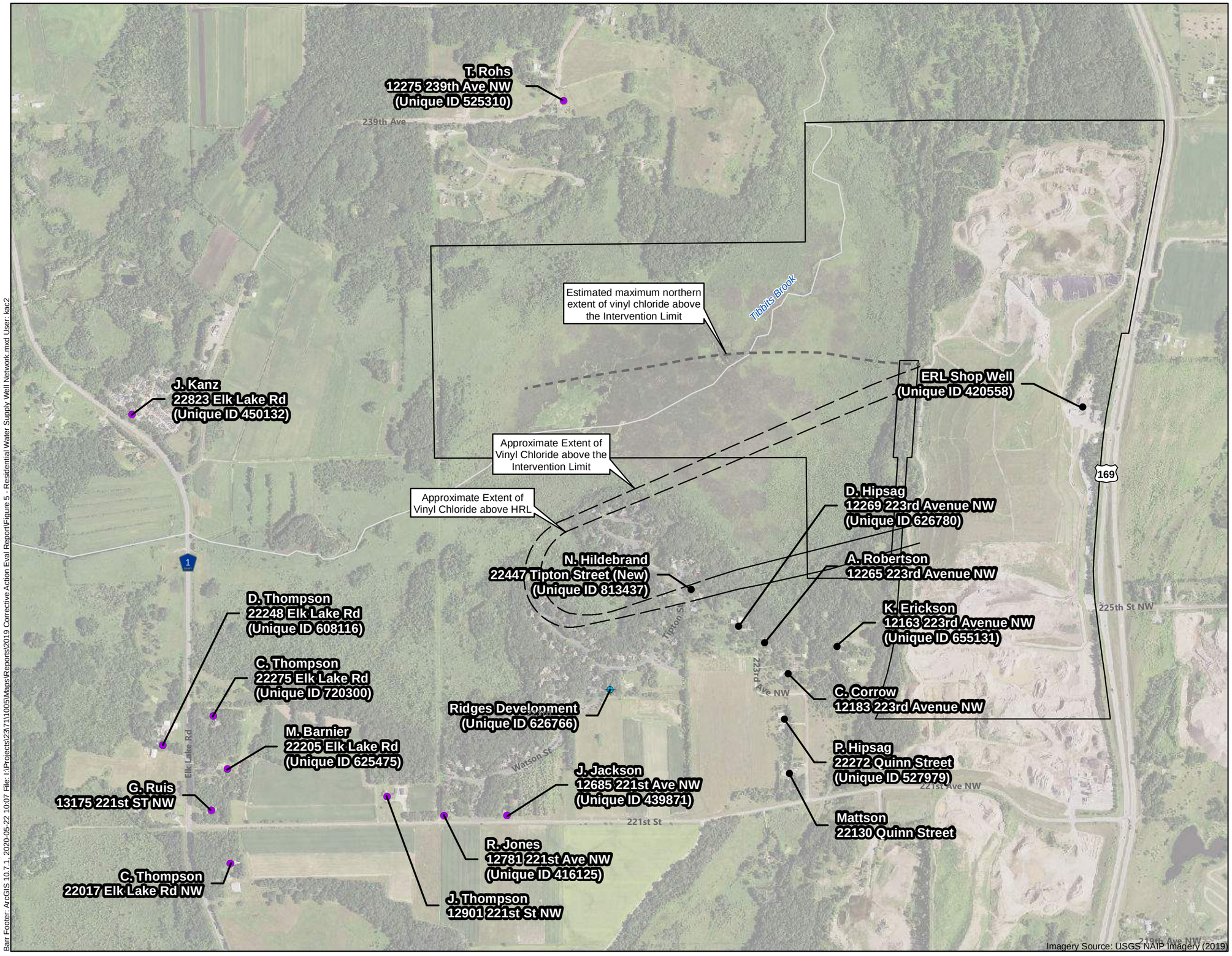
Feet
0 600 1,200

Figure 4

ESTIMATED EXTENT OF VINYL CHLORIDE
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.7.1, 2020-05-28 16:36 File: I:\Projects\23\7110005\Maps\Reports\2019 Corrective Action Eval Report\Figure 4 - Estimated Extent of Vinyl Chloride_v2.mxd User: kac2



Property Boundary

Residential Well Network Location

Community Water Supply Well

Residential Well (Expanded Network, 2015-2017)

Notes:
(1) 12265 223rd is listed as 11265 223rd in Permit SW-74.
(2) Upgradient monitoring locations not shown.

N

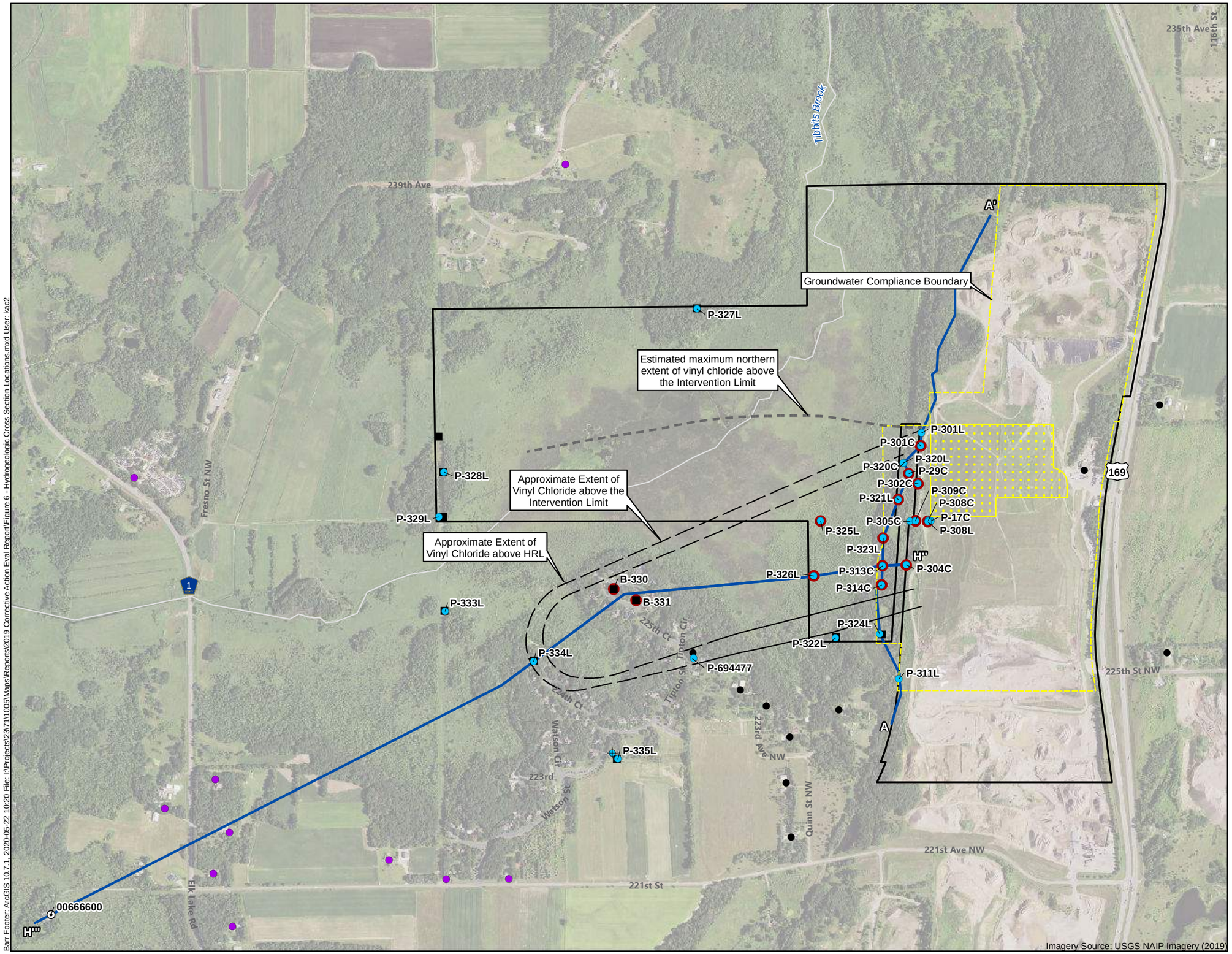
Feet
0 1,000 2,000

Figure 5

RESIDENTIAL WATER SUPPLY WELL NETWORK
Elk River Landfill
Elk River, Minnesota

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Barr Footer: ArcGIS 10.7.1, 2020-05-22 10:07 File: I:\Projects\23\7111\005\Maps\Reports\2019 Corrective Action Eval Report\Figure 5 - Residential Water Supply Well Network.mxd User: kac2



Property Boundary

Pre-Subtitle D Area

Confirmed HRL Exceedance

Cross Section Location

Monitoring Well

Vertical Groundwater Profile Boring (2016/2018)

Residential Well Network Location

Community Water Supply Well

Residential Well (Expanded Network, 2015-2017)

Other Well

Notes:
- Vinyl chloride extents based on 2019 data and investigation data (Barr, 2018).

Feet
0 1,000 2,000

Figure 6

HYDROGEOLOGIC CROSS SECTION LOCATIONS
Elk River Landfill
Elk River, Minnesota

BARR

Barr Footer: ArcGIS 10.7.1, 2020-05-22 10:20 File: I:\Projects\23\71\11005\Maps\Reports\2019 Corrective Action Eval Report\Figure 6 - Hydrogeologic Cross Section Locations.mxd User: kac2

1/4”
3/8
1/4”
1/4”

H’’’ WEST

H’’ EAST

A NORTH

A’ NORTH

11pt Arial Bold

9pt Arial

8pt Arial Italic

2.0 Th

Elevation (ft MSL)

Elevation (ft MSL)

G. Ruis

J. Thompson

SB-6

MW-1

PZ-3

FILL

UPPER OUTWASH

TILL

LOWER OUTWASH

TILL

BEDROCK
(EAU CLAIRE FM.)

Rice Lake/Tibbits Brook

Floating Vegetation

P-326L

P-304C

P-304C-6

B-330 (Projected)

B-331 (Projected)

B-334L

B-334H

P-326C (Intersection with A-A’)

Distance (ft)

Figure 7

HYDROGEOLOGIC CROSS SECTION H”-H’”
Elk River Landfill
Elk River, Minnesota

EAU CLAIRE

Eau Claire Formation:
Fine-grained sandstone/siltstone with shale partings present locally.

Silty sand; silt content approximately 30 F 50%
ML/CL- Silt or clay; < 5% sand; massive to firmly bedded

OWA 102-OWA and 101-OWA. Organics were not detected above Intervention Limits at Wells 43-OWA or 201-OWA or in vertical groundwater profile boring P-304C-6.

Approximate/Inferred Extent of Vinyl Chloride Above Health Risk Limits

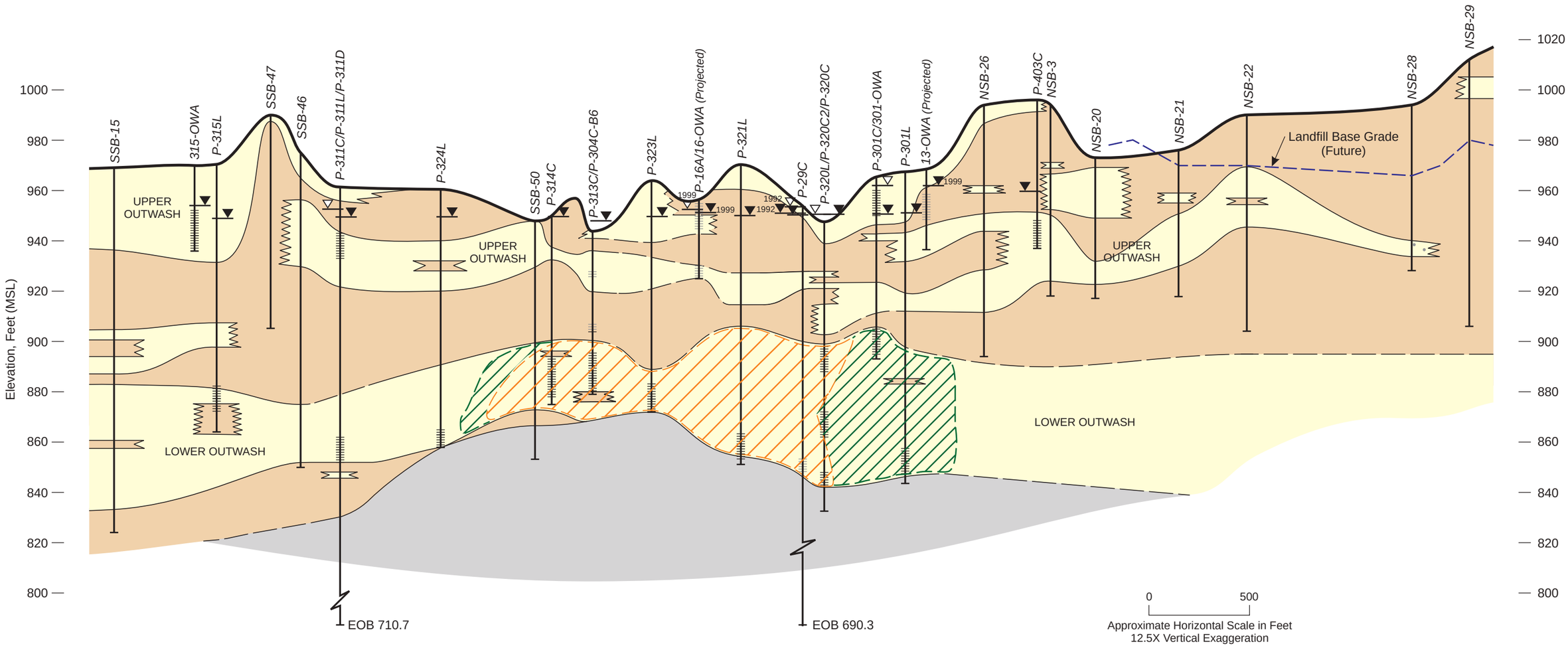
Approximate Extent of Vinyl Chloride Above Intervention Limits

Barr Footer: ArcGIS 10.4, 2018-03-27 16:18 File: I:\Projects\23\71\11005\Users\kac2\20180102_WP_Cross_Sections\Cross Section H_20180327.mxd User: kac2

\\barr.com\projects\Mpls\23 MN\71\23711005 ERL GW Network Development\WorkFiles\Corrective Action\CAAR\figures\ai\Figure 6 - Hydrogeologic Cross Section H"-H"'_v3a.ai

A
SOUTH

A'
NORTH



EXPLANATION

OUTWASH	Includes the following soil types: SP: Sand with <5% fines; thin/discontinuous gravel lenses rare to common. SM: (Where in contact with SP); Silty sand; silt content approximately 30 to 50%.
TILL/LACUSTRINE	Includes the following soil types: ML: Sandy silt - diamict with approximately 10 to 50% Sand and Gravel; firm to very hard. CL: Clay textured diamict with varying amounts of sand and gravel; firm to hard. SM: (Where bounded by ML or CL); Silty sand; silt content approximately 30 - 50% ML/CL: Silt or clay, <5% sand, massive to thinly bedded
BEDROCK	Eau Claire Formation: Fine-grained sandstone/siltstone with shale partings present locally.

LEGEND

- Ground Surface (Approximate)
- Geologic Contact (Dashed where approximate)
- Groundwater Elevation from Shallowest Well (2014 unless otherwise noted)
- Groundwater Elevation (2014 unless otherwise noted)
- Existing Well Screen
- Former Well Screen, Vertical Groundwater Profiling Screen Interval
- Approximate/Inferred Extent of Vinyl Chloride Above Health Risk Limits
- Approximate Extent of Vinyl Chloride Above Intervention Limits

THIS FILE WAS IMPORTED FROM COREL DRAW (.cdr)
LAYERING IS NOT PRESERVED IN THIS PROCESS

Figure 8

HYDROGEOLOGIC
CROSS SECTION A-A'
Elk River Landfill
Elk River, Minnesota

\\barr.com\projects\Mpls\23 MN\71\23711005 ERL, GW Network Development\WorkFiles\Corrective Action\MNA Evaluation\figures\Figure 7 - Hydrogeologic Cross Section A-A'_v2.pdf

Appendices

Appendix A

2018 – 2020 (April) Groundwater Monitoring Data

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-17C	P-17C	P-17C	P-17C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-301C	P-301C	P-301C	P-301C
				Date	7/19/2018	7/12/2019	10/23/2019	12/19/2019	4/17/2018	7/16/2018	10/15/2018	4/08/2019	7/10/2019	10/22/2019	12/19/2019	4/21/2020	4/17/2018	7/16/2018	10/15/2018	4/08/2019	7/08/2019	10/22/2019	12/19/2019	4/21/2020	4/18/2018	7/17/2018	10/18/2018	4/09/2019
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
Volatile Organic Compounds																												
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U J4	< 2.0	< 1.0	< 1.0 H	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5		< 0.50	< 0.50	< 0.50 H	--	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 1.0	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75		< 0.75	< 0.75	< 1.0 H	--	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0	--	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	--	< 1.0	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0		< 4.0	< 10	< 1.0 H	--	2.6	2.6	2.5	2.1	3.0	3.4	--	3.45	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	50.0		< 4.0	< 10	< 2.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 2.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,1-Dichloropropene	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,2,3-Trichlorobenzene	ug/l				< 4.0	< 10	< 5.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 5.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 5.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0		< 4.0	< 10	< 5.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 5.0 ^	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	25.0		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05		< 0.050	< 0.050	< 0.050	--	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	--	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	--	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	0.001		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25		< 0.25	< 0.25	< 0.25 *^	--	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 *^	--	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 *^	--	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25
1,2-Dichloroethylene, cis	ug/l	**6 HRL18 (1)**	12.5		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	10.0		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	1.25		< 4.0	< 10	< 1.0 H*	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	25.0		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,3-Dichlorobenzene	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0 ^	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,3-Dichloropropane	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5		< 0.50	< 0.50	< 0.25 H	--	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.25	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94			< 4.0	< 10	< 5.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.0	--	< 5.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	2.5		< 4.0	< 10	2.6 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
2,2-Dichloropropane	ug/l				< 4.0 ^	< 10	< 4.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H^	< 1.0
Acetone	ug/l	3000 HBV17 (1)	1000		< 40	< 100	< 10 H	--	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10.0 U	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10.0 U	< 20	< 10	< 10 H	< 10
Allyl chloride	ug/l	30 HRL94	7.5		< 4.0	< 10	< 2.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 2.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Benzene	ug/l	2 HRL09 (1)	0.5		1.1	1.2	1.5 H*	--	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50
Bromobenzene	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0 ^	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Bromochloromethane	ug/l				< 4.0	< 10	< 5.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 5.0 ^	< 1.00 U J4	< 2.0	< 1.0	< 1.0 H	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	1.5		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Bromoform	ug/l	40 HRL93	10.0		< 4.0	< 10 *F1	< 5.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0	--	< 5.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Bromomethane	ug/l	10 HRL93	2.5		< 4.0	< 10	< 4.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Butylbenzene	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Butylbenzene, sec	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0 ^	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Butylbenzene, tert	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0 ^	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25		< 0.25	< 0.25	< 0.25	--	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	--	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	--	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25
Chlorobenzene	ug/l	100 HRL93	25.0		6.3	< 10	5.3 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	2.5		< 4.0	< 10 *F1	< 5.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 5.0 ^	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Chloroethane	ug/l	ND RAA16			< 4.0	< 10	< 4.0 H^	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Chloroform	ug/l	20 HRL18	7.5		< 4.0	< 10	< 3.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 3.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Chloromethane	ug/l				< 4.0	< 10	< 3.0 H*^	--	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 3.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	--	< 3.0	< 1.00 U	< 2.0	< 1.0 *^	< 1.0 H	< 1.0
Chlorotoluene, o	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Chlorotoluene, p	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0		6.0	< 10	4.5 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0 ^	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Dibromomethane (methylene bromide)	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	175.0		< 4.0	< 10	< 3.0 H*^	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 3.0	< 1.00 U	< 2.0	< 1.0 *	< 1.0 H	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**			< 4.0	< 10	< 1.0 H	--	4.0	3.7	3.4	3.9	4.1	3.6 ^	--	4.61	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	--	< 1.0	< 1.00 U	< 2.0	2.0	< 1.0 H^	1.8
Ethane	ug/l				--	0.65 h	--	0.55	--	--	--	--	0.14 h	--	0.0060 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	40 HBV19 (1)	12.5		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	50.0		37	34	36 H	--	14	12	12	14	13	14	--	19.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 2.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Ethylene	ug/l				--	< 0.10 h	--	0.047 J	--	--	--	--	1.0 h	--	0.025 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	1 HRL93	0.25		< 0.25	< 0.25	< 1.4 H	--	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4 *	--	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	--	< 1.4	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25
Methane	ug/l				--	2100 h	--	1800	--	--	--	--	500 h	--	1200	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0		< 40	< 100 *	< 10 H	--	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10.0 U	< 10	< 10	< 10	< 10 *^	< 10	--	< 10	< 10.0 U	< 20 ^	< 10	< 10 H	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0		< 20	< 50	< 10 H	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	--	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	< 10	< 5.00 U	< 10	< 5.0	< 5.0 H	< 5.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Methylene chloride	ug/l	5 HRLMCL	1.25		< 4.0	< 10	< 5.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 5.0	< 1.00 U	< 2.0 ^	< 1.0	< 1.0 H	< 1.0
Naphthalene	ug/l	70 HRL13	17.5		< 4.0	< 10	< 5.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 5.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Propylbenzene	ug/l				< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0 ^	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Styrene	ug/l		25.0		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H^	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	1.25		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0 ^	< 1.00 U	< 2.0	< 1.0	< 1.0 H^	< 1.0
Tetrahydrofuran	ug/l	600 HRL18			< 20	< 50	< 10 H	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	--	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	< 10	< 5.00 U	< 10 ^	< 5.0	< 5.0 H	< 5.0
Toluene	ug/l	70 HBV19 (1)	50.0		< 4.0	< 10	< 1.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H	< 1.0
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1		< 0.10	< 0.10	< 0.10	--	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	--	< 0.100 U J4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	--	< 0.100 U J4	< 0.10	< 0.10	< 0.10	< 0.10 *
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0		< 4.0	< 10	< 4.0 H^	--	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	--	< 1.00 U J4	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 1.00 U J4	< 2.0	< 1.0 ^	< 1.0 H	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0		< 4.0	< 10	< 2.0 H	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 2.0	< 1.00 U	< 2.0	< 1.0	< 1.0 H^	< 1.0
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05		0.16	0.12	**0.38**	--	**0.49**	**0.44**	**0.36**	**0.28**	**0.47**	**0.90**	--	**0.668**	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050 *^	--	< 0.0500 U Q H	0.070	0.069	0.063	0.095
Xylene, total	ug/l	300 XYL HBV19 (1)	75		< 8.0	< 20	< 3.0 H	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	--	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 3.0	< 2.00 U	< 4.0	< 2.0	< 2.0 H	< 2.0

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-17C	P-17C	P-17C	P-17C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29C	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-29D	P-301C	P-301C	P-301C	P-301C
				Date	7/19/2018	7/12/2019	10/23/2019	12/19/2019	4/17/2018	7/16/2018	10/15/2018	4/08/2019	7/10/2019	10/22/2019	12/19/2019	4/21/2020	4/17/2018	7/16/2018	10/15/2018	4/08/2019	7/08/2019	10/22/2019	12/19/2019	4/21/2020	4/18/2018	7/17/2018	10/18/2018	4/09/2019
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
General Parameters																												
Alkalinity, total, as CaCO3	mg/l				1260	1040	--	--	--	422	--	--	429	--	--	--	--	178	--	--	172	--	--	--	--	478	--	--
Carbon, total organic	mg/l				--	69.5	56.2	--	--	--	--	--	3.7	2.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cation-Anion balance	%				0.46	2.4	--	--	--	-1.4	--	--	-1.7	--	--	--	--	0.35	--	--	3.3	--	--	--	--	-1.4	--	--
Chloride	mg/l				526	675	--	--	--	49.7	--	--	64.8	--	--	--	--	< 0.50	--	--	< 0.50	--	--	--	--	26.6	--	--
Dissolved oxygen, field	mg/l				9.8	2.4	3.0	5.1	3.5	0.6	1.4	3.5	0.5	2.6	3.1	--	3.6	0.5	0.6	1.5	0.3	0.3	0.7	--	0.2	1.7	1.2	0.7
Iron, ferrous, FE II, field	mg/l				--	6.5	--	--	--	--	--	--	2.70	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l				--	200	--	--	--	--	--	--	18.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l				20.0	2.6	--	--	--	< 0.020	--	--	0.070	--	--	--	--	0.14	--	--	0.17 F1	--	--	--	--	< 0.020	--	--
Nitrogen, nitrate + nitrite, as N	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL			--	< 0.050 H	< 0.050	--	--	--	--	--	< 0.050	< 0.050 H	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l				--	< 0.050 H	< 0.050	--	--	--	--	--	< 0.050	< 0.050 H	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, field	pH units				6.72	6.59	6.60	6.70	7.35	7.53	7.18	7.25	6.85	6.65	680	--	8.56	8.37	8.14	8.00	7.83	8.31	8.17	--	7.63	7.80	7.46	7.42
Redox (oxidation potential), field	mV				-69	-42	-88	12	20.1	131.1	17.5	194.1	176	181	35	--	-151.3	114.5	27.6	199.9	212.4	209.7	111	--	-101.7	-99	242.6	-32.0
Solids, total dissolved	mg/l				2130 H	2340	--	--	--	527	--	--	535	--	--	--	--	199	--	--	201	--	--	--	--	729	--	--
Solids, total suspended	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm				3454	3888	3199	3215	911	900	986	1331	802	932	895	--	317	320	315	323	322	320	309	--	917	1017	1037	1199
Sulfate, as SO4	mg/l				< 2.0	< 40.0	--	--	--	25.8	--	--	22.8	--	--	--	--	3.0	--	--	2.2	--	--	--	--	154	--	--
Sulfide, as S^{2-}, field	mg/l				--	0.75	--	--	--	--	--	--	0.23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C				15.3	15.6	147	14.8	9.4	12.3	12.1	11.1	12.2	11.7	10.0	--	10.1	11.9	11.6	10.6	11.9	11.4	10.4	--	9.8	10.7	10.8	10.4
Turbidity, field	NTU				16.6	22.1	29.1	33.3	14.0	15.5	88.7	61.3	73.1	87.1	71.1	--	10.2	17.1	3.0	3.9	5.1	4.6	4.0	--	16.7	41.7	1.8	4.2
Dissolved Metals																												
Arsenic	ug/l		2.5		20.6	34.0	--	--	--	< 5.0	--	--	< 1.0	--	--	--	--	< 5.0	--	--	< 1.0	--	--	--	--	< 5.0	--	--
Boron	ug/l	**500 RAA17**	250.0		**5250**	**3580**	--	--	--	39.8	--	--	132	--	--	--	--	< 20.0	--	--	< 20.0	--	--	--	--	30.7	--	--
Cadmium	ug/l	0.5 HRL15 (1)			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/l				173	174	--	--	--	123	--	--	122	--	--	--	--	42.6	--	--	43.6	--	--	--	--	142	--	--
Chromium	ug/l	100 CR HRL93	25.0		< 4.0	< 4.0	--	--	--	< 4.0	--	--	< 4.0	--	--	--	--	< 4.0	--	--	< 4.0	--	--	--	--	< 4.0	--	--
Copper	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	ug/l				17400	21000	--	--	--	1480	--	--	1250	--	--	--	--	232	--	--	342	--	--	--	--	841	--	--
Lead	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l				124	131	--	--	--	42	--	--	41.8	--	--	--	--	15.6	--	--	15.9	--	--	--	--	68.3	--	--
Manganese	ug/l	**100 HBV18**			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l				18.6	10.3	--	--	--	2.65	--	--	2.96	--	--	--	--	1.25	--	--	1.29	--	--	--	--	2.43	--	--
Sodium	mg/l				463	481	--	--	--	7.68	--	--	19.2	--	--	--	--	4.38	--	--	4.31	--	--	--	--	7.14	--	--
Zinc	ug/l	2000 HRL94	500.0		12.3	< 10.0	--	--	--	< 10.0	--	--	< 10.0	--	--	--	--	< 10.0	--	--	< 10.0	--	--	--	--	< 10.0	--	--

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-301C	P-301C	P-301C	P-301C	P-301L	P-301L	P-301L	P-301L	P-301L	P-301L	P-301L	P-301L	P-302C	P-302C	P-302C	P-302C	P-302C	P-302C	P-302C	P-304C	P-304C	P-304C	P-304C	P-304C
				Date	7/09/2019	10/22/2019	12/19/2019	4/22/2020	4/18/2018	7/17/2018	10/18/2018	4/11/2019	7/12/2019	10/23/2019	12/19/2019	4/23/2020	4/18/2018	7/17/2018	10/16/2018	4/09/2019	7/10/2019	10/23/2019	4/22/2020	4/17/2018	7/19/2018	10/15/2018	4/09/2019	7/09/2019
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
Volatile Organic Compounds																												
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5		< 1.0	--	< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U J4	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5		< 0.50	--	< 1.0	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50 H	--	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50 *^	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75		< 0.75	--	< 1.0	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75 h	< 0.75	< 1.0 H	--	< 0.750 U	< 0.75 h	< 0.75	< 0.75	< 0.75 h	< 0.75	< 1.0 *^	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	1.5 H	< 2.0	1.5	1.1	1.4
1,1-Dichloroethylene	ug/l	200 HBV19	50.0		< 1.0	--	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 2.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 2.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l				< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l				< 1.0	--	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 5.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0		< 1.0	--	< 5.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 5.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	25.0		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05		< 0.050	< 0.050 h	< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050	--	< 1.00 U	< 0.050 h	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	0.001		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25		< 0.25	0.40 h	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25 *^	--	< 0.250 U	0.45 h	0.41	0.33	0.46 h	0.38	< 0.25 *^	0.436	< 0.25	0.25	< 0.25	< 0.25	< 0.25
1,2-Dichloroethylene, cis	ug/l	**6 HRL18 (1)**	12.5		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	1.0 H	< 2.0	1.1	< 1.0	1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	10.0		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	1.25		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	25.0		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l				< 1.0	--	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l				< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5		< 0.50	--	< 0.25	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.25 H	--	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.25 *^	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94			< 1.0	--	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 5.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	2.5		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l				< 1.0	--	< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H^	< 1.0	< 1.0	< 4.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 4.0	< 1.00 U	< 1.0 H	< 2.0 ^	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	1000		< 10	--	< 10	< 10.0 U	< 10	< 10	< 10 H	< 10	< 10	< 10 H	--	< 10.0 U	< 20	< 20	< 20	< 20	< 10	< 10	< 10.0 U	< 10 H	< 20	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	7.5		< 1.0	--	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 2.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 2.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	0.5		< 0.50 *	--	< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50 H	--	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50 *^	< 0.500 U	< 0.50	0.74	< 0.50	< 0.50	< 0.50 *
Bromobenzene	ug/l				< 1.0	--	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l				< 1.0	--	< 5.0 ^	< 1.00 U J4	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	--	< 1.00 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 5.0 ^	< 1.00 U J4	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	1.5		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	10.0		< 1.0	--	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0 *	< 5.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 5.0 *	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0 *
Bromomethane	ug/l	10 HRL93	2.5		< 1.0	--	< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 4.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 4.0 *	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l				< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l				< 1.0	--	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l				< 1.0	--	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25		< 0.25	< 0.25 h	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	--	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Chlorobenzene	ug/l	100 HRL93	25.0		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	2.5		< 1.0	--	< 5.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0 *^	< 5.0 H	--	< 1.00 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 5.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16			< 1.0	--	< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 4.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 4.0 *^	< 1.00 U	3.3 H	2.6	2.6	2.2	2.0
Chloroform	ug/l	20 HRL18	7.5		< 1.0	--	< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 3.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l				< 1.0	--	< 3.0	< 1.00 U	< 1.0	< 1.0 *^	< 1.0 H	< 1.0	< 1.0	< 3.0 H	--	< 1.00 U	< 2.0	< 2.0 *^	< 2.0	< 2.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0 ^	< 1.0	< 1.0
Chlorotoluene, o	ug/l				< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l				< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0		< 1.0	--	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l				< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l				< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	175.0		< 1.0	--	< 3.0	< 1.00 U	< 1.0	< 1.0 *	< 1.0 H	< 1.0	< 1.0	< 3.0 H	--	< 1.00 U	< 2.0	< 2.0 *	< 2.0	< 2.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**			1.7	3.4 H	1.8	1.43	< 1.0	< 1.0	< 1.0 H^	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	2.4	3.2	2.1	3.6	4.0	1.6 ^	3.63	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Ethane	ug/l				--	--	--	--	--	--	--	--	< 0.10 h	--	0.075 J	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	40 HBV19 (1)	12.5		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	50.0		< 1.0	29 H	< 2.0	< 1.00 U	1.6	1.5	1.3 H	2.4	2.3	2.8 H	--	2.70	23	35	26	27	28	< 2.0 *^	29.4	65 H	72	57	40	34
Ethylene	ug/l				--	--	--	--	--	--	--	--	< 0.10 h	--	0.024 J	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	1 HRL93	0.25		< 0.25	--	< 1.4	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 1.4 H	--	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25 h	< 0.25	< 1.4	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Methane	ug/l				--	--	--	--	--	--	--	--	27 h	--	49	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0		< 10	--	< 10	< 10.0 U	< 10 ^	< 10	< 10 H	< 10	< 10 *	< 10 H	--	< 10.0 U	< 20 ^	< 20	< 20	< 20	< 10	< 10	< 10.0 U	< 10 H	< 20	< 10	< 10	< 10 *
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0		< 5.0	--	< 10	< 5.00 U	< 5.0	< 5.0	< 5.0 H	< 5.0	< 5.0	< 10 H*^	--	< 5.00 U	< 10	< 10	< 10	< 10	< 5.0	< 10 ^	< 5.00 U	< 5.0 H	< 10	< 5.0	< 5.0	< 5.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	1.25		< 1.0	--	< 5.0	< 1.00 U	< 1.0 ^	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	--	< 1.00 U	< 2.0 ^	< 2.0	< 2.0	< 2.0	< 1.0	< 5.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	17.5		< 1.0	--	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 5.0	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l				< 1.0	--	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		25.0		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H^	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	1.25		< 1.0	--	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0 H^	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18			< 5.0	--	< 10	< 5.00 U	< 5.0 ^	< 5.0	< 5.0 H	< 5.0	< 5.0	< 10 H	--	< 5.00 U	< 10 ^	< 10	< 10	< 10	< 5.0	< 10 *^	< 5.00 U	13 H	17	14	8.0	9.0
Toluene	ug/l	70 HBV19 (1)	50.0		< 1.0	--	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1		< 0.10 *	< 0.10 h	< 0.10	< 0.100 U J4	< 0.10	< 0.10	< 0.10	< 0.10 h	< 0.10	< 0.10	--	< 0.100 U J4	< 0.10 h	< 0.10	< 0.10	< 0.10 h	< 0.10	< 0.10	< 0.100 U J4	0.33	0.30	0.20	0.27	0.26
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0		< 1.0	--	< 4.0	< 1.00 U J4	< 1.0	< 1.0 ^	< 1.0 H	< 1.0	< 1.0	< 4.0 H	--	< 1.00 U	< 2.0	< 2.0 ^	< 2.0	< 2.0	< 1.0	< 4.0 ^	< 1.00 U J4	< 1.0 ^H	< 2.0	< 1.0	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0		< 1.0	--	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0 H^	< 1.0	< 1.0	< 2.0 H	--	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 2.0 ^	< 1.00 U	< 1.0 H	< 2.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05		0.079	**0.95 h**	0.073	0.0700	< 0.050	< 0.050	< 0.050	0.073 h	0.071	0.14	--	< 0.0500 U	**0.56 h**	**0.34**	**0.42**	**0.60 h**	**0.53**	0.14	**0.697**	0.17	**0.22**	0.19	0.15	**0.27**
Xylene, total	ug/l	300 XYL HBV19 (1)	75		< 2.0	--	< 3.0	< 2.00 U	< 2.0	< 2.0	< 2.0 H	< 2.0	< 2.0	< 3.0 H	--	< 2.00 U	< 4.0	< 4.0	< 4.0	< 4.0	< 2.0	< 3.0 *	< 2.00 U	< 2.0 H	< 4.0	< 2.0	< 2.0	< 2.0

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Location				P-301C	P-301C	P-301C	P-301C	P-301L	P-301L	P-301L	P-301L	P-301L	P-301L	P-301L	P-301L	P-302C	P-302C	P-302C	P-302C	P-302C	P-302C	P-302C	P-304C	P-304C	P-304C	P-304C	P-304C
Date				7/09/2019	10/22/2019	12/19/2019	4/22/2020	4/18/2018	7/17/2018	10/18/2018	4/11/2019	7/12/2019	10/23/2019	12/19/2019	4/23/2020	4/18/2018	7/17/2018	10/16/2018	4/09/2019	7/10/2019	10/23/2019	4/22/2020	4/17/2018	7/19/2018	10/15/2018	4/09/2019	7/09/2019
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																								
Effective Date		04/27/2020	07/23/2015																								
Exceedance Key		**Bold**	Underline																								
General Parameters																											
Alkalinity, total, as CaCO3	mg/l			473	--	--	--	--	293	--	--	285	--	--	--	--	692	--	--	651	--	--	--	796	--	--	730
Carbon, total organic	mg/l			--	--	--	--	--	--	--	--	1.5	< 1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cation-Anion balance	%			2.0	--	--	--	--	-0.063	--	--	2.3	--	--	--	--	-1.1	--	--	9.9	--	--	--	2.2	--	--	0.88
Chloride	mg/l			27.5	--	--	--	--	41.7	--	--	39.0	--	--	--	--	240	--	--	190	--	--	--	80.2	--	--	57.8
Dissolved oxygen, field	mg/l			0.8	2.2	1.3	--	1.8	3.3	2.0	1.0	0.3	0.4	0.6	--	0.6	2.6	2.4	1.0	2.4	2.1	--	2.4	3.7	5.0	1.1	2.4
Iron, ferrous, FE II, field	mg/l			--	--	--	--	--	--	--	--	0.15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l			--	--	--	--	--	--	--	--	8.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l			0.068	--	--	--	--	0.23	--	--	< 0.020	--	--	--	--	0.039	--	--	0.059	--	--	--	0.048	--	--	0.039
Nitrogen, nitrate + nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	< 0.050 H	< 0.050	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l			--	--	--	--	--	--	--	--	< 0.050 H	< 0.050	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, field	pH units			7.14	7.11	7.29	--	7.68	6.59	7.38	7.41	7.28	7.18	7.20	--	7.20	7.45	7.04	7.12	7.07	7.65	--	6.86	6.63	6.67	6.90	6.65
Redox (oxidation potential), field	mV			326.5	269	100	--	128.9	-50	303.2	2.6	25	31	59	--	-143.9	-131	-10.8	74.2	326.0	257.1	--	-115.8	-25	59.7	-32.7	283.6
Solids, total dissolved	mg/l			811	--	--	--	--	379	--	--	347	--	--	--	--	1050	--	--	1050	--	--	--	983 H	--	--	888
Solids, total suspended	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm			1160	1838	1155	--	740	675	736	724	638	704	680	--	1709	1938	1782	1868	1890	1231	--	1358	1993	1533	1355	1551
Sulfate, as SO4	mg/l			160	--	--	--	--	23.5	--	--	18.2	--	--	--	--	19.8	--	--	29.5	--	--	--	9.3	--	--	17.9
Sulfide, as S^{2-}, field	mg/l			--	--	--	--	--	--	--	--	0.10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C			10.9	12.4	9.9	--	9.0	15.0	10.1	8.7	10.7	9.9	8.8	--	11.9	14.4	13.1	12.9	13.3	10.5	--	9.0	10.5	9.8	8.5	10.2
Turbidity, field	NTU			9.8	34.7	10.0	--	8.5	3.6	1.4	8.0	3.0	2.1	1.9	--	26.6	6.0	7.0	20.1	42.1	6.9	--	20.1	12.1	3.6	41.2	15.8
Dissolved Metals																											
Arsenic	ug/l		2.5	5.1	--	--	--	--	< 5.0	--	--	< 1.0	--	--	--	--	8.5	--	--	11.6	--	--	--	< 5.0	--	--	2.9
Boron	ug/l	**500 RAA17**	250.0	43.9	--	--	--	--	33.1	--	--	40.7	--	--	--	--	384	--	--	444	--	--	--	**1100**	--	--	**788**
Cadmium	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/l			156	--	--	--	--	88.4	--	--	91.5	--	--	--	--	152	--	--	180	--	--	--	197	--	--	184
Chromium	ug/l	100 CR HRL93	25.0	< 4.0	--	--	--	--	< 4.0	--	--	< 4.0	--	--	--	--	< 4.0	--	--	< 4.0	--	--	--	< 4.0	--	--	< 4.0
Copper	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	ug/l			1080	--	--	--	--	175	--	--	238	--	--	--	--	12300	--	--	16100	--	--	--	4440	--	--	4240
Lead	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l			71.7	--	--	--	--	31.5	--	--	32.1	--	--	--	--	125	--	--	127	--	--	--	76.8	--	--	66.1
Manganese	ug/l	**100 HBV18**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l			2.47	--	--	--	--	6.37	--	--	2.38	--	--	--	--	4.85	--	--	5.22	--	--	--	2.51	--	--	2.19
Sodium	mg/l			6.87	--	--	--	--	7.7	--	--	5.21	--	--	--	--	40.3	--	--	43.6	--	--	--	63	--	--	45.5
Zinc	ug/l	2000 HRL94	500.0	< 10.0	--	--	--	--	< 10.0	--	--	< 10.0	--	--	--	--	< 10.0	--	--	< 10.0	--	--	--	< 10.0	--	--	< 10.0

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-304C	P-304C	P-305C	P-305C	P-305C	P-305C	P-305C	P-305C	P-305C	P-308C	P-308C	P-308L	P-308L	P-308L	P-308L	P-309C	P-309C	P-311D	P-311D	P-311D	P-311D	P-311D	P-311D	P-311D
				Date	10/23/2019	4/22/2020	4/17/2018	7/19/2018	10/16/2018	4/09/2019	7/08/2019	10/23/2019	4/22/2020	7/19/2018	7/11/2019	7/12/2019	10/23/2019	12/19/2019	12/20/2019	7/19/2018	7/09/2019	4/23/2018	7/20/2018	10/22/2018	6/10/2019	7/11/2019	10/22/2019	4/23/2020
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
Volatile Organic Compounds																												
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5		< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U J4	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U J4
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5		< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 *^	< 0.500 U	< 2.5	< 2.5	< 0.50	< 0.50	< 1.0	--	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75		< 1.0	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0 *^	< 0.750 U	< 3.8	< 3.8	< 0.75	< 1.0	< 1.0 F1	--	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	--	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0		1.6	1.45	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	16	8.5	23	--	4.0	5.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HBV19	50.0		< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 2.0	< 2.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,1-Dichloropropene	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,2,3-Trichlorobenzene	ug/l				< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 5.0	< 5.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	--	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0		< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 5.0	< 5.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HBV19	25.0		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05		< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.25	< 0.25	< 0.050	< 0.050	< 0.050	--	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	0.001		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25		< 0.25 *	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 *^	< 0.250 U	< 1.3	< 1.3	0.29	0.26	0.39	--	< 0.25	0.27	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 *^	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	**6 HRL18 (1)**	12.5		1.2	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	2.2	< 1.0	2.8	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	10.0		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,2-Dichloropropane	ug/l	5 HRL94	1.25		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	25.0		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,3-Dichlorobenzene	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1^	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,3-Dichloropropane	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5		< 0.25	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25 *^	< 0.500 U	< 2.5	< 2.5	< 0.50	< 0.25	< 0.25	--	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94			< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 5.0	< 5.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	2.5		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
2,2-Dichloropropane	ug/l				< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 4.0 ^	< 4.0	< 1.0	< 4.0	< 4.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Acetone	ug/l	3000 HBV17 (1)	1000		< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U Q H	< 40	< 40	< 10	< 10	11	--	< 40	< 40	< 10	< 10	< 10	< 10	< 10	--	< 10.0 U
Allyl chloride	ug/l	30 HRL94	7.5		< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 2.0	< 2.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	--	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	0.5		< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 *^	< 0.500 U	< 2.5	< 2.5	< 0.50	< 0.50	< 0.50	--	< 0.50	< 0.50 *	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.500 U
Bromobenzene	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1^	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Bromochloromethane	ug/l				< 5.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 ^	< 1.00 U J4	< 4.0	< 4.0	< 1.0	< 5.0	< 5.0 F1^	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U J4
Bromodichloromethane	ug/l	3 HBV18 (1)	1.5		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Bromoform	ug/l	40 HRL93	10.0		< 5.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 4.0	< 4.0	< 1.0 *	< 5.0 *^	< 5.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Bromomethane	ug/l	10 HRL93	2.5		< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 *	< 1.00 U	< 4.0	< 4.0	< 1.0	< 4.0	< 4.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Butylbenzene	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Butylbenzene, sec	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 *^	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Butylbenzene, tert	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1^	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25		< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 1.3	< 1.3	< 0.25	< 0.25	< 0.25	--	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	25.0		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	2.5		< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *^	< 1.00 U J4	< 4.0	< 4.0	< 1.0 *^	< 5.0	< 5.0 F1^	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U J4
Chloroethane	ug/l	ND RAA16			4.2 ^	1.61	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 4.0 ^	< 4.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Chloroform	ug/l	20 HRL18	7.5		< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 3.0	< 3.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Chloromethane	ug/l				< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 3.0	< 3.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Chlorotoluene, o	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Chlorotoluene, p	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	5.1	4.7	< 1.0	< 1.0	< 1.0 ^	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Dibromomethane (methylene bromide)	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	175.0		< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 4.0	< 4.0	3.2	< 3.0	4.6	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**			< 1.0	< 1.00 U	1.6	1.2	1.5	1.3	2.0	1.0 ^	1.50	< 4.0	< 4.0	16	8.7	**24**	--	6.7	5.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Ethane	ug/l				--	--	--	--	--	--	--	--	--	--	--	0.58 h	--	0.46	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	40 HBV19 (1)	12.5		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	50.0		38	46.9	10	8.5	8.3	7.0	11	8.8 *^	10.9	43	31	38	26	55	--	33	32	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Ethylene	ug/l				--	--	--	--	--	--	--	--	--	--	--	0.14 h	--	0.26	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	1 HRL93	0.25		< 1.4	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4	< 0.250 U	< 1.3	< 1.3	< 0.25	< 1.4	< 1.4	--	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	--	< 0.250 U
Methane	ug/l				--	--	--	--	--	--	--	--	--	--	--	770 h	--	2400	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0		< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 40	< 40	< 10 *	< 10	< 10	--	< 40	< 40	< 10	< 10	< 10	< 10	< 10 ^	--	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0		< 10	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10 ^	< 5.00 U	< 20	< 20	< 5.0	< 10	< 10	--	< 20	< 20	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 4.0	< 4.0	1.5	< 1.0	1.6	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	1.25		< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 5.0	< 5.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Naphthalene	ug/l	70 HRL13	17.5		< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 4.0	< 4.0	< 1.0	< 5.0	< 5.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Propylbenzene	ug/l				< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 ^	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Styrene	ug/l		25.0		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 F1	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Tetrachloroethylene	ug/l	4 HBV14 (1)	1.25		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0 ^	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18			15	9.76	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10 *^	< 5.00 U	33	< 20	< 5.0	< 10	< 10	--	< 20	< 20	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	< 5.00 U
Toluene	ug/l	70 HBV19 (1)	50.0		< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 4.0	< 4.0	< 1.0	8.8	< 1.0 F1	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1		0.21	0.188 J4	< 0.10	< 0.10	< 0.10	< 0.10 *	< 0.10	< 0.10	< 0.100 U J4	< 0.50	< 0.50	0.11	< 0.10	< 0.10	--	< 0.10	< 0.10 *	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.100 U J4
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0		< 4.0	< 1.00 U J4	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 4.0	< 4.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0		< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0 ^	< 1.00 U	< 4.0	< 4.0	< 1.0	< 2.0	< 2.0	--	< 4.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05		**0.50**	**0.256**	< 0.050	< 0.050	< 0.050	0.067	0.076	0.12	< 0.0500 U Q H	< 0.25	< 0.25	**1.7**	**0.41**	**1.9**	--	**0.31**	**0.41**	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050 *^	< 0.0500 U
Xylene, total	ug/l	300 XYL HBV19 (1)	75		< 3.0	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0 *	< 2.00 U	< 8.0	< 8.0	< 2.0	< 3.0	< 3.0 F1	--	< 8.0	< 8.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 2.00 U

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

				Location	P-304C	P-304C	P-305C	P-305C	P-305C	P-305C	P-305C	P-305C	P-305C	P-308C	P-308C	P-308L	P-308L	P-308L	P-308L	P-309C	P-309C	P-311D	P-311D	P-311D	P-311D	P-311D	P-311D	P-311D
				Date	10/23/2019	4/22/2020	4/17/2018	7/19/2018	10/16/2018	4/09/2019	7/08/2019	10/23/2019	4/22/2020	7/19/2018	7/11/2019	7/12/2019	10/23/2019	12/19/2019	12/20/2019	7/19/2018	7/09/2019	4/23/2018	7/20/2018	10/22/2018	6/10/2019	7/11/2019	10/22/2019	4/23/2020
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																									
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
General Parameters																												
Alkalinity, total, as CaCO3	mg/l				--	--	--	312	--	--	342	--	--	1220	1090	540	--	--	598	560	561	--	198	--	--	172	--	--
Carbon, total organic	mg/l				--	--	--	--	--	--	--	--	--	--	--	4.4	3.9	--	2.2	--	--	--	--	--	--	--	--	--
Cation-Anion balance	%				--	--	--	3.4	--	--	1.7	--	--	2.3	1.3	7.8	--	--	--	0.25	0.78	--	-3.9	--	--	1.6	--	--
Chloride	mg/l				--	--	--	53.2	--	--	78.3	--	--	771	702	41.3	--	--	32.1	243	240	--	< 0.50	--	--	< 0.50	--	--
Dissolved oxygen, field	mg/l				4.1	--	2.1	2.3	2.6	0.7	1.1	1.3	--	11.0	9.4	0.6	0.4	0.8	0.8	7.0	2.0	0.1	9.1	0.5	0.2	0.6	0.5	--
Iron, ferrous, FE II, field	mg/l				--	--	--	--	--	--	--	--	--	--	--	4.5	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l				--	--	--	--	--	--	--	--	--	--	--	187	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l				--	--	--	0.060	--	--	0.068	--	--	3.3	2.8	0.028	--	--	--	0.23	0.29	--	0.20	--	--	0.16	--	--
Nitrogen, nitrate + nitrite, as N	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL			--	--	--	--	--	--	--	--	--	--	--	< 0.050 H	< 0.050	--	< 0.050	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l				--	--	--	--	--	--	--	--	--	--	--	< 0.050 H	< 0.050	--	0.066	--	--	--	--	--	--	--	--	--
pH, field	pH units				6.66	--	7.62	7.28	7.19	7.44	7.33	7.56	--	6.72	6.72	7.01	7.40	7.50	7.50	6.90	6.79	7.78	7.94	7.47	7.85	7.57	7.60	--
Redox (oxidation potential), field	mV				283.0	--	-68.1	3.0	166.9	135.4	248.6	251.5	--	-70	215.0	-179	-217	-74	-74	-27	352.6	47.2	309.5	359.0	160	76.4	243.7	--
Solids, total dissolved	mg/l				--	--	--	451 H	--	--	481 H	--	--	2490 H	2410	658	--	--	--	1120 H	986	--	190	--	--	179	--	--
Solids, total suspended	mg/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm				1598	--	687	687	712	733	830	721	--	3891	3794	1111	599	1080	1080	1675	1907	492	340	335	305	351	340	--
Sulfate, as SO4	mg/l				--	--	--	9.1	--	--	8.3	--	--	< 40.0	< 40.0	19.9	--	--	38.9	11.9	10.3	--	3.1	--	--	3.2	--	--
Sulfide, as S^{2-}, field	mg/l				--	--	--	--	--	--	--	--	--	--	--	0.19	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C				9.9	--	10.3	12.0	12.3	11.4	12.5	11.6	--	15.3	15.3	17.9	14.0	9.9	9.9	13.4	13.2	8.8	9.5	8.7	8.8	8.7	8.6	--
Turbidity, field	NTU				10.8	--	16.3	10.9	4.7	7.1	7.3	6.0	--	6.0	30.9	8.7	10.9	12.2	122	69.3	18.7	0.8	5.1	0.6	1.3	2.0	0.8	--
Dissolved Metals																												
Arsenic	ug/l		2.5		--	--	--	< 5.0	--	--	6.4	--	--	33.4	35.8	< 1.0	--	--	--	13.2	21.5	--	< 5.0	--	--	1.7	--	--
Boron	ug/l	**500 RAA17**	250.0		--	--	--	**519**	--	--	**613**	--	--	**3940**	**4140 ^**	126	--	--	--	**1270**	**1220**	--	< 20.0	--	--	22.6	--	--
Cadmium	ug/l	0.5 HRL15 (1)			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/l				--	--	--	69.9	--	--	75.0	--	--	205	181	152	--	--	--	169	166	--	46.0	--	--	44.2	--	--
Chromium	ug/l	100 CR HRL93	25.0		--	--	--	< 4.0	--	--	< 4.0	--	--	< 4.0	< 4.0	< 4.0	--	--	--	< 4.0	< 4.0	--	< 4.0	--	--	< 4.0	--	--
Copper	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	ug/l				--	--	--	1530	--	--	1980	--	--	20900	17600	18500	--	--	--	6460	6440	--	1180	--	--	1150	--	--
Lead	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l				--	--	--	49.2	--	--	56.9	--	--	157	136	60.6	--	--	--	77.5	74.9	--	14.1	--	--	13.7	--	--
Manganese	ug/l	**100 HBV18**			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l				--	--	--	2	--	--	2.18	--	--	11.6	11.2	3.55	--	--	--	3.99	4.41	--	1.2	--	--	1.26	--	--
Sodium	mg/l				--	--	--	18.6	--	--	21.8	--	--	546	488	18.2	--	--	--	71.8	82.2	--	3.96	--	--	4.41	--	--
Zinc	ug/l	2000 HRL94	500.0		--	--	--	< 10.0	--	--	< 10.0	--	--	< 10.0	< 10.0	< 10.0	--	--	--	< 10.0	< 10.0	--	< 10.0	--	--	< 10.0	--	--

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-311L	P-311L	P-311L	P-311L	P-311L	P-311L	P-311L	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-320C	P-320C	P-320C
				Date	4/20/2018	7/19/2018	10/18/2018	4/11/2019	7/10/2019	10/23/2019	4/23/2020	4/23/2018	7/16/2018	10/15/2018	4/09/2019	7/09/2019	10/22/2019	4/23/2020	4/23/2018	7/17/2018	10/16/2018	4/10/2019	7/09/2019	10/23/2019	4/22/2020	4/17/2018	7/16/2018	10/15/2018
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
Volatile Organic Compounds																												
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U J4	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5		< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 *^	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 *^	< 0.500 U	< 0.50	< 0.50	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75		< 0.75 h	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0 *^	< 0.750 U	< 0.75 h	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0	< 0.750 U	< 0.75 h	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0 *^	< 0.750 U	< 0.75	< 0.75	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	1.24	4.8	7.0	7.2	4.8	5.0	4.5	4.33	5.2	4.6	4.0	4.0	3.7	6.1 *^	5.17	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	50.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 2.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0 ^	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	25.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05		< 0.050 h	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050 h	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050 h	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	0.001		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25		< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 *^	< 0.250 U	< 0.25 h	0.25	< 0.25	< 0.25	< 0.25	< 0.25 *^	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 *^	< 0.250 U	< 0.25	< 0.25	< 0.25
1,2-Dichloroethylene, cis	ug/l	**6 HRL18 (1)**	12.5		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	1.7	2.4	2.4	1.6	1.8	1.6	1.38	1.5	1.7	1.3	1.4 ^	1.4	2.0 *^	1.57	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	10.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	1.25		< 1.0	< 1.0	< 1.0 H	< 1.0 F1	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	25.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5		< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25 *^	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25 *^	< 0.500 U	< 0.50	< 0.50	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94			< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	2.5		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l				< 1.0	< 1.0	< 1.0 H^	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	1000		< 10	< 10	< 10 H	< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	7.5		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	0.5		< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 *^	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50 *F1	< 0.50	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50 *	< 0.50 *^	< 0.500 U	< 0.50	< 0.50	< 0.50
Bromobenzene	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 ^	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 ^	< 1.00 U J4	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	1.5		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	10.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	2.5		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 4.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25		< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25
Chlorobenzene	ug/l	100 HRL93	25.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	2.5		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 *^	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16			< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 4.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	7.5		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0 *^	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0 ^
Chlorotoluene, o	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	175.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**			< 1.0	< 1.0	< 1.0 H^	< 1.0	< 1.0	< 1.0 ^	1.56	4.5	7.3	6.9	5.0	4.6	4.3 ^	4.53	3.8	3.2	2.6	2.7	2.1	3.8 ^	4.75	4.3	3.5	3.5
Ethane	ug/l				--	--	--	--	--	--	--	--	--	--	--	0.23 h	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	40 HBV19 (1)	12.5		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	50.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 2.0 *^	1.23	18	23	21	15	14	14	19.7	22	20	16	19	16	24 *^	25.3	5.5	4.1	7.8
Ethylene	ug/l				--	--	--	--	--	--	--	--	--	--	--	< 0.10 h	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	1 HRL93	0.25		< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4	< 0.250 U	< 0.25	< 0.25	< 0.25
Methane	ug/l				--	--	--	--	--	--	--	--	--	--	--	450 h	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0		< 10	< 10	< 10 H	< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10 *	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0		< 5.0	< 5.0	< 5.0 H	< 5.0	< 5.0	< 10 ^	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10 ^	< 5.00 U	< 5.0	< 5.0	< 5.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	1.25		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	17.5		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l				< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Styrene	ug/l		25.0		< 1.0	< 1.0	< 1.0 H^	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	1.25		< 1.0	< 1.0	< 1.0 H^	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18			< 5.0	< 5.0	< 5.0 H	< 5.0	< 5.0	< 10 *^	< 5.00 U	20	26	22	18	16	13	15.1	17	18	14	18	17	13 *^	17.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HBV19 (1)	50.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1		< 0.10 h	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.100 U J4	< 0.10 h	< 0.10	< 0.10	0.10	0.11 *	< 0.10	0.109 J4	< 0.10 h	< 0.10	< 0.10	< 0.10	< 0.10 *	< 0.10	< 0.100 U J4	< 0.10	< 0.10	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0		< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 4.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	< 1.00 U J4	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 4.0 ^	< 1.00 U J4	< 1.0 ^	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0		< 1.0	< 1.0	< 1.0 H^	< 1.0	< 1.0	< 2.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05		< 0.050 h	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050 *^	< 0.0500 U	**0.22 h**	**0.37**	**0.38**	**0.38**	**0.30**	**0.59**	**0.306**	0.088 h	0.13	0.14	**0.20**	0.15	**0.52**	**0.329**	**0.20**	0.19	0.057
Xylene, total	ug/l	300 XYL HBV19 (1)	75		< 2.0	< 2.0	< 2.0 H	< 2.0	< 2.0	< 3.0 *	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0 *	< 2.00 U	< 2.0	< 2.0	< 2.0

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-311L	P-311L	P-311L	P-311L	P-311L	P-311L	P-311L	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-313C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-314C	P-320C	P-320C	P-320C
				Date	4/20/2018	7/19/2018	10/18/2018	4/11/2019	7/10/2019	10/23/2019	4/23/2020	4/23/2018	7/16/2018	10/15/2018	4/09/2019	7/09/2019	10/22/2019	4/23/2020	4/23/2018	7/17/2018	10/16/2018	4/10/2019	7/09/2019	10/23/2019	4/22/2020	4/17/2018	7/16/2018	10/15/2018
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
General Parameters																												
Alkalinity, total, as CaCO3	mg/l			--	347	--	--	319	--	--	--	621	--	--	532	--	--	--	810	--	--	735	--	--	--	376	--
Carbon, total organic	mg/l			--	--	--	--	--	--	--	--	--	--	--	2.9	4.1	--	--	--	--	--	--	--	--	--	--	--	--
Cation-Anion balance	%			--	1.2	--	--	4.1	--	--	--	-2.5	--	--	0.80	--	--	--	-2.8	--	--	4.1	--	--	--	-2.4	--
Chloride	mg/l			--	27.0	--	--	28.3	--	--	--	74.7	--	--	72.2	--	--	--	66.5	--	--	56.2	--	--	--	72.1	--
Dissolved oxygen, field	mg/l			0.6	2.5	1.7	1.1	0.7	1.5	--	4.2	1.3	4.0	2.3	0.7	0.9	--	0.4	0.3	3.5	1.4	2.1	3.2	--	5.9	0.2	0.9
Iron, ferrous, FE II, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	1.50	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	25.0	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l			--	< 0.020	--	--	< 0.020	--	--	--	< 0.020	--	--	< 0.020	--	--	--	< 0.020	--	--	< 0.020	--	--	--	< 0.020	--
Nitrogen, nitrate + nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--	< 0.050	< 0.050 H	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--	< 0.050	< 0.050 H	--	--	--	--	--	--	--	--	--	--	--
pH, field	pH units			7.66	7.36	7.95	7.33	7.19	7.00	--	5.96	7.15	6.95	7.22	6.87	6.84	--	6.95	7.00	6.67	7.00	6.69	6.76	--	7.55	7.42	7.18
Redox (oxidation potential), field	mV			151.9	54	99.4	338	290.7	271.5	--	176.4	156.9	28.3	266.7	133	89	--	-18.1	213.2	311.4	333.8	307.1	282.1	--	113.7	329.6	329.3
Solids, total dissolved	mg/l			--	449 H	--	--	413	--	--	--	722	--	--	673	--	--	--	925	--	--	895	--	--	--	505	--
Solids, total suspended	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm			734	693	723	761	782	774	--	1161	1289	1306	1168	1119	1220	--	1106	1534	1542	1554	1626	1472	--	861	885	884
Sulfate, as SO4	mg/l			--	21.5	--	--	21.1	--	--	--	21.3	--	--	20.6	--	--	--	35.5	--	--	21.7	--	--	--	33.1	--
Sulfide, as S^{2-}, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	0.06	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C			8.6	9.4	9.3	7.7	9.9	9.0	--	11.6	9.9	8.5	8.8	11.0	8.3	--	9.5	11.4	8.8	6.4	10.7	8.8	--	9.0	11.4	10.3
Turbidity, field	NTU			26.3	63.9	58.0	13.5	24.0	29.3	--	13.3	11.9	2.2	4.6	9.9	8.0	--	50.3	156.0	36.4	10.9	34.6	23.8	--	15.3	7.6	5.9
Dissolved Metals																												
Arsenic	ug/l		2.5	--	< 5.0	--	--	< 1.0	--	--	--	< 5.0	--	--	1.2	--	--	--	< 5.0	--	--	< 1.0	--	--	--	5.6	--
Boron	ug/l	**500 RAA17**	250.0	--	24.5	--	--	21.3	--	--	--	59.1	--	--	61.6	--	--	--	42.5	--	--	66.0	--	--	--	25.7	--
Cadmium	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/l			--	101	--	--	101	--	--	--	168	--	--	157	--	--	--	213	--	--	216	--	--	--	115	--
Chromium	ug/l	100 CR HRL93	25.0	--	< 4.0	--	--	< 4.0	--	--	--	< 4.0	--	--	< 4.0	--	--	--	< 4.0	--	--	4.6	--	--	--	< 4.0	--
Copper	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	ug/l			--	866	--	--	992	--	--	--	308	--	--	469	--	--	--	6530	--	--	11400	--	--	--	3330	--
Lead	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l			--	36.8	--	--	35.6	--	--	--	64.4	--	--	59.7	--	--	--	76.6	--	--	75.8	--	--	--	42.9	--
Manganese	ug/l	**100 HBV18**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l			--	1.72	--	--	1.78	--	--	--	2.51	--	--	2.36	--	--	--	2.75	--	--	2.76	--	--	--	2.14	--
Sodium	mg/l			--	4.09	--	--	4.59	--	--	--	11	--	--	10.9	--	--	--	9.76	--	--	10.1	--	--	--	5.69	--
Zinc	ug/l	2000 HRL94	500.0	--	< 10.0	--	--	< 10.0	--	--	--	< 10.0	--	--	< 10.0	--	--	--	< 10.0	--	--	< 10.0	--	--	--	< 10.0	--

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-320C	P-320C	P-320C	P-320C	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320L	P-320L	P-320L	P-320L	P-320L	P-320L	P-320L	P-321L	P-321L	P-321L	P-321L	P-321L	P-321L
				Date	4/08/2019	7/08/2019	10/22/2019	4/21/2020	4/17/2018	7/16/2018	10/15/2018	4/08/2019	7/08/2019	10/22/2019	4/21/2020	4/17/2018	7/16/2018	10/15/2018	4/08/2019	7/08/2019	10/23/2019	4/21/2020	4/17/2018	7/16/2018	10/15/2018	4/08/2019	7/10/2019	10/23/2019
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
Volatile Organic Compounds																												
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5		< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5		< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 *^	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75		< 0.75	< 0.75	< 1.0	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	--	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0 *^	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75 h	< 0.75	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	1.03	1.5	1.3	1.4	1.3	1.4	2.0 *^	1.95	5.7	5.5	6.7	5.1	5.1	4.8
1,1-Dichloroethylene	ug/l	200 HBV19	50.0		< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,1-Dichloropropene	ug/l				< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l				< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 5.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0		< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	25.0		< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05		< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	0.001		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0		< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25		< 0.25	< 0.25	< 0.25 *^	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 *^	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 *^	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25 *
1,2-Dichloroethylene, cis	ug/l	**6 HRL18 (1)**	12.5		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	10.0		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	1.25		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	25.0		< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l				< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l				< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5		< 0.50	< 0.50	< 0.25	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25 *^	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.25
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94			< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	2.5		< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l				< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0
Acetone	ug/l	3000 HBV17 (1)	1000		< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10	--	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	7.5		< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Benzene	ug/l	2 HRL09 (1)	0.5		< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 *^	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50
Bromobenzene	ug/l				< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l				< 1.0	< 1.0	< 5.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 ^	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
Bromodichloromethane	ug/l	3 HBV18 (1)	1.5		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	10.0		< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *^
Bromomethane	ug/l	10 HRL93	2.5		< 1.0	< 1.0	< 4.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0
Butylbenzene	ug/l				< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l				< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l				< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25		< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25
Chlorobenzene	ug/l	100 HRL93	25.0		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	2.5		< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
Chloroethane	ug/l	ND RAA16			< 1.0	< 1.0	< 4.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^
Chloroform	ug/l	20 HRL18	7.5		< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0
Chloromethane	ug/l				< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	--	< 1.00 U	< 1.0 ^*	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0 ^*	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 3.0
Chlorotoluene, o	ug/l				< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l				< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0		< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l				< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l				< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	175.0		< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 1.0	1.3	1.1	< 1.0	< 1.0	< 3.0
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**			3.6	4.5	3.7 ^	4.52	3.8	3.1	3.3	2.6	3.0	--	3.06	1.6	1.7	1.8	< 1.0	2.2	2.0 ^	2.58	7.7	7.0	7.8	6.6	7.6	5.6
Ethane	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.23 h	--
Ethyl benzene	ug/l	40 HBV19 (1)	12.5		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	50.0		5.1	7.0	8.3	11.5	10	7.0	4.4	7.5	8.9	--	13.5	7.6	8.3	8.3	8.0	8.2	11 *^	12.2	22	20	21	18	20	16
Ethylene	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.10 h	--
Hexachlorobutadiene	ug/l	1 HRL93	0.25		< 0.25	< 0.25	< 1.4 *	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	--	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 1.4
Methane	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	530 h	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0		< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10	--	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0		< 5.0	< 5.0	< 10	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10 ^	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	1.25		< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
Naphthalene	ug/l	70 HRL13	17.5		< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
Propylbenzene	ug/l				< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		25.0		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	1.25		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18			< 5.0	< 5.0	< 10	< 5.00 U	5.6	5.5	< 5.0	< 5.0	< 5.0	--	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10 *^	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10
Toluene	ug/l	70 HBV19 (1)	50.0		< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1		< 0.10	< 0.10	< 0.10	< 0.100 U J4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.100 U J4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.100 U J4	< 0.10	< 0.10	< 0.10	< 0.10 h*	< 0.10	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0		< 1.0	< 1.0	< 4.0 ^	< 1.00 U J4	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0		< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.00 U	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0 ^	< 1.00 U	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05		**0.27**	0.16	**0.24**	0.178	0.050	0.058	0.19	0.060	0.062	0.13	< 0.100 U Q H	**0.21**	0.17	0.14	**0.21**	**0.21**	**0.55**	**0.271**	**1.1**	**1.1**	**1.0**	**1.4 h**	**0.98**	**1.8**
Xylene, total	ug/l	300 XYL HBV19 (1)	75		< 2.0	< 2.0	< 3.0	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0 *	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

			Location	P-320C	P-320C	P-320C	P-320C	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320C2	P-320L	P-320L	P-320L	P-320L	P-320L	P-320L	P-320L	P-321L	P-321L	P-321L	P-321L	P-321L	P-321L
			Date	4/08/2019	7/08/2019	10/22/2019	4/21/2020	4/17/2018	7/16/2018	10/15/2018	4/08/2019	7/08/2019	10/22/2019	4/21/2020	4/17/2018	7/16/2018	10/15/2018	4/08/2019	7/08/2019	10/23/2019	4/21/2020	4/17/2018	7/16/2018	10/15/2018	4/08/2019	7/10/2019	10/23/2019
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																								
Effective Date		04/27/2020	07/23/2015																								
Exceedance Key		**Bold**	Underline																								
General Parameters																											
Alkalinity, total, as CaCO3	mg/l			--	390	--	--	--	351	--	--	368	--	--	--	360	--	--	356	--	--	--	537	--	--	384	--
Carbon, total organic	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.8	2.4
Cation-Anion balance	%			--	-0.44	--	--	--	-1.9	--	--	0.63	--	--	--	-0.33	--	--	0.41	--	--	--	-3.6	--	--	10.6	--
Chloride	mg/l			--	85.4	--	--	--	67.5	--	--	68.1	--	--	--	51.0	--	--	44.5	--	--	--	56.7	--	--	49.7	--
Dissolved oxygen, field	mg/l			0.6	1.0	1.4	--	4.0	2.6	2.0	0.4	1.1	1.9	--	6.1	4.0	3.0	0.5	1.4	1.8	--	2.6	1.2	2.4	1.1	0.9	1.1
Iron, ferrous, FE II, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.85	--
Manganese II, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	9.9	--
Nitrogen, ammonia, as N	mg/l			--	< 0.020	--	--	--	< 0.020	--	--	< 0.020	--	--	--	< 0.020	--	--	< 0.020	--	--	--	< 0.020	--	--	< 0.020	--
Nitrogen, nitrate + nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.050	< 0.050
Nitrogen, nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.050	< 0.050
pH, field	pH units			7.59	7.26	7.61	--	7.60	7.58	7.35	7.30	7.41	7.37	--	7.46	7.40	7.17	7.27	7.39	7.48	--	7.28	7.37	7.08	7.23	7.08	7.01
Redox (oxidation potential), field	mV			292.1	214.7	242.1	--	-93.5	200.4	128.4	263.9	215.7	224.7	--	-16.5	227.9	201.3	284.6	195.8	240.2	--	-49.4	192.6	6.3	191.2	166	80
Solids, total dissolved	mg/l			--	658	--	--	--	521	--	--	496 H	--	--	--	457	--	--	440	--	--	--	661	--	--	602	--
Solids, total suspended	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm			928	1015	977	--	829	810	802	849	924	970	--	819	813	820	855	837	827	--	1122	1071	1030	1035	944	1004
Sulfate, as SO4	mg/l			--	27.2	--	--	--	21.3	--	--	21.3	--	--	--	22.3	--	--	21.3	--	--	--	30.3	--	--	27.6	--
Sulfide, as S^{2-}, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.08	--
Temperature, field	deg C			9.7	11.5	11.0	--	9.6	11.7	10.7	10.5	11.8	11.7	--	8.4	12.0	10.7	10.4	11.8	11.4	--	10.6	11.4	10.6	11.1	11.2	10.6
Turbidity, field	NTU			1.4	1.3	2.9	--	11.7	10.4	10.8	5.5	1.5	10.0	--	22.6	11.2	13.1	8.3	1.5	3.6	--	26.4	11.0	1.5	5.7	13.2	9.0
Dissolved Metals																											
Arsenic	ug/l		2.5	--	< 1.0	--	--	--	< 5.0	--	--	6.7	--	--	--	< 5.0	--	--	1.3	--	--	--	< 5.0	--	--	< 1.0	--
Boron	ug/l	**500 RAA17**	250.0	--	44.5	--	--	--	28.0	--	--	32.6	--	--	--	< 20.0	--	--	21.0	--	--	--	41.1	--	--	36.6	--
Cadmium	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/l			--	128	--	--	--	109	--	--	120	--	--	--	112	--	--	110	--	--	--	146	--	--	143	--
Chromium	ug/l	100 CR HRL93	25.0	--	< 4.0	--	--	--	< 4.0	--	--	< 4.0	--	--	--	< 4.0	--	--	< 4.0	--	--	--	< 4.0	--	--	< 4.0	--
Copper	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	ug/l			--	305	--	--	--	318	--	--	436	--	--	--	1980	--	--	762	--	--	--	835	--	--	756	--
Lead	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l			--	47.8	--	--	--	39.6	--	--	42.9	--	--	--	37.6	--	--	37.9	--	--	--	53.5	--	--	53.7	--
Manganese	ug/l	**100 HBV18**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l			--	2.35	--	--	--	2.5	--	--	2.54	--	--	--	2.33	--	--	2.3	--	--	--	2.81	--	--	3.12	--
Sodium	mg/l			--	6.35	--	--	--	5.44	--	--	5.4	--	--	--	4.31	--	--	4.07	--	--	--	5.98	--	--	5.95	--
Zinc	ug/l	2000 HRL94	500.0	--	< 10.0	--	--	--	< 10.0	--	--	< 10.0	--	--	--	< 10.0	--	--	< 10.0	--	--	--	< 10.0	--	--	< 10.0	--

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-321L	P-321L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-323L	P-323L	P-323L	P-323L	P-323L	P-323L	P-323L	P-323L	P-324L	P-324L	P-324L	P-324L	P-324L	P-324L	P-324L
				Date	12/19/2019	4/21/2020	4/23/2018	7/17/2018	10/16/2018	4/10/2019	7/09/2019	10/23/2019	4/22/2020	4/19/2018	7/16/2018	10/15/2018	4/08/2019	7/10/2019	10/23/2019	12/19/2019	4/21/2020	4/19/2018	7/17/2018	10/15/2018	4/09/2019	7/09/2019	10/22/2019	12/19/2019
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
Volatile Organic Compounds																												
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	--
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5	--	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 *^	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75	--	< 0.750 U	< 0.75 h	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0 *^	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0	--	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0	--
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0	--	2.87	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	14	17	16	12	11	8.4	--	9.00	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,1-Dichloroethylene	ug/l	200 HBV19	50.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	--
1,1-Dichloropropene	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,2,3-Trichlorobenzene	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 5.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0 ^	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--
1,2,4-Trimethylbenzene	ug/l	30 HBV19	25.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05	--	< 1.00 U	< 0.050 h	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	--	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	--
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	0.001	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25	--	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 *^	< 0.250 U	0.88	0.86	0.78	0.90	0.58	0.58	--	0.604	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 *	--
1,2-Dichloroethylene, cis	ug/l	**6 HRL18 (1)**	12.5	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0 *^	< 1.00 U	5.3	**6.5**	**7.3**	5.9	5.2	4.9	--	4.22	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	10.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,2-Dichloropropane	ug/l	5 HRL94	1.25	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	1.0	--	1.03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	25.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--
1,3-Dichlorobenzene	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,3-Dichloropropane	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5	--	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25 *^	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25	--
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94		--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	2.5	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
2,2-Dichloropropane	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 4.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 4.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	--
Acetone	ug/l	3000 HBV17 (1)	1000	--	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 20	< 20	< 20	< 20	< 20	< 10	--	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	--
Allyl chloride	ug/l	30 HRL94	7.5	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	--
Benzene	ug/l	2 HRL09 (1)	0.5	--	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50 *	< 0.50 *^	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 *	< 0.50	--
Bromobenzene	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Bromochloromethane	ug/l			--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 ^	< 1.00 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--
Bromodichloromethane	ug/l	3 HBV18 (1)	1.5	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Bromoform	ug/l	40 HRL93	10.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0 *^	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 5.0	--
Bromomethane	ug/l	10 HRL93	2.5	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 *	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 4.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	--
Butylbenzene	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Butylbenzene, sec	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--
Butylbenzene, tert	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25	--	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	--	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	--
Chlorobenzene	ug/l	100 HRL93	25.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Chlorodibromomethane	ug/l	10 HRL93	2.5	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--
Chloroethane	ug/l	ND RAA16		--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 4.0 ^	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	--
Chloroform	ug/l	20 HRL18	7.5	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	--
Chloromethane	ug/l			--	< 1.00 U	< 1.0	< 1.0 *^	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0 ^	< 2.0	< 2.0	< 3.0	--	< 1.00 U	< 1.0	< 1.0 *^	< 1.0 ^	< 1.0	< 1.0	< 3.0	--
Chlorotoluene, o	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Chlorotoluene, p	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	--
Cymene p- (toluene isopropyl p-)	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Dibromomethane (methylene bromide)	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	175.0	--	< 1.00 U	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 3.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	--	< 1.00 U	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 3.0	--
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**		--	6.86	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	11	12	11	8.7	8.5	6.9	--	7.46	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	--
Ethane	ug/l			0.24	--	--	--	--	--	--	--	--	--	--	--	--	0.58 h	--	0.4	--	--	--	--	--	0.13 h	--	0.21
Ethyl benzene	ug/l	40 HBV19 (1)	12.5	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Ethyl ether	ug/l	200 RAA16 (1)	50.0	--	24.4	1.6	1.2	1.1	< 1.0	1.9	2.4 *^	2.68	56	65	61	44	40	32	--	45.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	--
Ethylene	ug/l			0.039 J	--	--	--	--	--	--	--	--	--	--	--	--	11 h	--	0.043 J	--	--	--	--	--	4.3 h	--	0.072 J
Hexachlorobutadiene	ug/l	1 HRL93	0.25	--	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4	--	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4	--
Methane	ug/l			1000	--	--	--	--	--	--	--	--	--	--	--	--	150 h	--	160	--	--	--	--	--	200 h	--	190
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0	--	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 20	< 20	< 20	< 20	< 20	< 10	--	< 10.0 U	< 10	< 10	< 10	< 10	< 10 *	< 10	--
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0	--	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10 ^	< 5.00 U	< 10	< 10	< 10	< 10	< 10	< 10	--	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	--
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 2.0	< 2.0	2.1	< 2.0	< 2.0	1.1	--	1.17	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Methylene chloride	ug/l	5 HRLMCL	1.25	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 2.0	< 2.0	2.6	< 2.0	3.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--
Naphthalene	ug/l	70 HRL13	17.5	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	--
Propylbenzene	ug/l			--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Styrene	ug/l		25.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Tetrachloroethylene	ug/l	4 HBV14 (1)	1.25	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Tetrahydrofuran	ug/l	600 HRL18		--	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10 *^	< 5.00 U	58	67	57	32	34	29	--	19.5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	--
Toluene	ug/l	70 HBV19 (1)	50.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1	--	< 0.100 U J4	< 0.10 h	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10 *	< 0.10	< 0.100 U J4	**1.0**	**0.90**	**0.84**	**1.2**	**1.1**	**1.3**	--	**0.759 J4**	< 0.10	< 0.10	< 0.10	< 0.10 *	< 0.10	--
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0	--	< 1.00 U J4	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 4.0 ^	< 1.00 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 4.0	--	< 1.00 U J4	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 4.0 ^	--
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0 ^	< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0 ^	< 2.0	< 2.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	--
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05	--	**0.529**	< 0.050 h	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050 *^	< 0.0500 U	**0.42**	**0.27**	**0.22**	**0.67**	**0.40**	**0.55**	--	**0.209**	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050 *^	--
Xylene, total	ug/l	300 XYL HBV19 (1)	75	--	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0 *	< 2.00 U	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 3.0	--	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	--

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

			Location	P-321L	P-321L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-322L	P-323L	P-323L	P-323L	P-323L	P-323L	P-323L	P-323L	P-323L	P-324L	P-324L	P-324L	P-324L	P-324L	P-324L	P-324L
			Date	12/19/2019	4/21/2020	4/23/2018	7/17/2018	10/16/2018	4/10/2019	7/09/2019	10/23/2019	4/22/2020	4/19/2018	7/16/2018	10/15/2018	4/08/2019	7/10/2019	10/23/2019	12/19/2019	4/21/2020	4/19/2018	7/17/2018	10/15/2018	4/09/2019	7/09/2019	10/22/2019	12/19/2019
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																								
Effective Date		04/27/2020	07/23/2015																								
Exceedance Key		**Bold**	Underline																								
General Parameters																											
Alkalinity, total, as CaCO3	mg/l			--	--	--	392	--	--	350	--	--	--	947	--	--	620	--	--	--	--	371	--	--	280	--	--
Carbon, total organic	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	11.3 ^	10.2	--	--	--	--	--	--	< 1.0	1.2	--
Cation-Anion balance	%			--	--	--	-9.2	--	--	0.58	--	--	--	-4.2	--	--	9.4	--	--	--	--	0.57	--	--	-3.7	--	--
Chloride	mg/l			--	--	--	20.4	--	--	17.5	--	--	--	201	--	--	159	--	--	--	--	25.3	--	--	32.0	--	--
Dissolved oxygen, field	mg/l			1.1	--	0.2	0.1	1.9	0.7	0.9	1.3	--	0.1	0.7	6.5	1.0	1.9	2.0	0.8	--	0.1	0.2	1.1	0.3	0.7	0.8	0.7
Iron, ferrous, FE II, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	5.0	--	--	--	--	--	--	--	2.03	--	--
Manganese II, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	12.1	--	--	--	--	--	--	--	18.2	--	--
Nitrogen, ammonia, as N	mg/l			--	--	--	< 0.020	--	--	< 0.020	--	--	--	< 0.020	--	--	< 0.020	--	--	--	--	< 0.020	--	--	0.033	--	--
Nitrogen, nitrate + nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.050	< 0.050	--	--	--	--	--	--	< 0.050	< 0.050 H	--
Nitrogen, nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.050	< 0.050	--	--	--	--	--	--	< 0.050	< 0.050 H	--
pH, field	pH units			6.95	--	7.54	7.52	7.17	7.20	7.09	7.26	--	6.83	6.91	6.63	6.72	6.78	6.70	6.64	--	7.75	7.84	7.38	7.49	7.40	7.21	7.37
Redox (oxidation potential), field	mV			329.3	--	193.2	76.4	107.9	306.7	306.1	262.3	--	243.1	196.0	9.6	243.2	144	70	264.0	--	-162.8	-9.1	-30.2	242.3	-43	-30	333.9
Solids, total dissolved	mg/l			--	--	--	411	--	--	412	--	--	--	1280	--	--	1050	--	--	--	--	375	--	--	309	--	--
Solids, total suspended	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm			1120	--	750	705	752	753	755	779	--	2034	2052	2024	1896	1611	1683	1704	--	520	509	577	556	567	651	643
Sulfate, as SO4	mg/l			--	--	--	29.6	--	--	24.9	--	--	--	25.2	--	--	16.0	--	--	--	--	19.2	--	--	< 2.0	--	--
Sulfide, as S^{2-}, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	0.14	--	--	--	--	--	--	--	0.26	--	--
Temperature, field	deg C			10.5	--	8.6	10.4	8.7	7.4	8.7	8.2	--	8.7	10.0	9.5	9.2	9.6	9.4	8.6	--	8.3	9.3	9.1	8.1	9.2	8.9	7.8
Turbidity, field	NTU			7.9	--	6.7	24.7	7.8	7.8	7.3	0.4	--	236.4	9.6	92.3	19.6	8.7	21.5	157.0	--	13.5	24.5	20.2	30.7	27.3	23.3	58.7
Dissolved Metals																											
Arsenic	ug/l		2.5	--	--	--	< 5.0	--	--	1.6	--	--	--	< 5.0	--	--	< 1.0	--	--	--	--	< 5.0	--	--	< 1.0	--	--
Boron	ug/l	**500 RAA17**	250.0	--	--	--	< 20.0	--	--	20.3	--	--	--	372	--	--	485	--	--	--	--	20.1	--	--	22.5	--	--
Cadmium	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/l			--	--	--	90.9	--	--	101	--	--	--	257	--	--	215	--	--	--	--	96.2	--	--	54.7	--	--
Chromium	ug/l	100 CR HRL93	25.0	--	--	--	< 4.0	--	--	< 4.0	--	--	--	< 4.0	--	--	< 4.0	--	--	--	--	< 4.0	--	--	< 4.0	--	--
Copper	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	ug/l			--	--	--	970	--	--	< 50.0	--	--	--	5130	--	--	4870	--	--	--	--	985	--	--	6860	--	--
Lead	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l			--	--	--	33.1	--	--	34.8	--	--	--	91.6	--	--	80.3	--	--	--	--	42.6	--	--	44.9	--	--
Manganese	ug/l	**100 HBV18**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l			--	--	--	1.57	--	--	1.67	--	--	--	4.27	--	--	4.5	--	--	--	--	1.92	--	--	1.93	--	--
Sodium	mg/l			--	--	--	3.66	--	--	3.5	--	--	--	53.5	--	--	70.1	--	--	--	--	4.96	--	--	4.49	--	--
Zinc	ug/l	2000 HRL94	500.0	--	--	--	< 10.0	--	--	< 10.0	--	--	--	< 10.0	--	--	< 10.0	--	--	--	--	< 10.0	--	--	< 10.0	--	--

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-324L	P-325L	P-325L	P-325L	P-325L	P-325L	P-325L	P-325L	P-326L	P-326L	P-326L	P-326L	P-326L	P-326L	P-326L	P-327L	P-328L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L
				Date	4/22/2020	5/10/2018	7/17/2018	10/17/2018	4/10/2019	7/09/2019	10/22/2019	4/21/2020	5/10/2018	7/17/2018	10/17/2018	5/02/2019	7/09/2019	10/22/2019	4/23/2020	5/10/2018	5/10/2018	5/10/2018	7/20/2018	10/22/2018	4/10/2019	7/12/2019	10/24/2019	4/23/2020
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
Volatile Organic Compounds																												
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5		< 1.00 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U J4
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0		< 1.00 U	< 2.0	< 2.0	< 2.0 ^	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5		< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.500 U	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50 H	< 0.500 U
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75		< 0.750 U	< 0.75 h	< 0.75	< 0.75	< 0.75 h	< 0.75	< 1.0	< 0.750 U	< 0.75 h	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0	< 0.750 U	< 0.75	< 0.75	< 0.75 h	< 0.75	< 0.75	< 0.75 h	< 0.75	< 1.0 H	< 0.750 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0		< 1.00 U	4.8	6.5	6.5 ^	5.8	6.3	5.7	6.41	4.6	6.7	7.8 ^	6.7	6.8	7.7	6.52	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,1-Dichloroethylene	ug/l	200 HBV19	50.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 2.0 H^	< 1.00 U
1,1-Dichloropropene	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,2,3-Trichlorobenzene	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	< 1.00 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	< 1.00 U
1,2,4-Trimethylbenzene	ug/l	30 HBV19	25.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05		< 1.00 U	< 0.050 h	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050	< 1.00 U	< 0.050 h	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050	< 1.00 U
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	0.001		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25		< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25 *	< 0.250 U	< 0.25 h	< 0.25	< 0.25	0.25	< 0.25	0.28	0.273	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.250 U
1,2-Dichloroethylene, cis	ug/l	**6 HRL18 (1)**	12.5		< 1.00 U	< 2.0	2.3	2.1	< 2.0 ^	2.1	1.9	1.42	< 1.0	2.0	2.3	2.3	2.0	2.3	1.83	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0 ^	< 1.0	< 1.0 H	< 1.00 U
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	10.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,2-Dichloropropane	ug/l	5 HRL94	1.25		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	25.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,3-Dichlorobenzene	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,3-Dichloropropane	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5		< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.25	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25	< 0.500 U	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.25 H	< 0.500 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94			< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	< 1.00 U
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	2.5		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
2,2-Dichloropropane	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0 ^	< 2.0 ^	< 2.0	< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0 ^	< 1.0	< 4.0 H	< 1.00 U
Acetone	ug/l	3000 HBV17 (1)	1000		< 10.0 U	< 20	< 20	< 20	< 20	< 20	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10 H	< 10	< 10	< 10 H	< 10.0 U
Allyl chloride	ug/l	30 HRL94	7.5		< 1.00 U	< 2.0	< 2.0	< 2.0 ^	< 2.0	< 2.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^H	< 1.0	< 1.0	< 2.0 H*	< 1.00 U
Benzene	ug/l	2 HRL09 (1)	0.5		< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50 h	< 0.50 *	< 0.50	< 0.500 U	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 *	< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50	< 0.50 h	< 0.50 H	< 0.500 U
Bromobenzene	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Bromochloromethane	ug/l				< 1.00 U J4	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	< 1.00 U J4
Bromodichloromethane	ug/l	3 HBV18 (1)	1.5		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Bromoform	ug/l	40 HRL93	10.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0 *	< 5.0 H	< 1.00 U
Bromomethane	ug/l	10 HRL93	2.5		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 4.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 4.0 H	< 1.00 U
Butylbenzene	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Butylbenzene, sec	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Butylbenzene, tert	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25		< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.250 U
Chlorobenzene	ug/l	100 HRL93	25.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Chlorodibromomethane	ug/l	10 HRL93	2.5		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0 ^^	< 5.0 H	< 1.00 U
Chloroethane	ug/l	ND RAA16			< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 4.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 4.0 H	< 1.00 U
Chloroform	ug/l	20 HRL18	7.5		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 3.0 H	< 1.00 U
Chloromethane	ug/l				< 1.00 U	< 2.0	< 2.0 *^	< 2.0	< 2.0	< 2.0	< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 3.0 H	< 1.00 U
Chlorotoluene, o	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Chlorotoluene, p	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	2.2 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Cymene p- (toluene isopropyl p-)	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Dibromomethane (methylene bromide)	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	175.0		< 1.00 U	< 2.0	< 2.0 *	< 2.0	< 2.0	< 2.0	< 3.0	2.21	< 1.0	3.1	2.6	2.9	2.2	< 3.0	2.67	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 3.0 H	< 1.00 U
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**			< 1.00 U	6.3	8.5	8.2	7.1	6.9	8.1 ^	10.9	6.5	8.2	8.3	8.2	7.3	7.8 ^	8.12	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Ethane	ug/l				--	--	--	--	--	0.32 h	--	--	--	--	--	--	0.36 h	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	40 HBV19 (1)	12.5		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Ethyl ether	ug/l	200 RAA16 (1)	50.0		< 1.00 U	26	34	34	29	28	25	35.8	22	24	27	23	20	26	29.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 2.0 H	< 1.00 U
Ethylene	ug/l				--	--	--	--	--	8.1 h	--	--	--	--	--	--	0.98 h	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	1 HRL93	0.25		< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25 h	< 0.25	< 1.4 *	< 0.250 U	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4 *	< 0.250 U	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.25 h	< 0.25	< 1.4 H	< 0.250 U
Methane	ug/l				--	--	--	--	--	380 h	--	--	--	--	--	--	430 h	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0		< 10.0 U	< 20	< 20	< 20 ^	< 20	< 20 *	< 10	< 10.0 U	< 10	< 10	< 10 ^	< 10	< 10 *	< 10	< 10.0 U	< 10	< 10	< 10	< 10	< 10 H	< 10	< 10 *	< 10 H	< 10.0 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0		< 5.00 U	< 10	< 10	< 10	< 10	< 10	< 10	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 H	< 5.0	< 5.0	< 10 H	< 5.00 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	1.03	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Methylene chloride	ug/l	5 HRLMCL	1.25		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	< 1.00 U
Naphthalene	ug/l	70 HRL13	17.5		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 5.0 H	< 1.00 U
Propylbenzene	ug/l				< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Styrene	ug/l		25.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Tetrachloroethylene	ug/l	4 HBV14 (1)	1.25		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Tetrahydrofuran	ug/l	600 HRL18			< 5.00 U	21	24	26	15	12	< 10	12.2	18	20	22	17	18	15	18.7	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 H	< 5.0	< 5.0	< 10 H^	< 5.00 U
Toluene	ug/l	70 HBV19 (1)	50.0		< 1.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 1.0 H	< 1.00 U
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1		< 0.100 U J4	< 0.10 h	< 0.10	< 0.10	< 0.10 h	< 0.10 *	< 0.10	< 0.100 U J4	< 0.10 h	< 0.10	< 0.10	< 0.10	< 0.10 *	< 0.10	< 0.100 U J4	< 0.10	< 0.10	< 0.10 h	< 0.10	< 0.10	< 0.10 h	< 0.10	< 0.10	< 0.100 U J4
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0		< 1.00 U J4	< 2.0	< 2.0 ^	< 2.0	< 2.0	< 2.0	< 4.0 ^	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0 ^	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 4.0 H	< 1.00 U J4
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0		< 1.00 U	< 2.0	< 2.0	< 2.0 ^	< 2.0	< 2.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.0	< 2.0 H*	< 1.00 U
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05		< 0.0500 U	**0.28 h**	**0.22**	0.19	**0.32 h**	**0.31**	**0.97**	**0.770**	**0.31 h**	**0.46**	**0.39**	**0.63**	**0.42**	**0.95**	**0.503**	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050 ^^	< 0.0500 U
Xylene, total	ug/l	300 XYL HBV19 (1)	75		< 2.00 U	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 3.0	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0 H	< 2.0	< 2.0	< 3.0 H	< 2.00 U

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

			Location	P-324L	P-325L	P-325L	P-325L	P-325L	P-325L	P-325L	P-325L	P-326L	P-326L	P-326L	P-326L	P-326L	P-326L	P-326L	P-327L	P-328L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L	P-329L
			Date	4/22/2020	5/10/2018	7/17/2018	10/17/2018	4/10/2019	7/09/2019	10/22/2019	4/21/2020	5/10/2018	7/17/2018	10/17/2018	5/02/2019	7/09/2019	10/22/2019	4/23/2020	5/10/2018	5/10/2018	5/10/2018	7/20/2018	10/22/2018	4/10/2019	7/12/2019	10/24/2019	4/23/2020
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																								
Effective Date		04/27/2020	07/23/2015																								
Exceedance Key		**Bold**	Underline																								
General Parameters																											
Alkalinity, total, as CaCO3	mg/l			--	--	591	--	--	563	--	--	--	571	--	--	526	--	--	187	184	--	189	--	--	159	--	--
Carbon, total organic	mg/l			--	--	--	--	--	3.8	7.3	--	--	--	--	--	9.9	3.2	--	--	--	--	--	--	--	--	--	--
Cation-Anion balance	%			--	--	-2.3	--	--	2.8	--	--	--	-2.4	--	--	2.6	--	--	-2.1	-0.56	--	3.7	--	--	6.0	--	--
Chloride	mg/l			--	--	185	--	--	141	--	--	--	60.1	--	--	52.0	--	--	13.2	2.59	--	1.8	--	--	2.0	--	--
Dissolved oxygen, field	mg/l			--	4.1	1.2	6.7	1.0	1.0	0.8	--	2.1	1.1	5.6	0.8	1.3	1.6	--	0.6	0.5	0.7	0.2	0.2	0.2	0.2	1.8	--
Iron, ferrous, FE II, field	mg/l			--	--	--	--	--	1.71	--	--	--	--	--	--	1.89	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l			--	--	--	--	--	19.7	--	--	--	--	--	--	20.3	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l			--	--	< 0.020	--	--	< 0.020	--	--	--	< 0.020	--	--	< 0.020	--	--	0.18	0.24	--	0.086	--	--	0.10	--	--
Nitrogen, nitrate + nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.050	< 0.050	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL		--	--	--	--	--	< 0.050	< 0.050 H	--	--	--	--	--	< 0.050	< 0.050 H	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l			--	--	--	--	--	< 0.050	< 0.050 H	--	--	--	--	--	< 0.050	< 0.050 H	--	--	--	--	--	--	--	--	--	--
pH, field	pH units			--	7.29	7.15	7.24	7.32	6.75	6.76	--	7.48	7.12	7.33	7.06	6.76	6.86	--	8.35	8.47	8.91	7.94	8.85	8.08	7.75	7.91	--
Redox (oxidation potential), field	mV			--	-46	-5.1	100.0	330.2	25	45	--	-29	-110.8	287.1	293.4	-95	-35	--	-226	-199	-214	201.6	156.7	274.6	296.2	238.4	--
Solids, total dissolved	mg/l			--	--	578	--	--	808	--	--	--	694	--	--	615	--	--	183	171	--	214	--	--	179	--	--
Solids, total suspended	mg/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 4.0	49.2	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm			--	1532	1444	1121	1539	1343	1299	--	1088	1067	1123	1163	1032	1141	--	390	364	259	378	226	374	358	392	--
Sulfate, as SO4	mg/l			--	--	25.3	--	--	19.3	--	--	--	23.8	--	--	21.1	--	--	9.24	13.6	--	12.8	--	--	7.7	--	--
Sulfide, as S^{2-}, field	mg/l			--	--	--	--	--	0.01	--	--	--	--	--	--	0.05	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C			--	10.0	8.5	8.5	7.0	10.1	8.9	--	10.0	9.1	8.8	8.4	10.8	9.6	--	7.9	7.5	8.0	8.5	9.3	6.2	11.1	8.6	--
Turbidity, field	NTU			--	6.0	3.8	2.7	2.4	4.3	3.9	--	7.3	6.0	3.2	3.0	5.1	8.9	--	7.0	8.2	16.0	1.9	5.8	4.6	11.4	11.2	--
Dissolved Metals																											
Arsenic	ug/l		2.5	--	--	< 5.0	--	--	< 1.0	--	--	--	< 5.0	--	--	< 1.0	--	--	1.8	1.1	--	< 5.0	--	--	< 1.0	--	--
Boron	ug/l	**500 RAA17**	250.0	--	--	209	--	--	302	--	--	--	20.6	--	--	25.6	--	--	21	22	--	20.2	--	--	22.1	--	--
Cadmium	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 2.0	< 2.0	--	--	--	--	--	--	--
Calcium	mg/l			--	--	187	--	--	184	--	--	--	156	--	--	157	--	--	48.3	46.8	--	53.0	--	--	43.2	--	--
Chromium	ug/l	100 CR HRL93	25.0	--	--	< 4.0	--	--	< 4.0	--	--	--	< 4.0	--	--	< 4.0	--	--	< 4.0	< 4.0	--	< 4.0	--	--	< 4.0	--	--
Copper	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 10	< 10	--	--	--	--	--	--	--
Iron	ug/l			--	--	1770	--	--	2190	--	--	--	3480	--	--	2640	--	--	2400	3900	--	352	--	--	970	--	--
Lead	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 10	< 10	--	--	--	--	--	--	--
Magnesium	mg/l			--	--	71.2	--	--	70.3	--	--	--	57.2	--	--	58.3	--	--	17.4	16.5	--	18.1	--	--	16.4	--	--
Manganese	ug/l	**100 HBV18**		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**210**	**210**	--	--	--	--	--	--	--
Mercury	ug/l			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.20	< 0.20	--	--	--	--	--	--	--
Potassium	mg/l			--	--	3.17	--	--	3.11	--	--	--	2.14	--	--	2.14	--	--	1.4	1.5	--	1.38	--	--	1.67	--	--
Sodium	mg/l			--	--	32.2	--	--	31.5	--	--	--	5.49	--	--	5.85	--	--	5.6	5.9	--	4.99	--	--	5.19	--	--
Zinc	ug/l	2000 HRL94	500.0	--	--	< 10.0	--	--	< 10.0	--	--	--	< 10.0	--	--	< 10.0	--	--	< 10	37	--	< 10.0	--	--	< 10.0	--	--

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74	Location	P-333L	P-333L	P-333L	P-333L	P-333L	P-333L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-335L	P-335L	P-335L	P-335L	P-335L	P-335L	P-335L	315-OWA	315-OWA
				Date	3/06/2018	4/19/2018	7/16/2018	4/10/2019	7/12/2019	4/23/2020	4/19/2018	7/16/2018	10/19/2018	4/12/2019	6/10/2019	7/10/2019	10/23/2019	12/19/2019	4/23/2020	4/19/2018	7/16/2018	10/19/2018	4/12/2019	7/11/2019	10/24/2019	4/23/2020	4/18/2018	7/17/2018
Effective Date		04/27/2020	07/23/2015																									
Exceedance Key		**Bold**	Underline																									
Volatile Organic Compounds																												
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5		< 0.050	< 0.50	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50	< 0.50	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.50	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75		< 0.050	< 0.75	< 0.75	< 0.75	< 0.75	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75 h	< 0.75	< 0.75	< 1.0	--	< 0.750 U	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0	< 0.750 U	< 0.75	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	50.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0 ^	--	< 1.0	< 2.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0
1,1-Dichloropropene	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0 ^	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 5.0	< 1.00 U	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	25.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05		< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 1.00 U	< 0.050	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	0.001		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25		< 0.050	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.25 *	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25
1,2-Dichloroethylene, cis	ug/l	**6 HRL18 (1)**	12.5		< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	10.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	1.25		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	25.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,3-Dichloropropane	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5		< 0.050	< 0.50	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50	< 0.25	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25	< 0.500 U	< 0.50	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	2.5		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
2,2-Dichloropropane	ug/l				< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0 ^	--	< 1.0	< 4.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 4.0	< 1.00 U	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	1000		< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 10	< 10	< 10	< 10	--	< 10	< 10	--	< 10.0 U	< 10	< 10	< 10	< 10	< 10	< 10	< 10.0 U	< 10	< 10
Allyl chloride	ug/l	30 HRL94	7.5		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 2.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0 ^	< 1.00 U	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	0.5		< 0.050	< 0.50	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50	< 0.50	--	< 0.500 U	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.500 U	< 0.50	< 0.50
Bromobenzene	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Bromochloromethane	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 5.0	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U J4	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	1.5		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	10.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 5.0 *^	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	2.5		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 4.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.0	< 1.0
Butylbenzene	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Butylbenzene, sec	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Butylbenzene, tert	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25		< 0.050	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25
Chlorobenzene	ug/l	100 HRL93	25.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	2.5		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *^	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 5.0	--	< 1.00 U J4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 4.0 ^	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.00 U	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	7.5		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 3.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0
Chloromethane	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 3.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0 *^
Chlorotoluene, o	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Chlorotoluene, p	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	175.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	1.4	1.9	3.3	4.9	--	4.9	3.5	--	6.00	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.00 U	< 1.0	< 1.0 *
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	1.9	2.9	4.5	6.8	--	6.5	5.3	--	9.08	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Ethane	ug/l				--	--	--	--	--	--	--	--	--	--	--	0.10 h	--	0.028 J	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	40 HBV19 (1)	12.5		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	50.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	1.1	2.1	3.0	--	3.1	3.0	--	6.52	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0
Ethylene	ug/l				--	--	--	--	--	--	--	--	--	--	--	31 h	--	0.030 J	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	1 HRL93	0.25		< 0.050	< 0.25	< 0.25	< 0.25	< 0.25	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 1.4	--	< 0.250 U	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4	< 0.250 U	< 0.25	< 0.25
Methane	ug/l				--	--	--	--	--	--	--	--	--	--	--	180 h	--	1300	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0		< 10	< 10	< 10	< 10	< 10 *	< 10.0 U	< 10	< 10	< 10	< 10	--	< 10	< 10	--	< 10.0 U	< 10	< 10	< 10	< 10	< 10 ^	< 10	< 10.0 U	< 10 ^	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	--	< 5.0	< 10	--	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.00 U	< 5.0	< 5.0
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	1.25		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0 ^	< 1.0
Naphthalene	ug/l	70 HRL13	17.5		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 5.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.00 U	< 1.0	< 1.0
Propylbenzene	ug/l				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Styrene	ug/l		25.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	1.25		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18			< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	--	< 5.0	< 10	--	< 5.00 U	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.00 U	< 5.0 ^	< 5.0
Toluene	ug/l	70 HBV19 (1)	50.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1		< 0.050	< 0.10	< 0.10	< 0.10	< 0.10	< 0.100 U J4	< 0.10	< 0.10	< 0.10	< 0.10 h	< 0.10	< 0.10	< 0.10	< 0.10	< 0.100 U J4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.100 U J4	< 0.10	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U J4	< 1.0	< 1.0	< 1.0 ^	< 1.0	--	< 1.0	< 4.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 4.0	< 1.00 U J4	< 1.0	< 1.0 ^
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0 ^	--	< 1.0	< 2.0	--	< 1.00 U	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 2.0	< 1.00 U	< 1.0	< 1.0
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05		< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.0500 U	< 0.050	< 0.050	< 0.050	0.050 h	< 0.050	0.050	0.10	< 0.050 *^	< 0.0500 U	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050 *^	< 0.0500 U	< 0.050	< 0.050
Xylene, total	ug/l	300 XYL HBV19 (1)	75		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	--	< 2.0	< 3.0	--	< 2.00 U	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.00 U	< 2.0	< 2.0

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

			Location	P-333L	P-333L	P-333L	P-333L	P-333L	P-333L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-334L	P-335L	P-335L	P-335L	P-335L	P-335L	P-335L	P-335L	315-OWA	315-OWA
			Date	3/06/2018	4/19/2018	7/16/2018	4/10/2019	7/12/2019	4/23/2020	4/19/2018	7/16/2018	10/19/2018	4/12/2019	6/10/2019	7/10/2019	10/23/2019	12/19/2019	4/23/2020	4/19/2018	7/16/2018	10/19/2018	4/12/2019	7/11/2019	10/24/2019	4/23/2020	4/18/2018	7/17/2018
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74																								
Effective Date		04/27/2020	07/23/2015																								
Exceedance Key		**Bold**	Underline																								
General Parameters																											
Alkalinity, total, as CaCO3	mg/l			--	195	189	172	174	--	213	200	208	--	--	241	--	--	--	184	185	173	--	173	--	--	--	38.9
Carbon, total organic	mg/l			--	--	--	--	--	--	--	--	--	--	--	< 1.0 ^	< 1.0	--	--	--	--	--	--	--	--	--	--	--
Cation-Anion balance	%			--	-2.2	1.6	4.4	4.7	--	-2.6	1.3	0.35	--	--	-2.6	--	--	--	-0.18	0.13	1.4	--	1.5	--	--	--	3.2
Chloride	mg/l			--	1.35	1.32	1.33	1.4	--	3.64	3.94	6.38	--	--	6.8	--	--	--	2.27	2.13	2.04	--	2.5	--	--	--	5.3
Dissolved oxygen, field	mg/l			0.3	2.9	0.6	0.3	0.6	--	1.8	0.4	1.3	1.0	0.6	0.6	0.7	1.1	--	1.4	0.4	0.7	0.5	0.8	0.9	--	0.5	2.3
Iron, ferrous, FE II, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	1.14	--	--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	55	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l			--	0.071	0.096	< 0.020	0.050	--	< 0.020	< 0.020	< 0.020	--	--	< 0.020 F1	--	--	--	0.050	0.033	< 0.020	--	< 0.020	--	--	--	< 0.020
Nitrogen, nitrate + nitrite, as N	mg/l			--	< 0.050	< 0.050	< 0.050	--	--	< 0.050	< 0.050	< 0.050	--	--	--	--	--	--	< 0.050	< 0.050	< 0.050	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--	< 0.050	< 0.050	--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--	< 0.050	< 0.050	--	--	--	--	--	--	--	--	--	--	--
pH, field	pH units			8.07	7.67	8.13	8.09	7.38	--	7.74	7.80	7.81	7.51	7.64	6.89	7.18	7.18	--	7.78	7.88	7.85	7.99	7.97	8.43	--	6.32	7.03
Redox (oxidation potential), field	mV			-218.5	75	59	282.8	271.6	--	-250	56	97.2	211.1	202	85	88	-10	--	-221	25	209.2	316.0	294.6	242.9	--	328.7	221.6
Solids, total dissolved	mg/l			--	213	177	221	200	--	205	214	260	--	--	256	--	--	--	394	215	226	--	214	--	--	--	89.0
Solids, total suspended	mg/l			--	7.2	< 4.0	< 4.0	--	--	< 4.0	< 4.0	84.4	--	--	--	--	--	--	< 4.0	< 4.0	26.4	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm			382	383	350	387	397	--	420	395	446	476	426	446	455	615	--	370	340	367	379	388	359	--	149	131
Sulfate, as SO4	mg/l			--	16.2	14	12.7	13.8	--	20.2	17.4	19.8	--	--	16.3	--	--	--	15	13.5	12.9	--	12.9	--	--	--	13.0
Sulfide, as S^{2-}, field	mg/l			--	--	--	--	--	--	--	--	--	--	--	0.20	--	--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C			6.7	7.7	9.4	7.5	7.9	--	9.0	9.3	9.7	8.3	9.4	9.2	8.8	8.1	--	10.2	10.9	10.2	9.0	10.5	9.4	--	8.0	7.8
Turbidity, field	NTU			161.0	--	7.2	3.5	1.9	--	--	--	86.7	64.0	51	30.7	53.2	19.9	--	--	7.0	20.9	3.2	5.5	19.6	--	51.5	18.3
Dissolved Metals																											
Arsenic	ug/l		2.5	--	< 1.0	< 5.0	< 1.0	< 1.0	--	< 1.0	< 5.0	< 1.0 ^	--	--	< 1.0	--	--	--	< 1.0	< 5.0	< 1.0 ^	--	< 1.0	--	--	--	< 5.0
Boron	ug/l	**500 RAA17**	250.0	--	< 20	< 20	< 20	22.0	--	< 20	< 20	< 20	--	--	< 20.0	--	--	--	< 20	< 20	< 20	--	< 20.0	--	--	--	< 20.0
Cadmium	ug/l	0.5 HRL15 (1)		--	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	--	--	--	--	--	--	< 2.0	< 2.0	< 2.0	--	--	--	--	--	--
Calcium	mg/l			--	48.3	50.9	49.6	50.9	--	52.5	54.4	56.7	--	--	61.0	--	--	--	45.9	47.4	46.1	--	46.9	--	--	--	14.5
Chromium	ug/l	100 CR HRL93	25.0	--	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	< 4.0	< 4.0	--	--	< 4.0	--	--	--	< 4.0	< 4.0	< 4.0	--	< 4.0	--	--	--	< 4.0
Copper	ug/l			--	< 10	< 10	< 10	--	--	< 10	< 10	< 10	--	--	--	--	--	--	< 10	< 10	< 10	--	--	--	--	--	--
Iron	ug/l			--	950	840	1100	790	--	760	300	580	--	--	594	--	--	--	500	510	1500	--	385	--	--	--	99.8
Lead	ug/l			--	< 10	< 10	< 10	--	--	< 10	< 10	< 10	--	--	--	--	--	--	< 10	< 10	< 10	--	--	--	--	--	--
Magnesium	mg/l			--	17.8	18.4	17.5	17.1	--	21.2	21.0	21.7	--	--	22.2	--	--	--	18.1	18.0	16.8	--	16.5	--	--	--	4.18
Manganese	ug/l	**100 HBV18**		--	**170**	**160**	**170**	--	--	**220**	**150**	**160**	--	--	--	--	--	--	**250**	**170**	**170**	--	--	--	--	--	--
Mercury	ug/l			--	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	--	--	--	--	--	--	< 0.20	< 0.20	< 0.20	--	--	--	--	--	--
Potassium	mg/l			--	1.5	1.3	1.3	1.47	--	1.8	1.4	1.6	--	--	1.65	--	--	--	2.3	1.6	1.6	--	1.37	--	--	--	3.12
Sodium	mg/l			--	4.0	3.4	3.1	3.42	--	2.9	2.6	2.9	--	--	2.97	--	--	--	4.6	3.7	3.8	--	3.61	--	--	--	2.86
Zinc	ug/l	2000 HRL94	500.0	--	< 10	< 10	< 10	< 10.0	--	< 10	< 10	< 10	--	--	< 10.0	--	--	--	< 10	< 10	< 10	--	< 10.0	--	--	--	< 10.0

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

			Location	315-OWA	315-OWA	P694477	P694477	P694477	P694477	P694477	P694477	P694477	P694477	P694477
			Date	10/16/2018	7/10/2019	4/19/2018	7/16/2018	10/22/2018	4/12/2019	5/02/2019	7/11/2019	10/24/2019	12/20/2019	4/24/2020
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74											
Effective Date		04/27/2020	07/23/2015											
Exceedance Key		**Bold**	Underline											
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	17.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.190 U
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	2250.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.185 U
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	0.5	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 H	< 1.0	< 0.139 U
1,1,2-Trichloroethane	ug/l	3 HRL93	0.75	< 0.75	< 0.75	< 0.75 h	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	< 1.0 H	< 1.0	< 0.119 U
1,1-Dichloroethane	ug/l	80 RAA16 (1)	25.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	1.2	< 0.0982 U
1,1-Dichloroethylene	ug/l	200 HBV19	50.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 2.0 H^	< 2.0	< 0.121 U
1,1-Dichloropropene	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.162 U
1,2,3-Trichlorobenzene	ug/l			< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0 ^	< 5.0 H	< 5.0	< 1.47 U
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	0.00075	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.324 U
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 5.0 H	< 5.0 ^	< 0.880 U
1,2,4-Trimethylbenzene	ug/l	30 HBV19	25.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.316 U
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		0.05	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.780 U
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	0.001	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.130 U
1,2-Dichlorobenzene	ug/l	600 HRL93	150.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.0850 U
1,2-Dichloroethane	ug/l	1 HRL13 (1)	0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.130 U
1,2-Dichloroethylene, cis	ug/l	**6 HRL18 (1)**	12.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.147 U J4
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	10.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.208 U
1,2-Dichloropropane	ug/l	5 HRL94	1.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.284 U
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	25.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.400 U
1,3-Dichlorobenzene	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0 ^	< 0.120 U
1,3-Dichloropropane	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.100 U J4
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	0.5	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.25 H	< 0.25	< 0.151 U
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 5.0 H	< 5.0	< 0.228 U
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	2.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.140 U
2,2-Dichloropropane	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 4.0 H	< 4.0	< 0.276 U
Acetone	ug/l	3000 HBV17 (1)	1000	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10 H	< 10	< 7.30 U
Allyl chloride	ug/l	30 HRL94	7.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	--	< 1.0	< 1.0	< 2.0 H*	< 2.0	< 0.800 U
Benzene	ug/l	2 HRL09 (1)	0.5	< 0.50	< 0.50	< 0.50 h	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50 H	< 0.50	< 0.0934 U
Bromobenzene	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0 ^	< 0.180 U
Bromochloromethane	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 5.0 H	< 5.0 ^	< 0.113 U
Bromodichloromethane	ug/l	3 HBV18 (1)	1.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.145 U
Bromoform	ug/l	40 HRL93	10.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 5.0 H	< 5.0	< 0.234 U J0
Bromomethane	ug/l	10 HRL93	2.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 4.0 H	< 4.0	< 0.394 U
Butylbenzene	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 1.05 U
Butylbenzene, sec	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0 ^	< 0.576 U
Butylbenzene, tert	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0 ^	< 0.390 U
Carbon tetrachloride	ug/l	1 HRL13 (1)	0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25 ^	< 0.25	< 0.180 U
Chlorobenzene	ug/l	100 HRL93	25.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.0420 U
Chlorodibromomethane	ug/l	10 HRL93	2.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 5.0 H	< 5.0 ^	< 0.122 U
Chloroethane	ug/l	ND RAA16		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 4.0 H	< 4.0	< 0.340 U
Chloroform	ug/l	20 HRL18	7.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 3.0 H	< 3.0	< 0.206 U
Chloromethane	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 3.0 H	< 3.0	< 0.870 U
Chlorotoluene, o	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.173 U
Chlorotoluene, p	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.0900 U J4
Cumene (isopropyl benzene)	ug/l	300 HRL93	75.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0 ^	< 0.0850 U
Cymene p- (toluene isopropyl p-)	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.510 U
Dibromomethane (methylene bromide)	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.150 U
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	175.0	< 1.0	< 1.0	< 1.0	1.3	1.0	--	1.7	2.2	< 3.0 H	< 3.0	< 0.322 U
Dichlorofluoromethane (Freon-21)	ug/l	**20 RAA17**		< 1.0	< 1.0	< 1.0	1.4	1.3	--	1.6	2.0	2.0 H	3.3	3.30
Ethane	ug/l			--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/l	40 HBV19 (1)	12.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.147 U
Ethyl ether	ug/l	200 RAA16 (1)	50.0	< 1.0	< 1.0	< 1.0	1.5	1.7	--	2.2	2.9	3.4 H	5.2	6.28
Ethylene	ug/l			--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/l	1 HRL93	0.25	< 0.25	< 0.25	< 0.25 h	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 1.4 H	< 1.4	< 0.243 U
Methane	ug/l			--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	1000.0	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10 ^	< 10 H	< 10	< 12.7 U
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	75.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	< 5.0	< 5.0	< 10 H	< 10	< 0.456 U
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	15	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.0700 U
Methylene chloride	ug/l	5 HRLMCL	1.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 5.0 H	< 5.0	< 1.33 U
Naphthalene	ug/l	70 HRL13	17.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 5.0 H	< 5.0	< 0.976 U
Propylbenzene	ug/l			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0 ^	< 0.190 U
Styrene	ug/l		25.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.0458 U
Tetrachloroethylene	ug/l	4 HBV14 (1)	1.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0 ^	< 0.179 U J0 J4
Tetrahydrofuran	ug/l	600 HRL18		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	< 5.0	< 5.0	< 10 H^	< 10	< 0.704 U
Toluene	ug/l	70 HBV19 (1)	50.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0 H	< 1.0	< 0.260 U
Trichloroethylene (TCE)	ug/l	**0.4 HRL15 (1)**	0.1	< 0.10	< 0.10	< 0.10 h	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.117 U
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	500.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 4.0 H	< 4.0	< 0.165 U
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	50000.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 2.0 H*	< 2.0	< 0.151 U
Vinyl chloride	ug/l	**0.2 HRL18 (1)**	0.05	< 0.050	< 0.050	< 0.050 h	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	0.10	0.075	< 0.231 U
Xylene, total	ug/l	300 XYL HBV19 (1)	75	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 2.0	< 2.0	< 3.0 H	< 3.0	< 0.176 U

Appendix A
Groundwater Data Compared to Groundwater-Based Intervention Limits (2018-April 2020)
Corrective Action Summary
Elk River Landfill

			Location	315-OWA	315-OWA	P694477	P694477	P694477	P694477	P694477	P694477	P694477	P694477	P694477
			Date	10/16/2018	7/10/2019	4/19/2018	7/16/2018	10/22/2018	4/12/2019	5/02/2019	7/11/2019	10/24/2019	12/20/2019	4/24/2020
Parameter	Units	MDH Human Health-Based Water Guidance Table	Elk River Groundwater Limits Table - SW-74											
Effective Date		04/27/2020	07/23/2015											
Exceedance Key		**Bold**	Underline											
General Parameters														
Alkalinity, total, as CaCO3	mg/l			--	36.9	--	245	--	--	--	259	--	--	--
Carbon, total organic	mg/l			--	--	--	--	--	--	--	--	--	--	--
Cation-Anion balance	%			--	1.2	--	-2.7	--	--	--	-3.6	--	--	--
Chloride	mg/l			--	2.4	--	6.3	--	--	--	9.0	--	--	--
Dissolved oxygen, field	mg/l			4.9	5.0	1.4	0.6	0.7	0.9	0.2	0.7	2.0	0.2	0.5
Iron, ferrous, FE II, field	mg/l			--	--	--	--	--	--	--	--	--	--	--
Manganese II, field	mg/l			--	--	--	--	--	--	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l			--	< 0.020	--	0.23	--	--	--	< 0.020	--	--	--
Nitrogen, nitrate + nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrate, as N	mg/l	10 HRLMCL		--	--	--	--	--	--	--	--	--	--	--
Nitrogen, nitrite, as N	mg/l			--	--	--	--	--	--	--	--	--	--	--
pH, field	pH units			6.79	7.35	7.60	7.59	7.50	7.71	7.38	7.67	7.71	7.41	7.74
Redox (oxidation potential), field	mV			198.8	319.1	-102	75	176.6	215.3	290.1	269.8	256.4	308.4	219.6
Solids, total dissolved	mg/l			--	61.0	--	297	--	--	--	338	--	--	--
Solids, total suspended	mg/l			--	--	--	--	--	--	--	--	--	--	--
Specific conductance @ 25 ºC, field	umhos/cm			157	103	462	445	484	506	508	534	529	573	602
Sulfate, as SO4	mg/l			--	4.8	--	19.8	--	--	--	19.4	--	--	--
Sulfide, as S^{2-}, field	mg/l			--	--	--	--	--	--	--	--	--	--	--
Temperature, field	deg C			8.1	6.8	9.4	9.7	9.5	9.8	10.0	10.6	10.2	9.9	11.4
Turbidity, field	NTU			145.0	78.6	1.3	6.0	4.8	1.9	5.9	11.4	2.6	0.6	5.0
Dissolved Metals														
Arsenic	ug/l		2.5	--	< 1.0	--	< 5.0	--	--	--	< 1.0	--	--	--
Boron	ug/l	**500 RAA17**	250.0	--	< 20.0	--	24.7	--	--	--	27.0	--	--	--
Cadmium	ug/l	0.5 HRL15 (1)		--	--	--	--	--	--	--	--	--	--	--
Calcium	mg/l			--	10.1	--	62.7	--	--	--	65.6	--	--	--
Chromium	ug/l	100 CR HRL93	25.0	--	< 4.0	--	< 4.0	--	--	--	< 4.0	--	--	--
Copper	ug/l			--	--	--	--	--	--	--	--	--	--	--
Iron	ug/l			--	57.3	--	431	--	--	--	718	--	--	--
Lead	ug/l			--	--	--	--	--	--	--	--	--	--	--
Magnesium	mg/l			--	3.03	--	22.7	--	--	--	23.3	--	--	--
Manganese	ug/l	**100 HBV18**		--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/l			--	--	--	--	--	--	--	--	--	--	--
Potassium	mg/l			--	2.91	--	1.41	--	--	--	1.38	--	--	--
Sodium	mg/l			--	2.2	--	3.31	--	--	--	3.64	--	--	--
Zinc	ug/l	2000 HRL94	500.0	--	< 10.0	--	< 10.0	--	--	--	< 10.0	--	--	--

Data Footnotes and Qualifiers

Barr Standard Footnotes and Qualifiers

--	Not analyzed/Not available.
U	The analyte was analyzed for, but was not detected.
*	Estimated value, QA/QC criteria not met.
h	EPA recommended sample preservation, extraction or analysis holding time was exceeded.

TestAmerica Qualifiers

*	LCS or LCSD is outside acceptance limits.
^	ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC is outside acceptance limits.
F1	MS and/or MSD Recovery is outside acceptance limits.
H	Sample was prepped or analyzed beyond the specified holding time
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Pace Qualifiers - 2020

J0	The identification of the analyte is acceptable, but the reported concentration is an estimate. The calibration met method criteria.
J4	The associated batch QC was outside the established quality control range for accuracy.
Q	Sample was prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.

MDH Human Health-Based Water Guidance Table

CR	Value represents the criteria for Chromium, hexavalent.
DCP	Value shown is 1,3-dichloropropene in the MDH criterion, however, the laboratory reports cis and trans isomers individually.
(1)	Health Based Value 2014; Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.
HBV14	Health Based Value 2014.
HBV17	Health Based Value 2017.
HBV18	Health Based Value 2018.
HBV19	Health Base Value 2019.
HRL09	Health Risk Limit 2009.
HRL13	Health Risk Limit 2013.
HRL15	Health Risk Limit 2015
HRL18	Health Risk Limit 2018.
HRL20	Health Risk Limit 2020.
HRL93	Health Risk Limit 1993.
HRL94	Health Risk Limit 1994.
***	Dual guidance applies: See Dual Guidance for Drinking Water (https://www.health.state.mn.us/communities/environment/risk/guidance/dualguidance.html)
HRLMCL	Health Risk Limit; Maximum Contaminant Level.
ND	Not derived due to insufficient information.
RAA13	Risk Assessment Advice 2013.
RAA16	Risk Assessment Advice 2016.
RAA17	Risk Assessment Advice 2008.
XYL	Value shown is for the sum of the mixed o,m and p Xylene isomers.

Appendix B

Concentrations Trend Plots

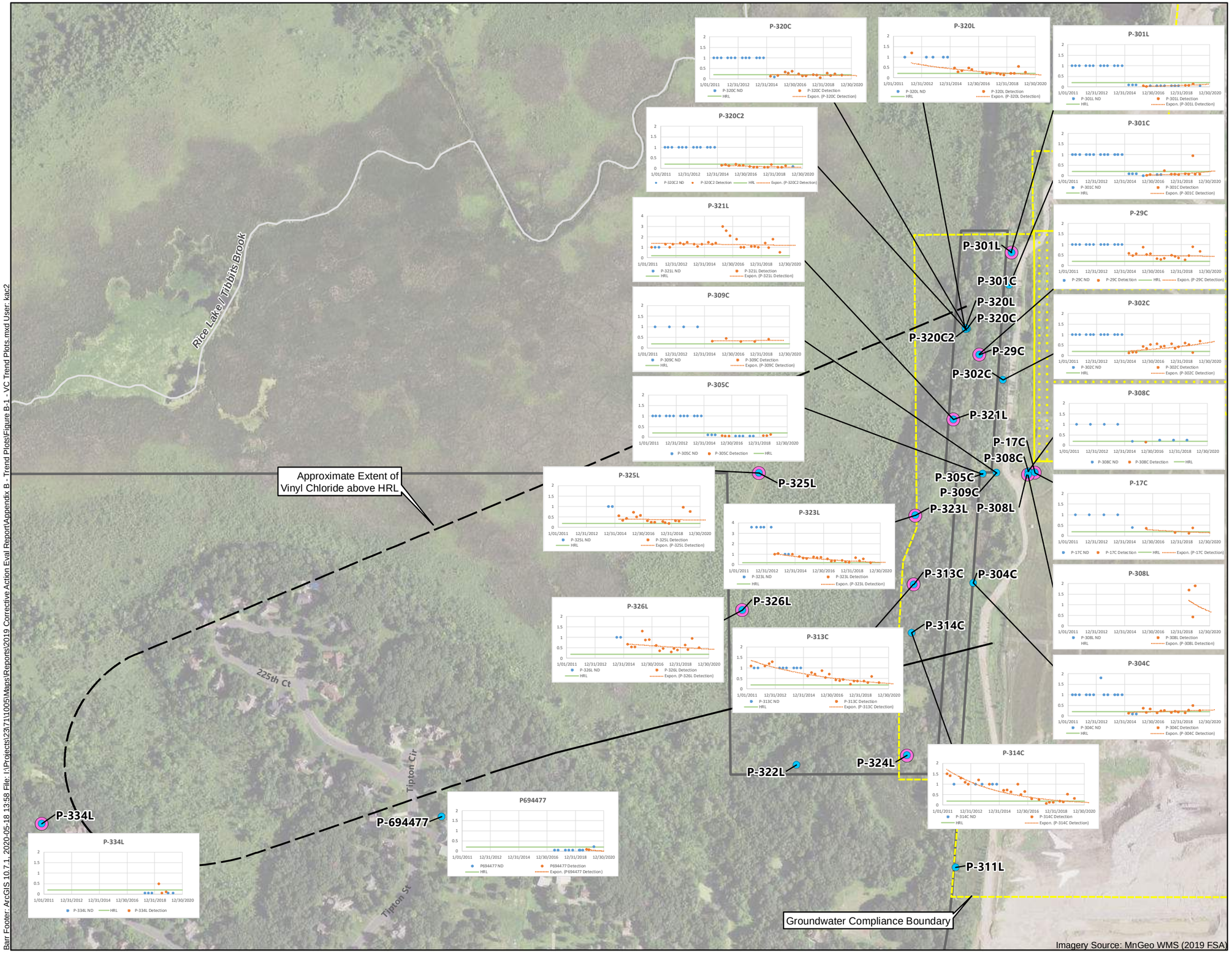
Appendix B
Trend Plots – Overall Summary

This appendix shows vinyl chloride and parent compound concentration trends since 2011 at wells where vinyl chloride has recently been detected. Data from the April 2020 sampling event are included in the plots and are subject to quality assurance review presented in the spring 2020 quarterly monitoring report. The trends for the displayed wells indicate the following:

1. The central and southern portion of vinyl chloride extents nearing the Compliance Boundary (P-313C, P-314C, P-323L) is attenuating steadily over time. The reductive dechlorination progression from TCE to vinyl chloride is evident in this area.
2. Limited attenuation is occurring in the northern portion of vinyl chloride extents near the landfill and Compliance Boundary. Wells P-321L and P-302C have shown stable to increasing trends, respectively. Precursor compounds TCE and cis-DCE are not typically observed in this area.
3. In general, an uptick in vinyl chloride concentrations were observed in 2019 but draft April 2020 data indicate concentrations have returned to levels observed prior to 2019.
4. Vinyl chloride was detected for the first time at distal wells P-334L and P-694477 in 2019. Draft April 2020 vinyl chloride data for these locations are non-detect, although the reporting limit for the P-694477 sample was elevated.
5. Concentrations of chlorinated compounds down the centerline of the plume show attenuation of these compounds with distance from the source area. Vinyl chloride plots alone do not encapsulate the entirety of attenuation with distance (or time) due to the reductive dechlorination process transforming TCE and, more prominently cDCE, to vinyl chloride.
6. Based on theoretical molar mass transformations via a reductive dechlorination pathway, 1 µg/L of cDCE is estimated to produce approximately 0.6 µg/L of vinyl chloride. As shown on Figure 4 of the report, cDCE is present in groundwater at wells P-325L and P-326L and not present in groundwater at P-334L. The limited extent of cDCE, coupled with decreasing vinyl chloride concentrations with distance, suggest that natural attenuation is occurring and that the extent of vinyl chloride may be extended downgradient due to sequential dechlorination reactions producing vinyl chloride via the degradation of cDCE.
7. Vinyl chloride concentrations have dramatically decreased in concentration downgradient of former well P-43B. See attached historic trend plots (and map showing well locations).

Attachments:

Figure B-1	Vinyl Chloride Trends Map
Figure B-2	Vinyl Chloride Trends with Regression (2011-2020)
Figure B-3	Vinyl Chloride, Potential Precursor Compound (TCE, DCE), and Total Molar Chlorinated Ethene Trends (2011-2020)
Figure B-4	Vinyl Chloride and Total Molar Chlorinated Ethene Concentrations along Plume Centerline
Figure B-5	Historic Trend Plots (and map showing historic boring/well locations)



Property Boundary

Pre-Subtitle D Area

Monitoring Well

MNA Monitoring Well

N

Feet

0 450 900

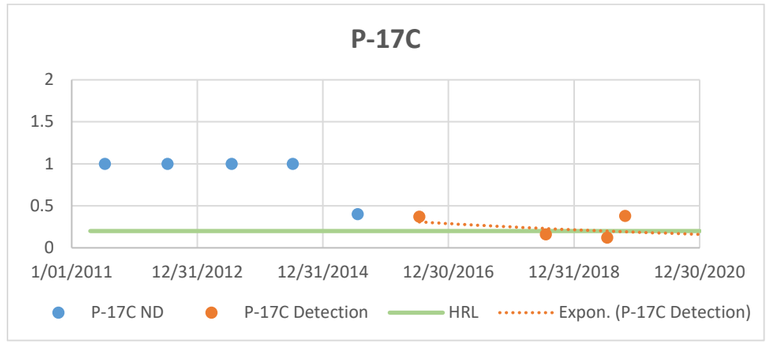
Figure B-1

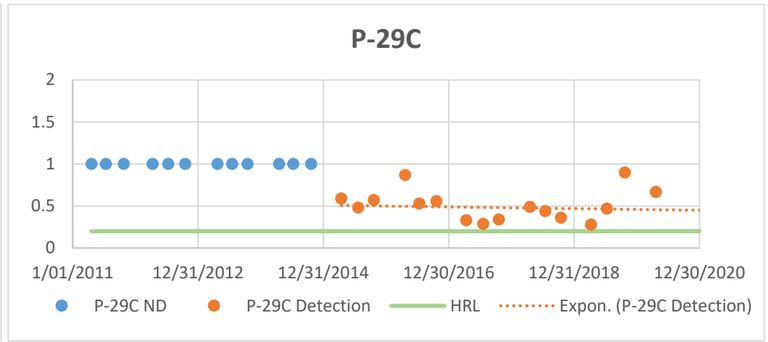
VINYL CHLORIDE TRENDS
Elk River Landfill
Elk River, Minnesota

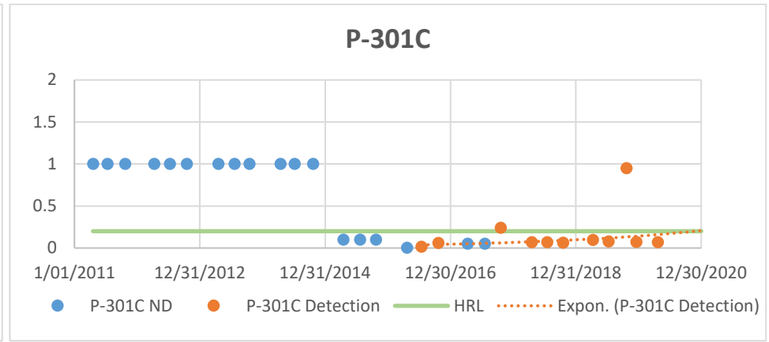
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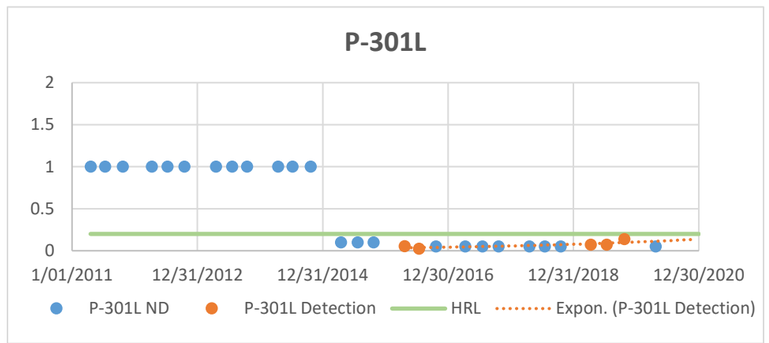
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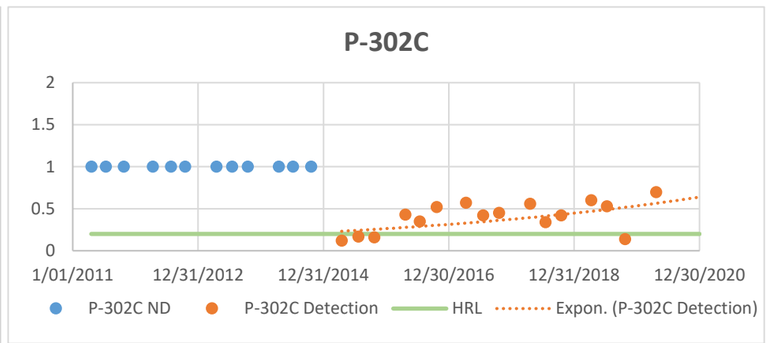
Figure B-2 Vinyl Chloride Trends with Regression (2011-2019)

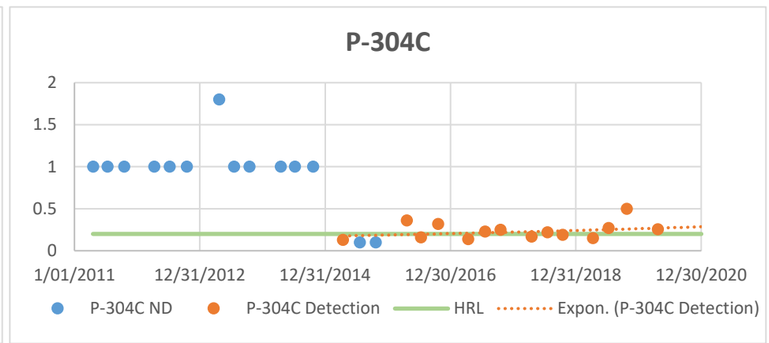


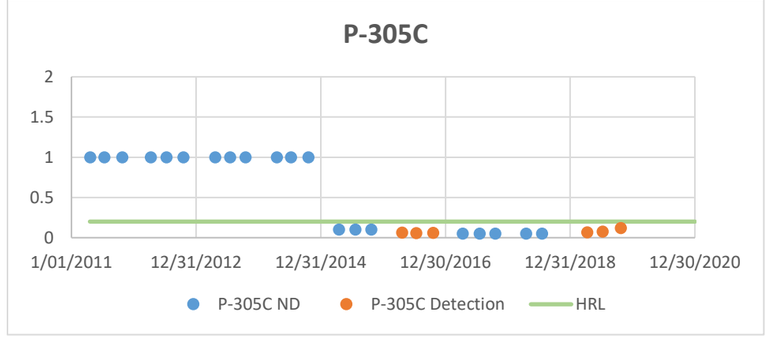


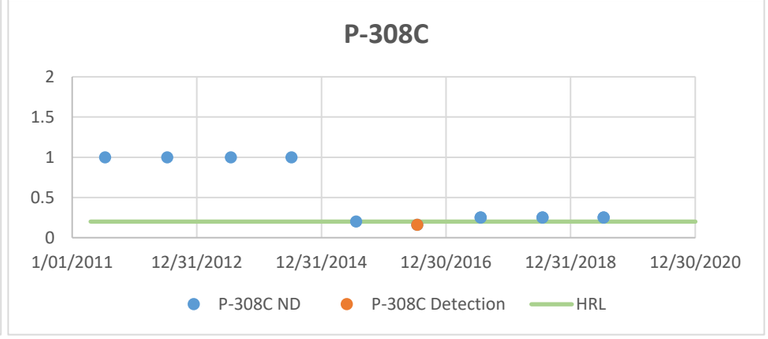


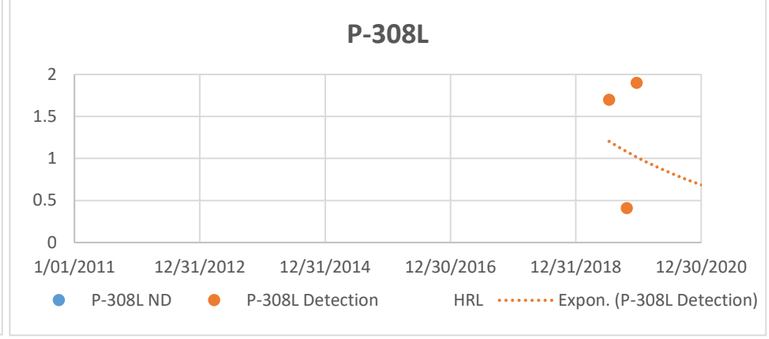


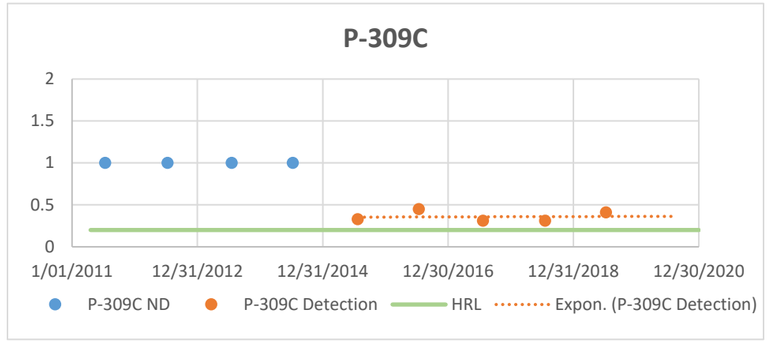


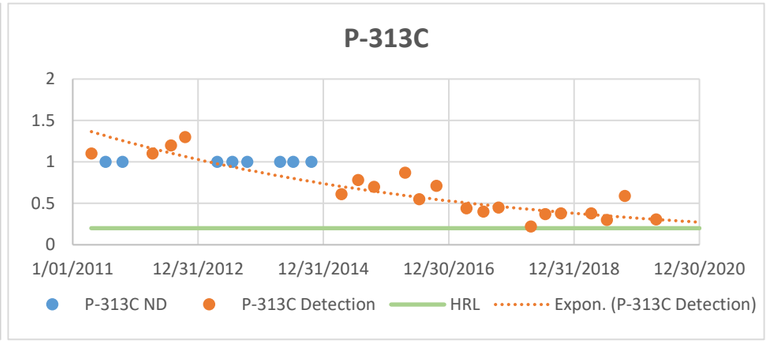












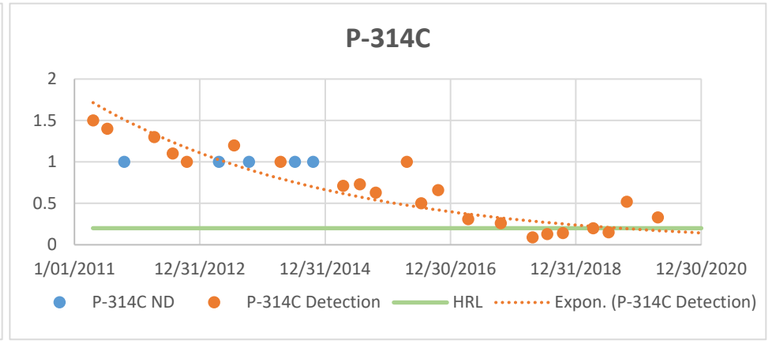
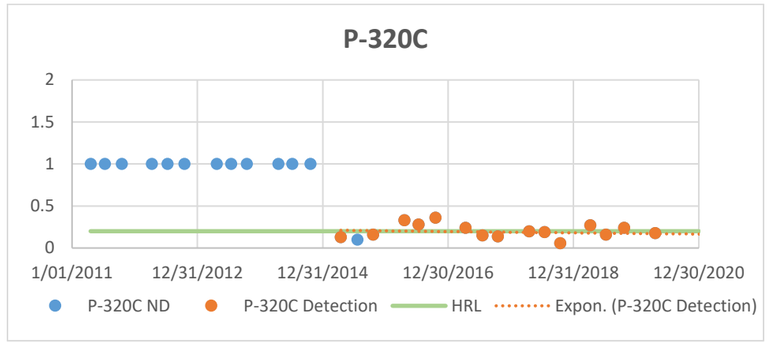
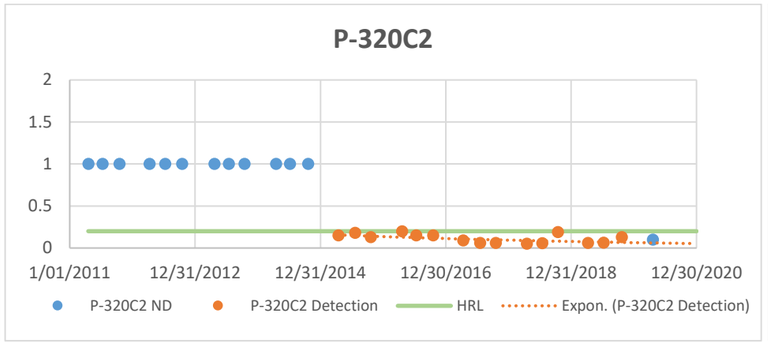
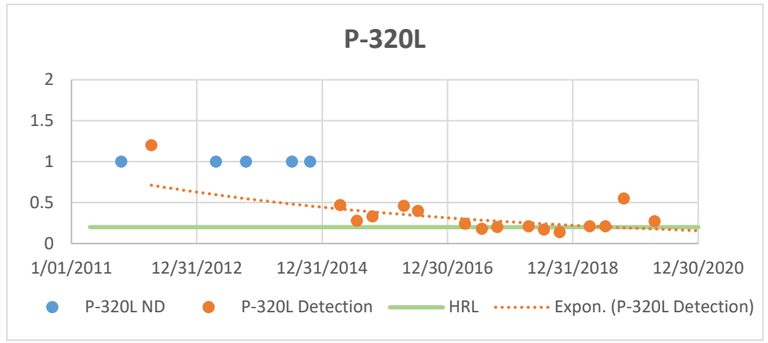
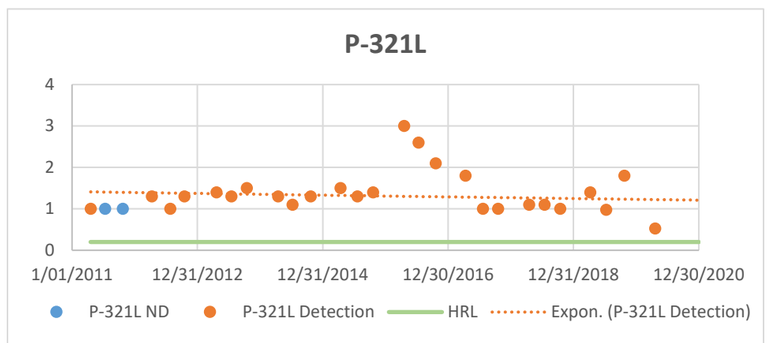


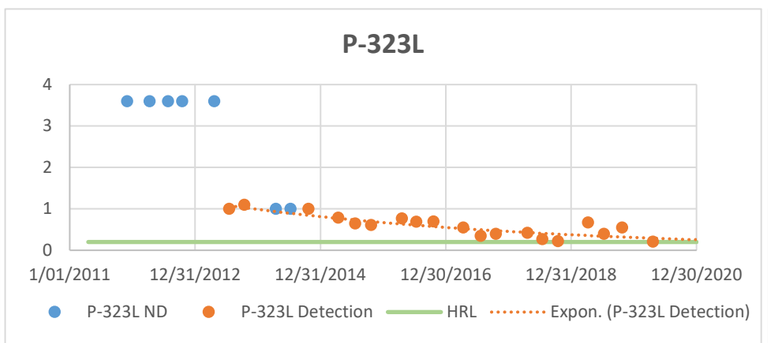
Figure B-2 Vinyl Chloride Trends with Regression (2011-2019)

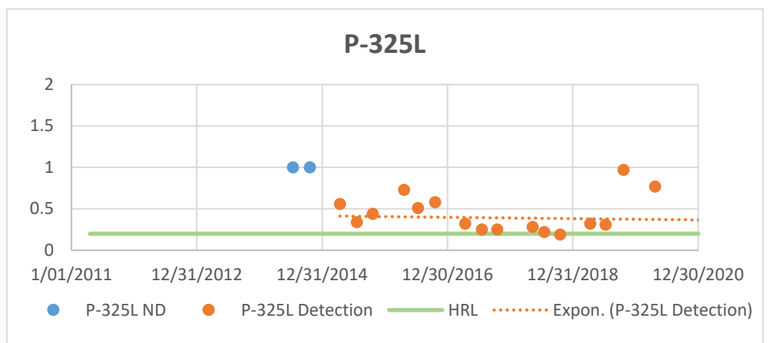


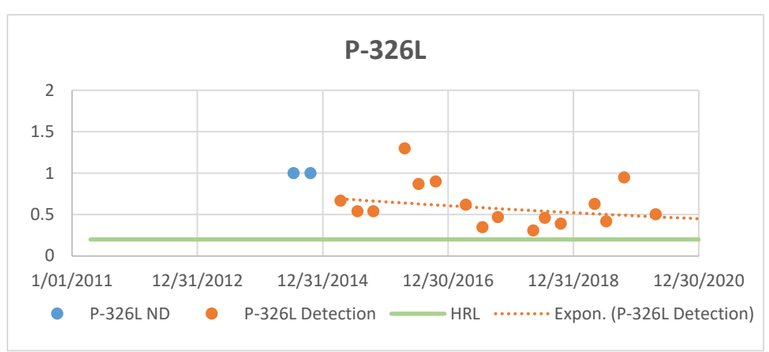


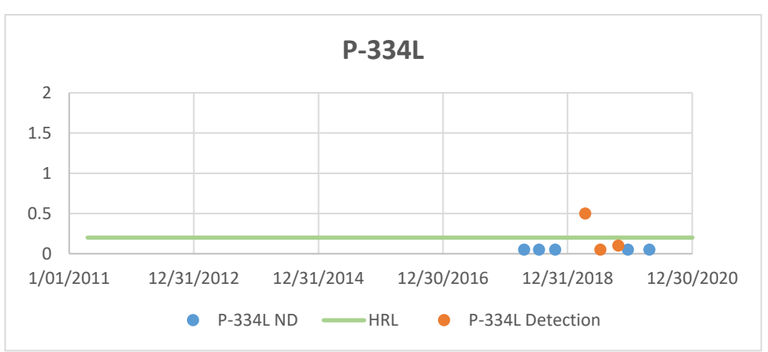


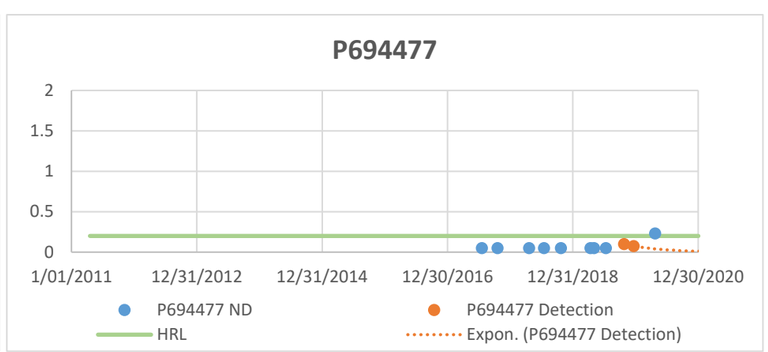






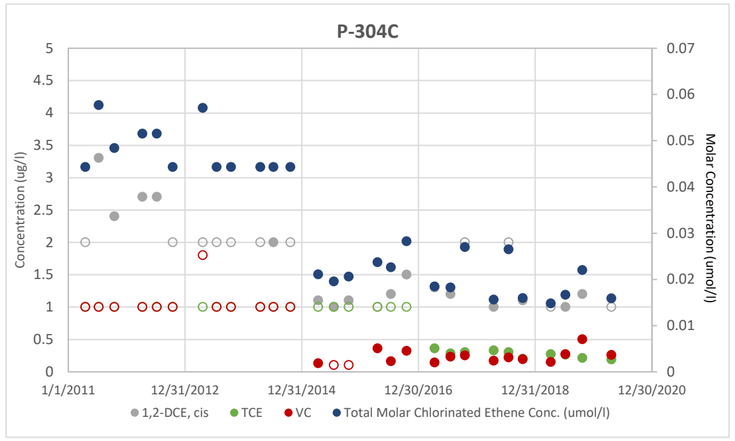


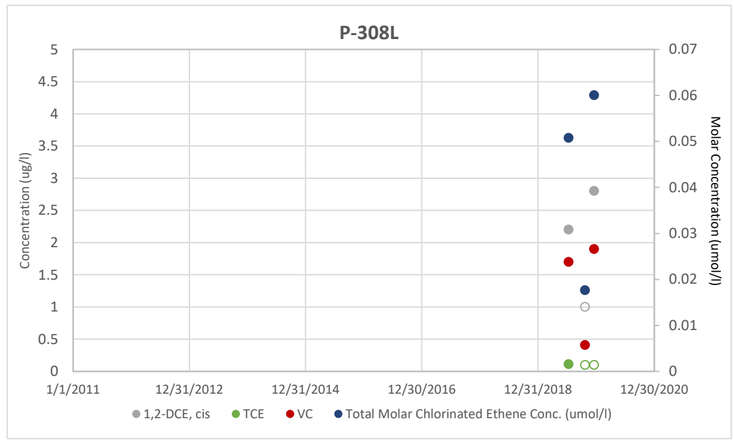


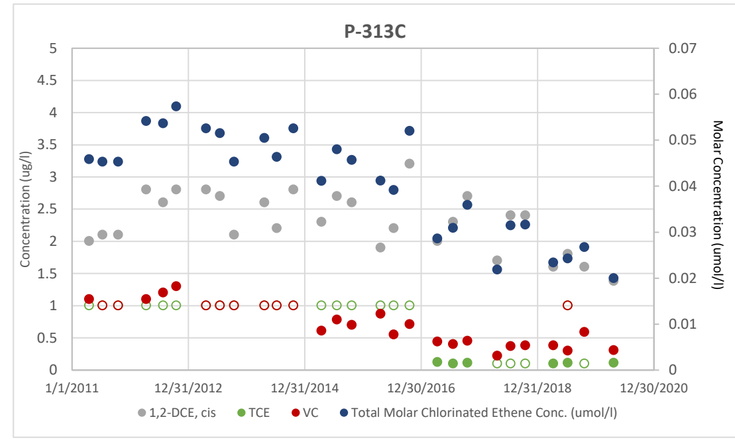


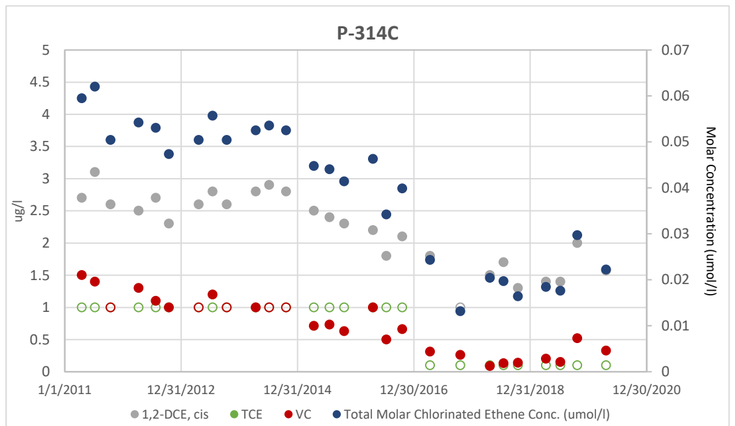
Note: Only locations where vinyl chloride has been detected in recent are displayed.

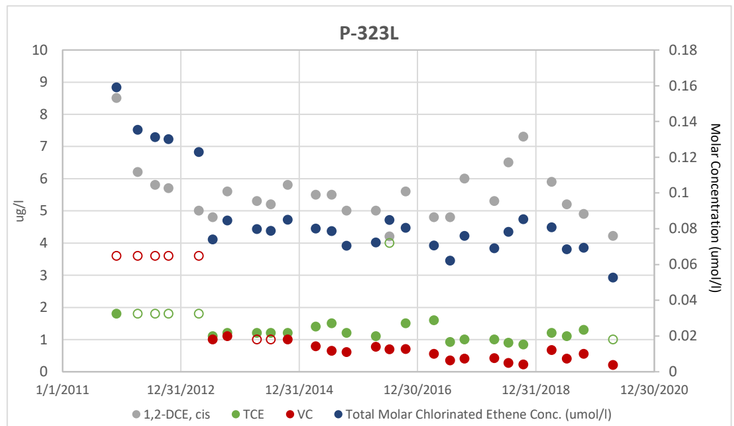
Figure B-3 Vinyl Chloride, Potential Precursor Compound (TCE, DCE), and Total Molar Chlorinated Ethene Trends (2011-2019)

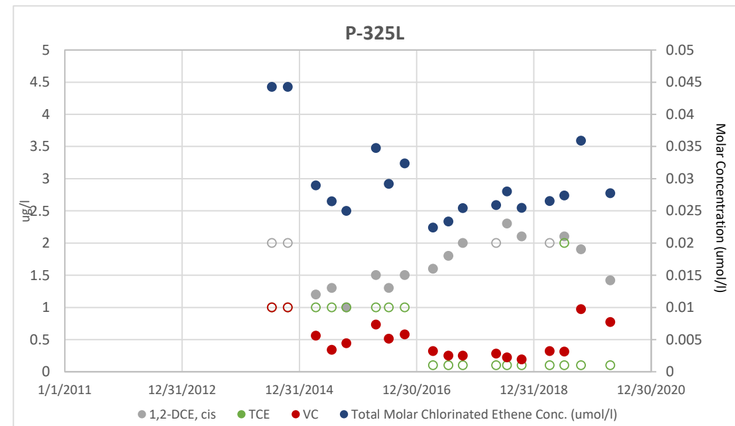


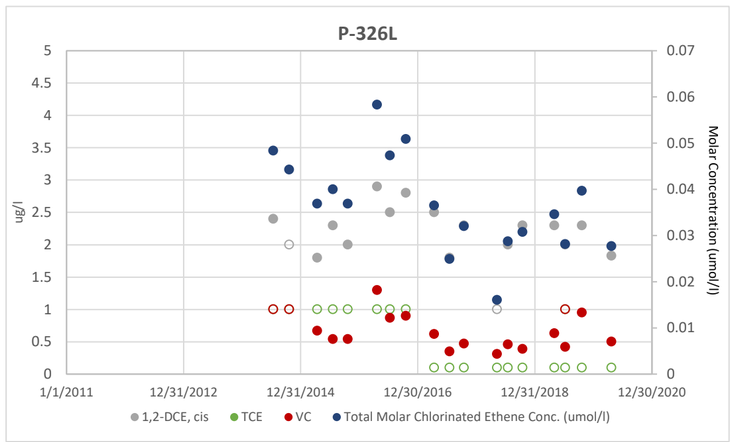






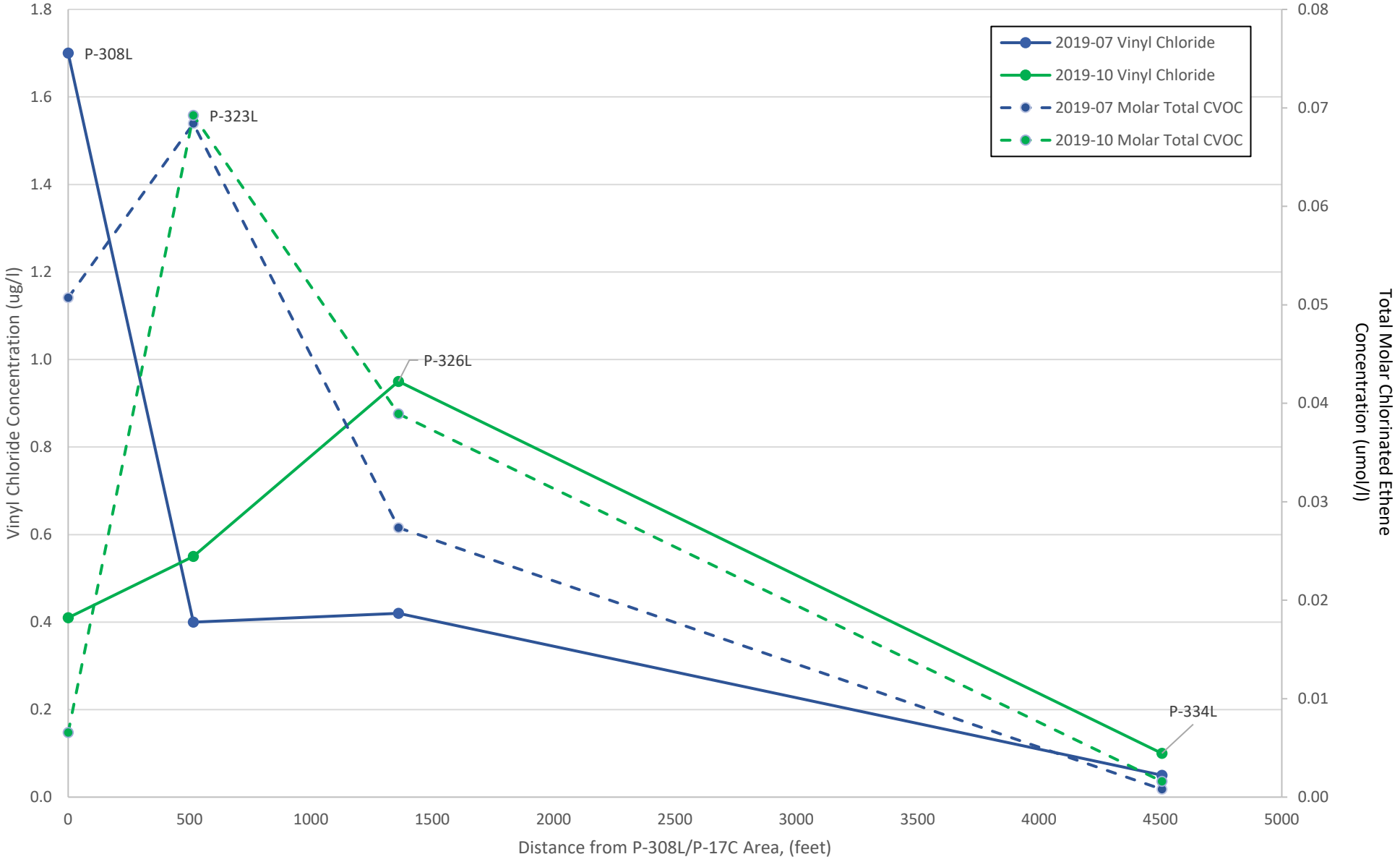






Notes: Only wells where TCE or cis-DCE detected in 2019 are displayed (PCE not detected).
Open symbol indicats sample was non-detect.

Figure B-4 Vinyl Chloride and Total Molar Chlorinated Ethene Concentrations along Plume Centerline



Note: Only monitoring events following P-308L installation plotted.

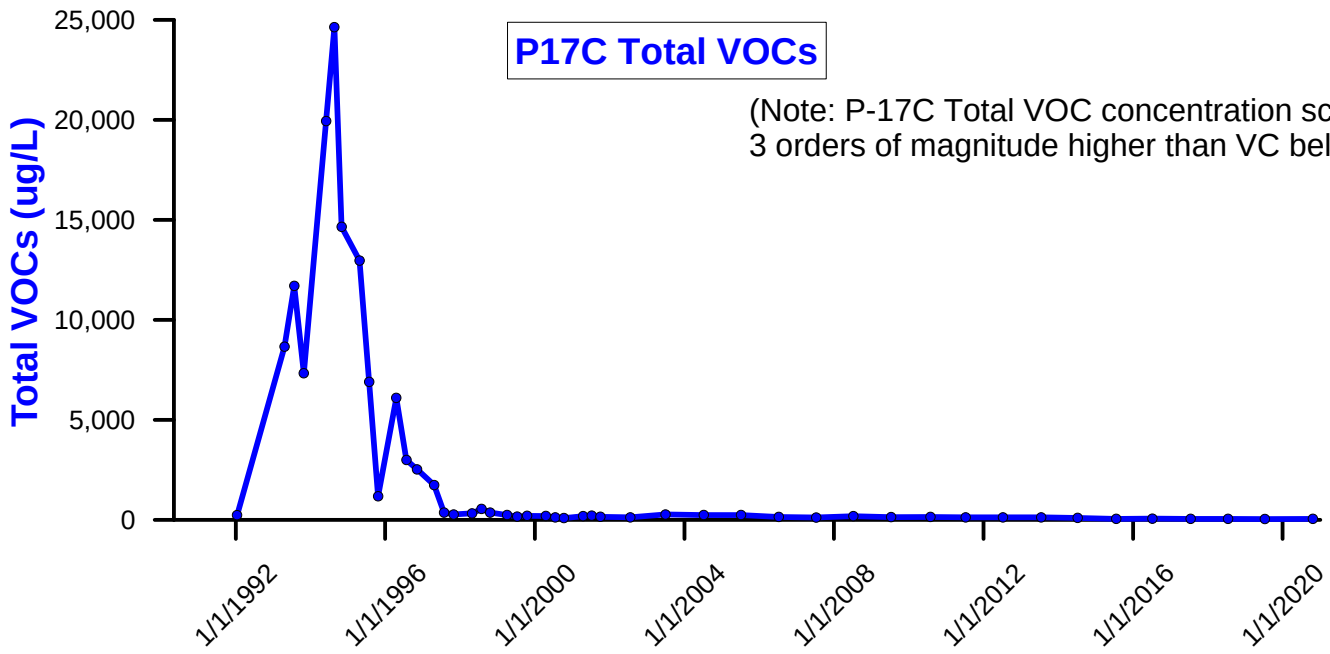
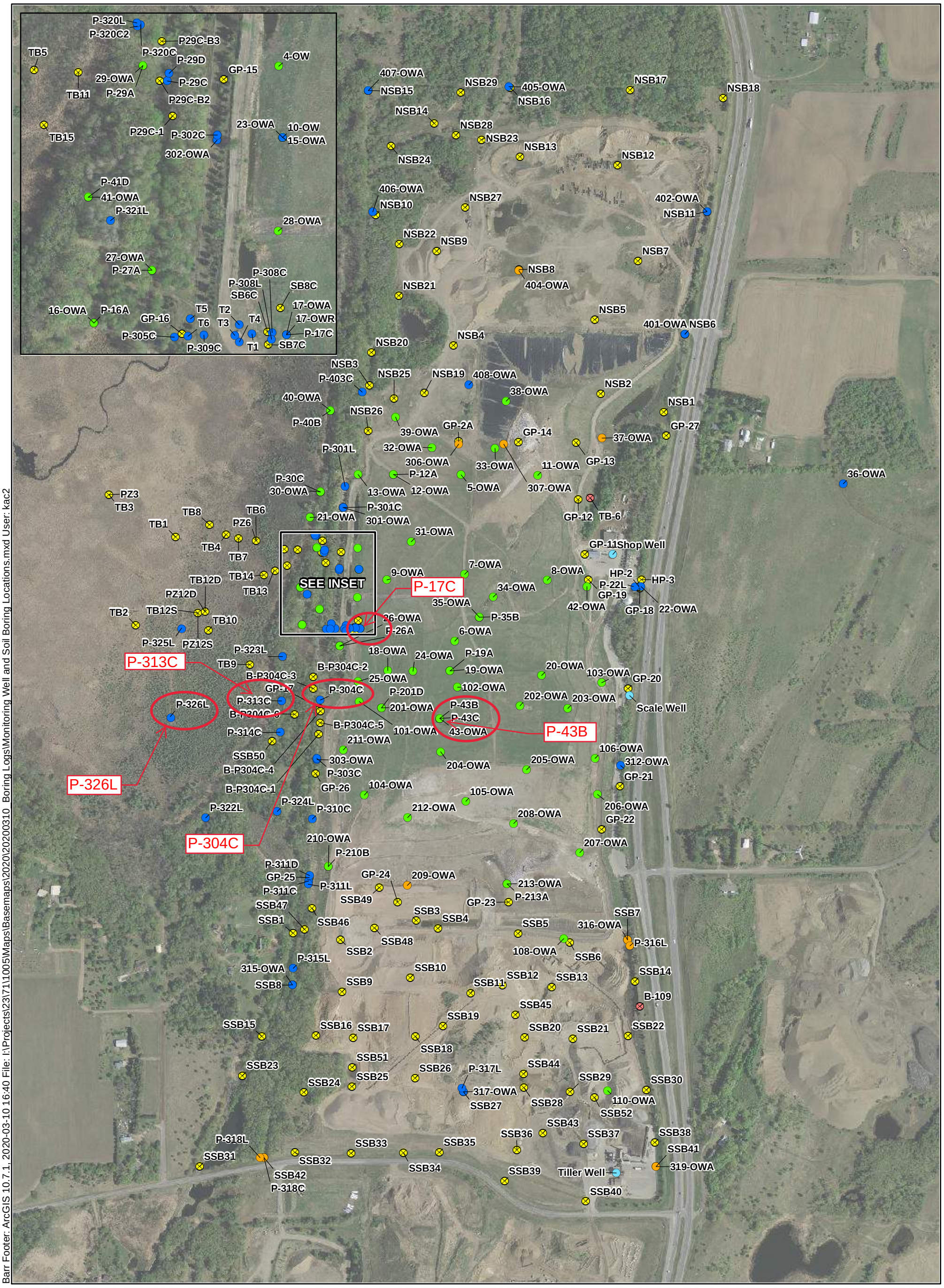




Figure B-5
Historic Trend Plots
Elk River Landfill Elk River, Minnesota



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Monitoring Locations (Surveyed)
- Monitoring Well
- Monitoring Well (Sealed)
- Boring Location

Monitoring Locations (Digitized)
- Monitoring Well (Sealed)
- Water Well (Approximate Location)
- Soil Boring

N

Feet
0 600 1,200

See historic data time series charts

Imagery Source: Sherburne County (2018)
Data Source: Barr, Wenck, MN DOT

B-5 Map
MONITORING WELL AND SOIL BORING LOCATIONS
Elk River Landfill
Elk River, Minnesota

BARR

Appendix C

Preliminary Attenuation Rate Calculations

Appendix C
Estimated Attenuation Rates and Projections

This appendix documents the inputs, assumptions, and methodology for developing A) estimated groundwater flow velocity, B) attenuation rates and resulting projections of vinyl chloride concentrations (and travel distance) downgradient of ERL, and C) vinyl chloride mass and input (flux) from the western edge of ERL into the groundwater system.

A) Vinyl Chloride Transport Velocity and Approximated Arrival Times at Downgradient Monitoring Wells

The vinyl chloride transport velocity (V_{VC}) the lower outwash aquifer (where organics mass transport is predominantly occurring west of ERL) is estimated to be approximately 106 feet/year (Equation 1). The 106 feet/year value is based on the observed extent of vinyl chloride downgradient of the facility at P-334L (detected for the first time at this location in 2019) and the beginning of landfill operations (estimated to be 1972).

Applying a retardation factor (R) of 1.052 for vinyl chloride (Equation 2), the groundwater flow velocity (V_{GW}) is calculated to be approximately 112 feet/year (Equation 3). This calculated V_{GW} is approximately twice the calculated velocity from an aquifer test at P-308L performed in 2019 (Equation 4). This discrepancy is attributed to the heterogeneity in the lower outwash (e.g., coarse gravel was more abundant at wells P-325L and P-326L than at the wells along the west side of the landfill).

Note that the vinyl chloride transport velocity would be higher if the release did not occur for years after landfill operations began. In the estimates provided in this Appendix, a +25% multiplier is applied to represent an alternative higher end estimate for vinyl chloride transport velocity ($V_{VC,HI}$ = 133 ft/yr) and groundwater flow velocity ($V_{GW,HI}$ = 140 ft/yr) to account for this uncertainty.

Using these velocity values, the estimated arrival times for the slug of elevated organics concentrations (observed at P-17C in 1994) to arrive at downgradient monitoring points was calculated (See Table C1). Based on this estimation, the slug of elevated organics concentrations is predicted to have reached the borings B-330/B-331 in the period of 2017 to 2023 and is projected to reach well P-334L between 2026 and 2034. Vinyl chloride was detected in groundwater from one sample interval at a concentration of 0.43 micrograms per liter (µg/L) at B-331 in 2016.

B) Attenuation Rates

Location-specific (k_{POINT}) and bulk overall attenuation rates (k_{BULK}) and were calculated to further assess attenuation and develop projections based on existing data. Location-specific attenuation rates provide a gauge of the degree of attenuation is occurring at the evaluated location. For example, a value of 0.07/year represents a half-life of approximately 10 years. Bulk overall attenuation rates provide an overall assessment of attenuation across the entire length of a plume. Details are provided below.

Location-Specific Attenuation Rates (k_{POINT})

Location-specific vinyl chloride attenuation rates are useful in assessing trends and projecting time until concentrations reach a certain level (i.e. Intervention Limits) at well locations. This evaluation was only applied to vinyl chloride in the central and southern portions of the plume (where decreasing vinyl chloride trends are occurring near the Compliance Boundary) and not the northern half of the plume (i.e., well P-321L and northward) due to mixed trends. See Appendix B for trend data. Attenuation rates were also not calculated for locations P-334L and P694477 due to too few detections at these locations.

Appendix C
Estimated Attenuation Rates and Projections

This approach should not be used to make projections across an entire plume (Newell & Rifai et. al, 2002).

Vinyl chloride concentration data from 2011 to 2019 was reviewed to calculate k_{POINT} values (Newell & Rifai et. al, 2002) for six wells located near (P-313C, P-314C, P-321L, P-323l), and beyond (P-325L, P-326L) the Compliance Boundary (see Equation 6).

Calculated k_{POINT} values ranged from 0.081 (P-326L) to 0.269 (P-314C). These values indicate the following:

- Attenuation is occurring at a greater rate near the Compliance Boundary compared to the downgradient Property boundary.
- In recent years, the central and southern areas of the vinyl chloride extents near the landfill are naturally attenuating over time and attenuation near P-321L is more stagnant.

Note that the location-specific attenuation rates may be biased low as they do not account for conversion of precursor compounds (PCE, TCE, and DCE) to vinyl chloride. Using first order kinetics and k_{POINT} values, projections for when each of these wells may approach Intervention Limits (ILs) were calculated. These projections range from approximately 4 (i.e., 2024 at P-314C) to 28 years (i.e., 2048 at P-326L) and are shown in Table C2.

Bulk Attenuation Rates (k_{BULK})

Bulk attenuation rates describe the behavior of the entire plume at one point in time and can be useful to project how far along a flow path a plume will expand (Newell & Rifai et. al, 2002).

Overall bulk attenuation rates (k_{BULK}) were estimated using trend line analysis methods outlined in MPCA guidance (MPCA, 2006). A primary assumption in applying this method is that vinyl chloride and other organics have achieved steady state (i.e., not expanding). Late 2019 monitoring results showed first-time confirmed detections of vinyl chloride in samples from monitoring wells P-334L and P-694477. Vinyl chloride was not detected in the spring 2020 samples at wells P-334L (<0.05 µg/L) or P-694477 (<0. 231; i.e., the reporting limit was elevated). The sporadic detections at concentrations near the reporting limit and non-detections suggest these wells are located near the plume fringe and that further monitoring is necessary to assess the overall stability of the organics downgradient of the ERL. Note that if the extents of vinyl chloride are expanding, the attenuation rates presented below are overestimated.

Three approaches were applied to develop a range of potential overall attenuation rates along the plume centerline (P-308L, P-323L, P-326L, and P-334L) using the trend line analysis method. July and October 2019 datasets were used in the review for the first two approaches with the objective of including both wells P-308L (installed in 2019) and P-334L (installed in 2018).

1) July and October 2019 datasets (vinyl chloride only). This approach likely represents a low estimate of attenuation rates as conversion from precursor compounds (PCE, TCE, DCE) to vinyl chloride are not considered.
2) July and October 2019 datasets (total molar concentration of vinyl chloride and precursor compounds PCE, TCE, DCE). This approach includes precursor compounds to capture transformation to vinyl chloride and likely represents a high estimate of attenuation rates as

precursor compounds are present at several locations and generally attenuate more rapidly than vinyl chloride.

3) Maximum reported concentrations at each well since 2015 (vinyl chloride only). This approach estimates rates at the highest reported concentrations at each well since 2015 when reporting limits were lowered to current standards.

Based on these varying approaches (Equation 5), estimated overall attenuation rates are summarized in the following table:

	Bulk Overall Att. Rate at V_{GW} = 112 ft/yr		***Bulk Overall Att. Rate at V_{GW} = 145 ft/yr***	
Method	**$K_{BULK,JULY}$ (/yr)**	**$K_{BULK,OCT}$ (/yr)**	***$K_{BULK,JULY,HI}$ (/yr)***	***$K_{BULK,OCT,HI}$ (/yr)***
1. Vinyl chloride (2019)	0.078	0.045	*0.102*	*0.058*
2. Molar (2019)	0.112	0.067	*0.145*	*0.087*
3. Vinyl chloride (max since 2015)	0.067		*0.087*	
4. Overall average	0.074		*0.096*	

The estimated vinyl chloride travel velocities and k_{BULK} are applied to evaluate the following scenarios. See Table C2 for details.

A) Scenario A: What is the estimated highest vinyl concentration at the Compliance Boundary that would naturally attenuate before reaching nearest residential water supply user in the direct downgradient flowpath of the mapped vinyl chloride extent.
   a. Range: 1 to 90 µg/l
   b. Average: 7 µg/l

   This scenario suggests that, on average, vinyl chloride concentrations at or below 7 µg/l at the Compliance Boundary will attenuate before reaching the nearest residential well downgradient of P-334L.

B) Scenario B: What is the estimated highest vinyl chloride concentration at monitoring well P-334L that would naturally attenuate below the IL or detection limit (0.05 µg/l) before reaching nearest residential water supply user in the direct downgradient flow path of the mapped vinyl chloride extent.
   a. Range: 0.21 to 1.8 µg/l
   b. Average: 0.54 µg/l)

   This scenario suggests that, on average, vinyl chloride concentrations at or below 0.54 µg/l in groundwater at well P-334L will attenuate before reaching the nearest residential well downgradient of P-334L.

C) Scenario C: How far is vinyl chloride projected to travel downgradient of the Compliance Boundary considering peak 2019 concentrations reported near Compliance Boundary (*1.8 ug/l at P-321L*)?
   a. Range: 3,500 to 9,000 feet
   b. Average: 5,400 feet

This scenario suggests that, on average, the vinyl chloride detected in groundwater at well P-321L will travel a distance of 5,400 feet. For context the nearest residential water supply user in the direct downgradient flow path of the mapped vinyl chloride extent is approximately 7,500 feet downgradient of the Compliance Boundary.

C) Mass Estimates of Vinyl Chloride

The change in vinyl chloride inputs from western edge of the landfill into the groundwater system over time were estimated using a mass flux approach that applies principles of Darcy's Law. The Approximate Extent of Vinyl Chloride Above Intervention Limits shown on Cross Section A-A' (Figure 8 of the Report) represents the evaluated transect of flow. This transect of flow was evaluated using datasets from April 2010 and 2019. The April 2010 dataset was selected as it represents the passage of approximately 10 years. Data inputs, assumptions, and calculated values are included in Table C4.

Using the mass flux approach, in 2019, vinyl chloride flowed from the western edge of ERL (represented by Cross Section A-A') into the downgradient groundwater system at a rate of 0.065 lb/yr. This is a 42% reduction compared to April 2010 (0.11 lb/yr). Consistent with the k_{POINT} values, the zones showing the greatest decrease in mass flux over that time period were in the central and southern areas while the northern area remained similar over that time period.

For context, the estimated total mass of vinyl chloride in the plume downgradient of the unlined area is estimated to be approximately 1 lb. Data inputs and calculated values are included in Table C5.

Summary

The estimates above suggest that natural attenuation to meet ILs in the short term along the southern portion of the organics plume is plausible and less likely in the northern area. Assuming the plume is stable, vinyl chloride concentrations along the Compliance Boundary from are anticipated to attenuate under natural conditions before reaching the nearest residential well downgradient of well P-334L (using average k_{BULK} value).

Mass flux calculations show the overall input of vinyl chloride into the downgradient groundwater system is declining over time. This reduction of inputs is expected to result in lower downgradient concentrations and have a positive effect on the overall plume extents in coming years.

Reliance on Rates and Projections

The attenuation rates and the resulting projections above should be considered as approximations based on existing data (at this time) and the stated assumptions (i.e., not definitive estimates). Further long-term monitoring at current vinyl chloride reporting limits and at wells installed in the last decade are necessary to improve confidence in and refine these estimates as appropriate. This variability and need for additional data is further emphasized by the variability in the values derived using k_{BULK}.

References

MPCA, 2006. Guidelines, Natural Attenuation of Chlorinated Solvents in Groundwater. Minnesota Pollution Control Agency, Site Remediation Section, Revised June 2006.

Newell & Rifai et. al, 2002. Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation Studies. United States Environmental Protection Agency Groundwater Issue. EPA/540/S-02/500. November 2002.

Appendix C

Vinyl Chloride Transport Velocity and Attenuation Rate Estimates

Elk River Landfill

1) **Vinyl Chloride Velocity Estimate → $V_{VC}=x/t_{LF}$**

Variable	Value	Units	Source/Comment			
x	5000	ft	Estimated distance vinyl chloride has traveled from source			
t_{LF}	47	years	Years from beginning of landfill operations (est. 1972) to detection of vinyl chloride at P-334L in 2019.			
V_{VC}	106	ft/yr	Vinyl chloride velocity	$V_{VC,HI}$	133 ft/yr	+25% higher end estimate

2) **Retardation Factor → $R=1+r_b k_d/n$**

Variable	Value	Units	Source/Comment
r_s	2.65	kg/L	Quartz solids density
r_b	1.9875	kg/L	Bulk Density → $r_b=r_s(1-n)$
f_{oc}	0.00035		Fractional organic carbon - https://www.itrcweb.org/DNAPL-ISC_tools-selection/Content/Appendix%20I.%20Foc%20Tables.htm
k_{oc}	18.6	L/kg	MPCA Risk-Based Buidance for Soil Leaching Pathway, Working Draft Guidelines (1998)
k_d	0.00651	L/kg	Soil Distribution Coefficient → $k_d=f_{oc}k_{oc}$
n	0.25		2015 Hydro Report (Barr)
R	1.052		Retardation Factor - Vinyl chloride 5.2% retarded

3) **Groundwater Velocity → $V_{GW}=V_{VC}R$**

Variable	Value	Units	Source/Comment			
V_{GW}	112	ft/yr	Velocity of Groundwater at Base of Lower Outwash Unit	$V_{GW,HI}$	140	+25% higher end estimate

4) **ALTERATE Groundwater Velocity → $V_{GW}=Ki/n$**

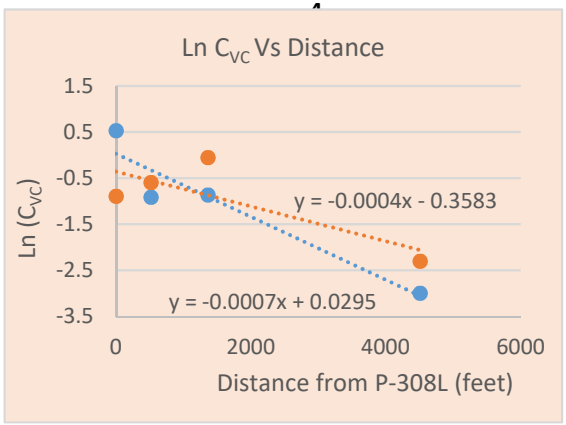
Variable	Value	Units	Source/Comment
K	41.99	ft/day	P-308L Step Test (2019) ALTERNATE IS 5.67 ft/d (0.002 cm/s from 2015 Hydro Report)
n	0.25		2015 Hydro Report
$x_{P323L-P334L}$	3990	ft	Distance from P-323L to P-334L
i	0.00097	ft/ft	Avg water Levels 2018-2019 (P-323L, P-334L), Distance between the locations (3990 ft)
V_{GW}	59.7	ft/yr	Not utilized for attenuation rate calculations as it does not align with vinyl chloride presence at well P-334L

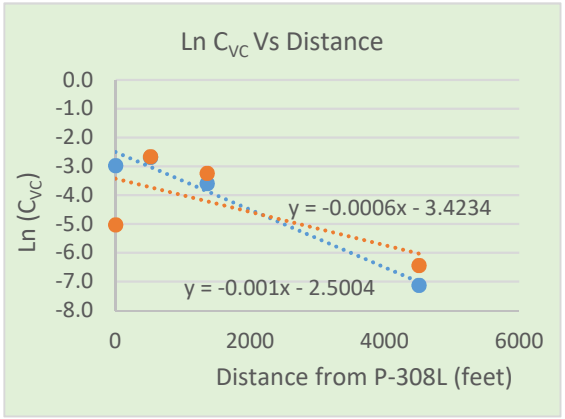
Appendix C
Vinyl Chloride Transport Velocity and Attenuation Rate Estimates
Elk River Landfill

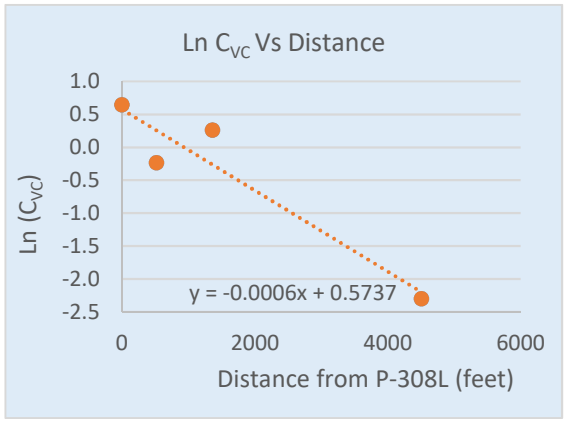
5) **Overall Bulk Attenuation Rate (Solve for k_{BULK}) → $-k/V_{GW}$=Regression Slope (see MPCA, 2006 - Appendix A for methodology)**

		July 2019		October 2019		Molar July 2019		Molar October 2019		Max Conc. (since 2015)	
	Distance	C_{VC} (ug/l	Ln C_{VC}	C_{VC} (ug/l)	Ln C_{VC}	C_{MOL} (umol/l)	Ln C_{MOL} (umol	C_{MOL} (umol/l)	Ln C_{MOL} (umol	C_{VC} (ug/l)	Ln C_{VC}
P-308L	0	1.7	0.53	0.41	-0.89	0.051	-2.981	0.0066	-5.027	1.9	0.641853886
P-323L	516	0.4	-0.92	0.55	-0.60	0.068	-2.682	0.0692	-2.670	0.79	-0.235722334
P-326L	1361	0.42	-0.87	0.95	-0.05	0.027	-3.599	0.0389	-3.246	1.3	0.262364264
P-334L	4506	0.05	-3.00	0.1	-2.30	0.001	-7.131	0.0016	-6.438	0.1	-2.302585093
Reg. Slope		-7E-04	Plot Slope	-0.0004	Plot Slope	-0.001	Plot Slope	-0.0006	Plot Slope	-0.0006	Plot Slope
k_{BULK}		**0.078**	**/yr**	**0.045**	**/yr**	**0.112**	**/yr**	**0.067**	**/yr**	**0.067**	**/yr**
$k_{BULK,HI-VELO}$		**0.098**	**/yr**	**0.056**		**0.140**		**0.084**		**0.084**	

AVERAGE
0.074
0.092







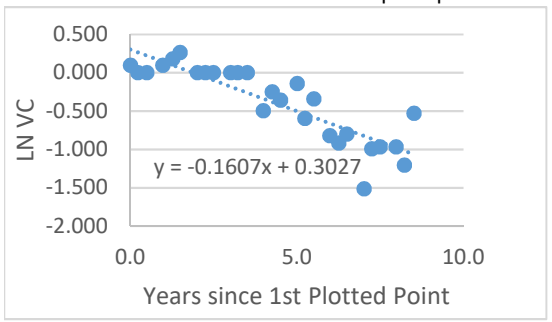
Overall attenuation rates indicate attenuation is occuring over the length of the plume, but there is high variability in rates based on calculation methods

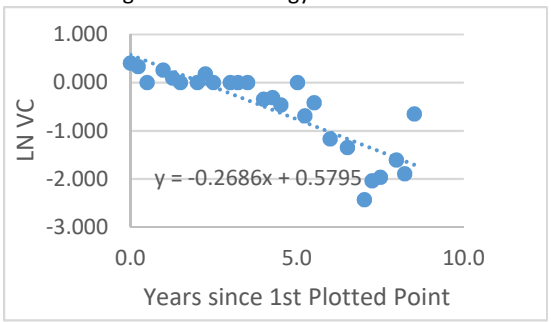
Appendix C
Vinyl Chloride Transport Velocity and Attenuation Rate Estimates
Elk River Landfill

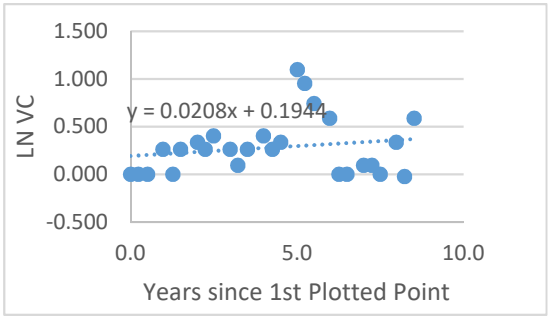
6) **Location-specific Attenuation Rates (see Newell & Rifai et al., 2002 for calculation methods)** red values are non-detect

P-313C	VC (ug/l)	ln VC	Yrs	P-314C	VC (ug/l)	ln VC	Yrs	P-321L	VC (ug/l)	ln VC	Yrs
4/19/2011	1.1	0.095	0.0	4/19/2011	1.5	0.405	0.0	4/19/2011	1.0	0.000	0.0
7/11/2011	1.0	0.000	0.2	7/11/2011	1.4	0.336	0.2	7/12/2011	1.0	0.000	0.2
10/17/2011	1.0	0.000	0.5	10/17/2011	1.0	0.000	0.5	10/24/2011	1.0	0.000	0.5
4/10/2012	1.1	0.095	1.0	4/10/2012	1.3	0.262	1.0	4/10/2012	1.3	0.262	1.0
7/26/2012	1.2	0.182	1.3	7/26/2012	1.1	0.095	1.3	7/26/2012	1.0	0.000	1.3
10/16/2012	1.3	0.262	1.5	10/16/2012	1.0	0.000	1.5	10/17/2012	1.3	0.262	1.5
4/22/2013	1.0	0.000	2.0	4/22/2013	1.0	0.000	2.0	4/22/2013	1.4	0.336	2.0
7/18/2013	1.0	0.000	2.2	7/18/2013	1.2	0.182	2.2	7/17/2013	1.3	0.262	2.2
10/14/2013	1.0	0.000	2.5	10/14/2013	1.0	0.000	2.5	10/15/2013	1.5	0.405	2.5
4/22/2014	1.0	0.000	3.0	4/15/2014	1.0	0.000	3.0	4/15/2014	1.3	0.262	3.0
7/9/2014	1.0	0.000	3.2	7/9/2014	1.0	0.000	3.2	7/9/2014	1.1	0.095	3.2
10/22/2014	1.0	0.000	3.5	10/22/2014	1.0	0.000	3.5	10/22/2014	1.3	0.262	3.5
4/15/2015	0.61	-0.494	4.0	4/15/2015	0.71	-0.342	4.0	4/14/2015	1.5	0.405	4.0
7/21/2015	0.78	-0.248	4.3	7/21/2015	0.73	-0.315	4.3	7/21/2015	1.3	0.262	4.3
10/22/2015	0.7	-0.357	4.5	10/22/2015	0.63	-0.462	4.5	10/21/2015	1.4	0.336	4.5
4/20/2016	0.87	-0.139	5.0	4/20/2016	1.0	0.000	5.0	4/19/2016	3.0	1.099	5.0
7/12/2016	0.55	-0.598	5.2	7/12/2016	0.5	-0.693	5.2	7/11/2016	2.6	0.956	5.2
10/20/2016	0.71	-0.342	5.5	10/20/2016	0.66	-0.416	5.5	10/19/2016	2.1	0.742	5.5
4/12/2017	0.44	-0.821	6.0	4/12/2017	0.31	-1.171	6.0	4/11/2017	1.8	0.588	6.0
7/20/2017	0.4	-0.916	6.3	10/19/2017	0.26	-1.347	6.5	7/21/2017	1.0	0.000	6.3
10/17/2017	0.45	-0.799	6.5	4/23/2018	0.088	-2.430	7.0	10/17/2017	1.0	0.000	6.5
4/23/2018	0.22	-1.514	7.0	7/17/2018	0.13	-2.040	7.2	4/17/2018	1.1	0.095	7.0
7/16/2018	0.37	-0.994	7.2	10/16/2018	0.14	-1.966	7.5	7/16/2018	1.1	0.095	7.2
10/15/2018	0.38	-0.968	7.5	4/10/2019	0.2	-1.609	8.0	10/15/2018	1.0	0.000	7.5
4/9/2019	0.38	-0.968	8.0	7/9/2019	0.15	-1.897	8.2	4/8/2019	1.4	0.336	8.0
7/9/2019	0.3	-1.204	8.2	10/23/2019	0.52	-0.654	8.5	7/10/2019	0.98	-0.020	8.2
10/22/2019	0.59	-0.528	8.5					10/23/2019	1.8	0.588	8.5
	k_{P313C}	**0.1607**			k_{P314C}	**0.2686**			k_{P321L}	**NA (not decreasing)**	

NOTE: k=slope of plotted LN VC vs Time Plot using this methodology







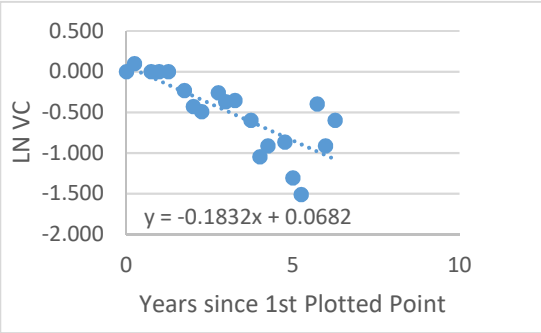
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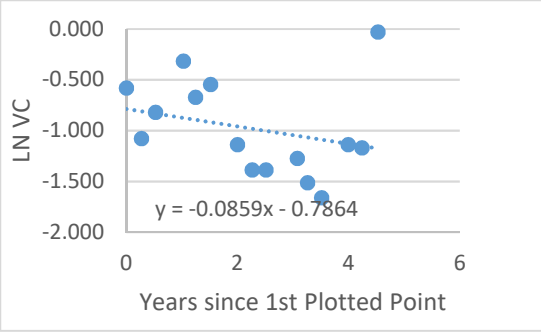
P-323L	VC (ug/l)	ln VC	Yrs
12/1/2011	3.6		
4/10/2012	3.6		
7/26/2012	3.6		
10/16/2012	3.6		
4/22/2013	3.6		
7/17/2013	1.0	0.000	0
10/14/2013	1.1	0.095	0.2
4/15/2014	1.0	0.000	0.7
7/10/2014	1.0	0.000	1.0
10/22/2014	1.0	0.000	1.3
4/14/2015	0.79	-0.236	1.7
7/21/2015	0.65	-0.431	2.0
10/21/2015	0.61	-0.494	2.3
4/19/2016	0.77	-0.261	2.8
7/11/2016	0.69	-0.371	3.0
10/20/2016	0.7	-0.357	3.3
4/11/2017	0.55	-0.598	3.7
7/21/2017	0.35	-1.050	4.0
10/17/2017	0.4	-0.916	4.3
4/19/2018	0.42	-0.868	4.8
7/16/2018	0.27	-1.309	5.0
10/15/2018	0.22	-1.514	5.2
4/8/2019	0.67	-0.400	5.7
7/10/2019	0.4	-0.916	6.0
10/23/2019	0.55	-0.598	6.3
	k_{P323L}	**0.1832**	

P-325L	VC (ug/l)	ln VC	Yrs
7/14/2014	1.0		
10/21/2014	1.0		
4/14/2015	0.56	-0.580	0
7/22/2015	0.34	-1.079	0.3
10/22/2015	0.44	-0.821	0.5
4/22/2016	0.73	-0.315	1.0
7/11/2016	0.51	-0.673	1.2
10/19/2016	0.58	-0.545	1.5
4/13/2017	0.32	-1.139	2.0
7/18/2017	0.25	-1.386	2.3
10/16/2017	0.25	-1.386	2.5
5/10/2018	0.28	-1.273	3.1
7/17/2018	0.22	-1.514	3.3
10/17/2018	0.19	-1.661	3.5
4/10/2019	0.32	-1.139	4.0
7/9/2019	0.31	-1.171	4.2
10/22/2019	0.97	-0.030	4.5
	k_{P325L}	**0.0859**	

P-326L	VC (ug/l)	ln VC	Yrs
7/14/2014	1.0		
10/21/2014	1.0		
4/14/2015	0.67	-0.400	0
7/22/2015	0.54	-0.616	0.3
10/22/2015	0.54	-0.616	0.5
4/22/2016	1.3	0.262	1.0
7/11/2016	0.87	-0.139	1.2
10/19/2016	0.9	-0.105	1.5
4/13/2017	0.62	-0.478	2.0
7/18/2017	0.35	-1.050	2.3
10/16/2017	0.47	-0.755	2.5
5/10/2018	0.31	-1.171	3.1
7/17/2018	0.46	-0.777	3.3
10/17/2018	0.39	-0.942	3.5
5/2/2019	0.63	-0.462	4.0
7/9/2019	0.42	-0.868	4.2
10/22/2019	0.95	-0.051	4.5
	k_{P326L}	**0.0811**	

NOTE: k=slope of plotted LN VC vs Time Plot using this methodology





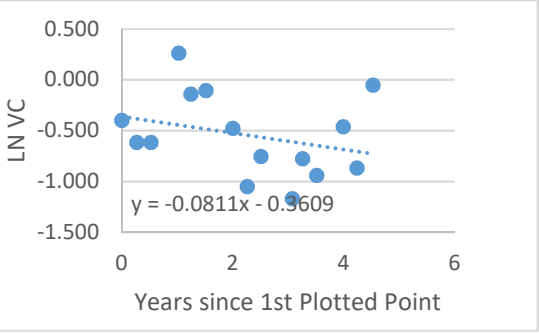


Table C1
Organics Plug Travel Projections

Projections/Estimated timing of when the 1992 organics slug arrived/will arrive downgradient of ERL

Location	Distance from P-17C (feet)	Est. Year (using V_{VC})	Est. Year (using $V_{VC,HI}$)	Observed Maximum Vinyl Chloride Concentration (ug/l)	Observed Maximum Vinyl Chloride Concentration Date	Notes
P-325L	1175	**2003**	**2001**	0.97	10/22/2019	P-325L was installed in 2014.
P-326L	1375	**2005**	**2002**	1.3	4/22/2016	P-326L was installed in 2014.
B-330 / B-331	3300	**2023**	**2017**	0.43	5/2/2016	Temporary boring B-331 was completed in 2016.
P-334L	4500	**2034**	**2026**	0.10	10/23/2019	P-334L was installed in 2018.

Inputs

V_{VC}	106	ft/yr	Vinyl Chloride Travel Velocity (estimated)
$V_{VC,HI}$	133	ft/yr	Vinyl Chloride Travel Velocity (high estimate)
Year	1992		Starting Year of Organics Concentration Spike at P-17C (1992-1994)

Table C2
Projecting Time to Achieve ILs at Wells

Well	k_{POINT}	C_0	C_0 Date	C_{IL}	Projected Year C_{IL} Achieved
P-313C	0.161	1.1	4/19/2011	0.05	2031
P-314C	0.269	1.5	4/19/2011	0.05	2024
P-321L	NA (not decreasing)	1.0	4/19/2011	0.05	
P-323L	0.183	1.0	7/17/2013	0.05	2030
P-325L	0.086	0.56	4/14/2015	0.05	2044
P-326L	0.081	0.67	4/14/2015	0.05	2048

Notes: -Projected Year C_{IL} Achieved is based on application of first order kinetics using calculated overall attenuation rate and dataset shown in attached calculations.
-Locations nearest to the Compliance Boundary and Property Boundary are shown.

Variables

$C_{IL} = C_0 e^{-kt}$

t = time (years)

k_{POINT} = Calculated overall attenuation rate at well (/year)

x = distance

C_{IL} = Vinyl chloride intevention limit (0.05 ug/l)

V_{VC} = Vinyl chloride velocity (ft/year)

C_0 = Vinyl chloride concentration at date listed. Listed date based on first detections at well since 2011 (or installation date)

Table C3
Bulk Attenuation Projections

ID	Description	Guiding Equation	Overall Attenuation Rate		Vinyl Chloride Travel Distance, Velocity, and Time					Vinyl Chloride Concentration	
			Variable	Overall Attenuation Rate (/yr)	Start Point	End Point	Distance (feet)	V_{GW} (ft / year)	Travel Time (years)	C_{IL} (ug/l)	C_{CB} (ug/l)
A	Calculate the maximum vinyl chloride concentration at the Compliance Boundary that would naturally attenuate below ILs before reaching nearest residential water supply user downgradient of mapped extent?	$C_{CB} = \frac{C_{IL}}{e^{-k\frac{x}{V_{GW}}}}$	$k_{JUL, VC}$	0.078	Compliance Boundary	Nearest Directly Downgardient Residential Water Supply User	7500	112	67	0.05	**10**
			$k_{OCT, VC}$	0.045							**1.0**
			$k_{JUL, MOL}$	0.112							**90**
			$k_{OCT, MOL}$	0.067							**4.5**
			$k_{MAX,VC}$	0.067							**4.5**
			k_{AVG}	0.074							**<u>7.1</u>**
B	Calculate the maximum vinyl chloride concentration at P-334L that would naturally attenuate before reaching nearest residential water supply user downgradient of mapped extent (C. Thompson)?	$C_{P-334L} = \frac{C_{IL}}{e^{-k\frac{x}{V_{GW}}}}$	$k_{JUL, VC}$	0.078	P-334L	Nearest Directly Downgardient Residential Water Supply User	3600	112	34	0.05	**0.62**
			$k_{OCT, VC}$	0.045							**0.21**
			$k_{JUL, MOL}$	0.112							**1.8**
			$k_{OCT, MOL}$	0.067							**0.43**
			$k_{MAX,VC}$	0.067							**0.43**
			k_{AVG}	0.074							**<u>0.54</u>**
C	How far is vinyl chloride projected to travel downgradient of the Compliance Boundary considering peak 2019 concentrations reported near Compliance Boundary *(1.8 ug/l at P-321L)* ?	$x = \left(\frac{ln\frac{C_{IL}}{C_{CB}}}{-k}\right)V_{GW}$	$k_{JUL, VC}$	0.078	Compliance Boundary	NA	**5124**	112	46	0.05	1.8
			$k_{OCT, VC}$	0.045			**8968**		80		
			$k_{JUL, MOL}$	0.112			**3587**		32		
			$k_{OCT, MOL}$	0.067			**5978**		53		
			$k_{MAX,VC}$	0.067			**5978**		53		
			k_{AVG}	0.074			**<u>5435</u>**		49		

<u>Assumptions/Notes:</u>

-Overall attenuation rates may be conservatively biased low due to observed presence of parent compounds to vinyl chloride upgradient of P-334L.
-The extent of vinyl chloride is stable and no longer expanding.
-First order kinetics applied, i.e. $C_x=C_0e^{-kt}$
-The higher end groundwater velocities (+25%) do not yield different results than what is shown above. A change in groundwater velocities yields a proportional change in attenuation rates. This results in no change to results in bolded text above.
NA = Not applicable or not analyzed
Inputs in Standard Text
Results in Bolded Text
<u>Value calculated using average attenuation rate, or estimated groundwater velocity, is underlined.</u>

<u>Variables</u>

C_{CB} = Vinyl chloride concentration at Compliance Boundary.
t = time
k = overall attenuation rate
x = distance
C_{IL} = Vinyl chloride intevention limit (0.05 ug/l)
V_{VC} = Vinyl chloride velocity
C_{P334L} = Vinyl chloride concentration at P-334L

Table C4
Mass of Vinyl Chloride Leaving the Source Area Estimates (April 2010 / 2019)

Mass Flux Leaving Source Area Estimate - April 2010

Box ID	Wells Included in "Box"	"Box" Depth (feet)	"Box" Width (feet)	"Box" Area (sq feet)	K (ft/day)	GW Elev u/g (ft MSL)	GW Elev d/g (ft MSL)	i (ft/ft)	VC Conc (µg/L)	VC Flux (g/day)	VC Flux (lb/yr)
A - south	P-314C	27	500	13500	41.99	952	951	0.0013	2.00	0.04	0.03
B	P-313C	27	250	6750	41.99	952	951	0.0013	1.40	0.01	0.01
C	P-323L	20	400	8000	41.99	952	951	0.0013	*1.00*	0.01	0.01
D	P-321L	50	400	20000	41.99	952	951	0.0013	1.20	0.04	0.03
E	4 Wells	55	400	22000	41.99	952	951	0.0013	*0.85*	0.03	0.02
F - north	2 Wells	55	500	27500	41.99	952	951	0.0013	*0.03*	0.00	0.00
									Total	**0.14**	**0.11**
				Distance u/g to d/g contour (feet)		750					

Mass Flux Leaving Source Area Estimate - 2019

Box ID	Wells Included in "Box"	"Box" Depth (feet)	"Box" Width (feet)	"Box" Area (sq feet)	K (ft/day)	GW Elev u/g (ft MSL)	GW Elev d/g (ft MSL)	i (ft/ft)	VC Conc (µg/L)	VC Flux (g/day)	VC Flux (lb/yr)
A - south	P-314C	27	500	13500	41.99	952	951	0.0013	0.29	0.01	0.00
B	P-313C	27	250	6750	41.99	952	951	0.0013	0.42	0.00	0.00
C	P-323L	20	400	8000	41.99	952	951	0.0013	0.54	0.01	0.01
D	P-321L	50	400	20000	41.99	952	951	0.0013	1.4	0.04	0.04
E	4 Wells	55	400	22000	41.99	952	951	0.0013	0.29	0.01	0.01
F - north	2 Wells	55	500	27500	41.99	952	951	0.0013	0.20	0.01	0.01
									Total	**0.08**	**0.065**
				Distance u/g to d/g contour (feet)		750					
									Decrease in VC flux in 2019 compared to April 2010:		**42%**

Notes:

Mass flux estimated using transect/box model method by application of Darcy's Law.

Estimated areas are based on Approximate Extent of Vinyl Chloride above IL on Figure 8 of CAER.

Hydraulic conductivity (K) data based on P-308L step test (2019)

Wells P-29C, P-320C, P-320C2, and P-321L included in Box E. Wells P-301C and P-301L included in Box F.

2019 groundwater elevations/horizontal gradient (i) are based on 952 ft MSL (u/g) and 951 ft MSL (d/g) contours on Figure 3 of CAER.

For consistency, the 2010 groundwater elevations/horizontal gradient (i) were kept consistent with 2019. The current downgradient well network was not yet established.

2019 Average Vinyl Chloride and Total Organics concentrations are average values from wells located in each "box".

2010 Average Vinyl Chloride concentrations are from the April 2010 monitoring event from wells located in each "box". For locations with no data or where non-detect values were reported due to higher reporting limits, data from the nearest date where a detection was reported is applied. These data points are *italicized* .

Table C5
Total Plume Mass Estimate

Zone Description (start/end)	Est. Plume Thickness (ft)	Within Approximate Extent of VC Limits (Fig. 4)				Within Max Estimated Northern Extent of VC above ILs (Fig. 4)				Est. Mass of Vinyl Chloride in Plume Incl. North Area (ug/l)
		Vinyl Chloride Conc. (ug/l)	Est. Area of Plume (Acres)	Groundwater Volume (cubic feet)	Est. Mass of Vinyl Chloride in Plume (lbs)	North Area Vinyl Chloride Conc. (ug/l)	Est. North Area (Acres)	Est. North Area Groundwater Volume (cubic feet)	Est. North Area Mass of Vinyl Chloride (lbs)	
1 - Western Edge of Unlined Area / Midpoint between Compliance and Property Boundaries	40	0.39	35.7	15550920	0.38	0.05	4.1	1785960	0.01	0.38
2 - Midpoint between Compliance and Property Boundaries / Midpoint between Property Boundary and Plume Toe	20	0.41	96.3	20974140	0.54	0.05	36.7	7993260	0.02	0.56
3 - Midpoint between Property Boundary and Toe of Plume / Toe of Plume	15	0.05	43.3	7073055	0.02	0.05	51.6	8428860	0.03	0.05
TOTAL			**175.3**	**43598115**	**0.94**		**92.4**	**18208080.00**	**0.06**	**0.99**

Notes

Estimated plume areas based on Approximate Extent of Vinyl Chloride above IL and Maximum Estimated Northern Extent of VC above ILs on Figure 4 of CAER.

Estimated Plume Thickness based on Figure 7 and Figure 8 of CAER.

Porosity value of 0.25 from Supplemental Site-Wide Hydrogeologic Evaluation Report (Barr, 2015a).

Average vinyl chloride concentrations based on average concentration values from wells located in each zone. North Area vinyl chloride concentration assumed to be 0.05 ug/l for this calculation.

Appendix D

Area Water Supply Wells

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BARR

Technical Memorandum

To: File
From: Jim Eidem
Subject: 2020 Well Search Update
Date: May 2020
Project: Elk River Landfill

This technical memorandum summarizes the 2014 update to the Elk River Landfill (ERL) well search. The following subsections describe the well search update methods and results.

Methods

The Minnesota Well Index (MWI) was queried to identify water wells located in the vicinity of ERL (Figure D1). Well records from the MWI are attached.

Results

The construction details for the wells located west of the landfill are summarized in Table D1. Table D1 also summarizes the years the residential wells were sampled dating back to 2011. Data are included in Table D2. No organics have been detected.

Attachments:

Table D1, Well Construction Summary
Table D2, Residential Water Supply Well Data (2011-2019)
Figure D1, Well Search Results
Well Records

Table D1
Well Construction Summary
Elk River Landfill
Elk River, Minnesota

Approximate Distance (feet) and Direction from ERL		MN Unique Number	Name of Well Record (and on Fig D1 if different)	Address	Attached Data	Use	Approximate Elevation (feet MSL)	Well Depth (feet bgs)	Base of Casing (feet bgs)	Aquifer	Estimated Completion Interval (feet MSL)
5000'	SW	00416125	JONES, RANDY	12781 221st Ave NW	2015-2016	Domestic	989	135	131	Quaternary	858 - 854
4300'	SW	00439871	JACKSON, JERRY	12685 221st Ave NW	2015-2016	Domestic	990	137	133	Quaternary	857 - 853
2800'	SW	00455265	LAFSON, ELOF	see unique ID# on figure (12210 221st Ave NW)	--	Domestic	957	101	88	Quaternary	869 - 856
8400'	SW	00458929	THOMPSON, MATTHEW	see unique ID # on figure (22112 Elk Lake Rd)	--	Domestic	951	92	81	Quaternary	870 - 859
1200'	SW	00527979	Unnamed (P. Hipsag)	22272 Quinn St	2011-2019	Domestic	992	140	135	Quaternary	857 - 852
8000'	SW	00535970	THOMPSON, CLAY	22017 Elk Lake Rd NW	2016	Domestic	979	170	160	Quaternary	819 - 809
8000'	SW	00608116	THOMPSON, DICK	22248 Elk Lake Rd	2017	Domestic	961	94	85	Quaternary	876 - 867
7000'	SW	00625475	BARNIER, MARK	22205 Elk Lake Rd	2015-2016	Domestic	981	113	104	Quaternary	877 - 868
3000'	SW	00626766	RIDGES OF RICE LAKE 1	Ridges Development	2011-2019	Community	987	325	294	Quaternary	693 - 662
1800'	SW	00626780	HIPSAG, DOUG	12269 223rd Ave NW (St.)	2011-2019	Domestic	987	150	147	Quaternary	840 - 837
600'	SW	00655131	ERICKSON, KEVIN & SHAVON (K. Erickson)	12163 223rd Ave NW	2011-2019	Domestic	974	132	122	Quaternary	852 - 842
2000'	SW	00694477	HILDENBRAND, DEBBIE & NA (22447 Tipton St)	HILDENBRAND, DEBBIE & NA (22447 Tipton St)		Domestic	1000	145	142	Quaternary	858 - 855
7400'	SW	00720300	THOMPSON, COREY	22275 Elk Lake Rd	2017	Domestic	960	91	82	Quaternary	878 - 869
2000'	SW	00813437	HILDENBRAND, DEBBIE & NA (22447 Tipton St)	22447 Tipton Ave	2016-2019	Domestic	1000	300	254	Mt. Simon	746 700
1500'	SW	00638355*	AIRHART, DONNA & STEVE (Mattson)	22130 Quinn St	2011-2019	Domestic	991	105	95	Quaternary	896 - 886
1400'	SW	None	None (A. Robertson)	12265 223rd Ave (formerly listed as 11265 223rd Ave)	2011-2019	Domestic	--	--	--	--	-- - --
1100'	SW	None	None (C. Corrow)	12183 223rd Ave	2011-2019	Domestic	--	--	--	--	-- - --
8000'	SW	None	None (G. Ruis)	13175 221st Ave NW	2016	Domestic	--	--	--	--	-- - --
5300'	SW	None	None (J. Thompson)	12901 221st Ave NW	2016	Domestic	--	--	--	--	-- - --
8400'	W	00450132	CATO, NANCY (J. Kanz)	22824 Elk Lake Rd	2015	Domestic	961	127	113	Quaternary	848 - 834
7500'	W	00508127	PERL SOD	see unique ID# on figure	--	Undefined	948	210	135	Mt. Simon	813 - 738
7500'	W	00562960	ED FIELDS & SONS, INC	see unique ID# on figure (13000 238th Ave NW)	--	Domestic	949	130	123	Quaternary	826 - 819
8200'	W	00606204	DUNHAM, HOWARD	22722 Elk Lake Rd	--	Domestic	955	89	84	Quaternary	871 - 866
4600'	NW	00525310	SHERPER, DON (T. Rohs)	1227 239th Ave NW	2011-2019	Domestic	984	110	105	Quaternary	879 - 874
4200'	NW	00672355	DRUK, TIM	23115 128th St	--	Domestic	948	89	89	Quaternary	859 - 859
5200'	NW	00672356	DRUK, TIM	23255 128th St	--	Domestic	961	89	84	Quaternary	877 - 872
4200'	NW	00676075	GWYNN, MIKE	23128 128th St	--	Domestic	949	100	91	Quaternary	858 - 849
4500'	NW	00676082	Unnamed	--	--	Domestic	951	93	84	Quaternary	867 - 858
5600'	NW	00676434	Unnamed	23282 128th St NW	--	Domestic	957	210	141	CMTS	816 - 747
5500'	NW	00676922	OLSON, MATT	12876 232nd Ave NW	--	Domestic	951	104	99	Quaternary	852 - 847
5000'	NW	00681344	Unnamed	12821 232nd Ave	--	Domestic	958	90	86	Quaternary	872 - 868
5100'	NW	00703235	Unnamed	12845 232nd Ave	--	Domestic	953	94	90	Quaternary	863 - 859
5000'	NW	00704785	HARTUNGS, JESSE	23195 128th St NW	--	Domestic	951	105	95	Quaternary	856 - 846
5300'	NW	00706000	Unnamed	12875 232nd Av NW	--	Domestic	953	105	95	Quaternary	858 - 848
5200'	NW	00706665	Unnamed	12861 232nd Ave	--	Domestic	953	103	99	Quaternary	854 - 850
4850'	NW	00709882	ISRAELSON, JOAN	12280 239th Av NW	--	Domestic	963	97	87	Quaternary	876 - 866
3500'	NW	00731676	KINGERY, BRIAN & ST. MARIE, TANYA	23105 128th St NW	--	Domestic	958	104	94	Quaternary	864 - 854
5400'	NW	00734477	HANLON, CHRIS	12818 232nd Av NW	--	Domestic	954	110	100	Quaternary	854 - 844

Notes:

Well construction and elevations from Minnesota Well Index (Minnesota Department of Health and Minnesota Geological Survey, 2014, 2020).

-- not available

bgs - below ground surface

MSL - Mean sea level

* - Noted as sealed in County Well Index. Residential well at 22130 Quinn St. is included in ERL residential well monitoring network.

Monitoring wells 696665-696667, 770880, 770881; irrigation well 126512; scientific boring 272081; ERL monitoring wells not included in table.

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

Location			ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New
Date			10/20/2011	10/18/2012	10/15/2013	10/20/2014	10/23/2015	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/23/2015	4/25/2016	10/21/2016
Alt. Name (2020)			ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	N. Hildenbrand	N. Hildenbrand	N. Hildenbrand
Unique Well ID# (or MPCA ID)			00420558	00420558	00420558	00420558	00420558	00420558	00420558	00420558	00420558	00813437	00813437	00813437
Parameter	Units	MDH Human Health-Based Water Guidance Table												
Effective Date		04/27/2020												
Exceedance Key		No Exceed												
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 0.050	< 0.050	< 0.050	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.25	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 2.0	< 2.0	< 2.0 *	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 1.0	< 1.0	< 1.0
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0
Chlorobenzene	ug/l	100 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 0.25	< 0.25	< 1.4	< 1.0	< 1.0	< 1.0
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 20	< 20	< 20	< 20	< 10 ^	< 10	< 10	< 10 ^	< 10	< 10 ^	< 10	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0 ^	< 5.0	< 10	< 5.0	< 5.0	< 5.0

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

Location			ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New
Date			10/20/2011	10/18/2012	10/15/2013	10/20/2014	10/23/2015	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/23/2015	4/25/2016	10/21/2016
Alt. Name (2020)			ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	ERL Shop Well	N. Hildenbrand	N. Hildenbrand	N. Hildenbrand
Unique Well ID# (or MPCA ID)			00420558	00420558	00420558	00420558	00420558	00420558	00420558	00420558	00420558	00813437	00813437	00813437
Parameter	Units	MDH Human Health-Based Water Guidance Table												
Effective Date		04/27/2020												
Exceedance Key		No Exceed												
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.0	< 10	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.10	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 4.0	< 1.0 ^	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.050	< 0.050	< 0.050	< 0.050	< 0.10	< 0.0040	< 0.050
Xylene, total	ug/l	300 XYL HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.0	< 2.0	< 2.0
General Parameters														
Alkalinity, total, as CaCO3	mg/l		214	149	148	3520	174	167	175	177	216	172	--	168
Chemical Oxygen Demand	mg/l		< 5.0	< 5.0	< 5.0	< 5.0	< 10.0 F1	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	--	< 10.0
Chloride	mg/l		< 1.0	< 1	< 1	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 1.0	0.527	--	< 0.5
Dissolved oxygen	mg/l		--	--	--	--	--	0.8	0.6	0.5	1.5	--	0.4	0.6
Nitrogen, ammonia, as N	mg/l		0.18	0.14	0.099	0.15 F1	0.13	0.13	0.13	0.13	0.15	0.17	--	0.22 F1
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	--	< 0.050
pH	pH units		7.70	7.20	7.18	7.59	8.13	7.97	7.93	7.83	7.60	8.02	7.89	7.98
Redox (oxidation potential)	mV		--	--	--	--	--	-200.0	-180	-101	-39	--	-173	-210.0
Solids, total dissolved	mg/l		157	184	158	179	164	194	202	184	165	130	--	174
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0
Specific conductance @ 25 ºC	umhos/cm		307	418	409	356	325	328	326	326	327	333	337	328
Sulfate, as SO4	mg/l		--	--	--	--	--	--	--	--	--	--	--	--
Temperature	deg C		10.0	10.2	10.0	11.8	11.4	11.3	11.0	10.8	11.0	10.0	9.2	9.5
Turbidity	NTU		--	--	--	--	--	--	1.7	0.9	1.4	--	--	--
Total Metals														
Calcium	mg/l		--	--	--	--	43.7	40.6	41.7	44.5	42.0	43.0	--	40.2
Magnesium	mg/l		--	--	--	--	13.7	13.7	13.7	13.7	13.5	13.4	--	13.6
Potassium	mg/l		--	--	--	--	1.4	1.4	1.4	1.4	1.4	1.5	--	1.6
Sodium	mg/l		--	--	--	--	6.4	6.4	6.5	6.1	6.0	5.9	--	5.9

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

		Location	**22447 Tipton St. New**	**22447 Tipton St. New**	**22447 Tipton St. New**	**12269 223rd Ave**	**12269 223rd Ave**	**12269 223rd Ave**	**12269 223rd Ave**	**12269 223rd Ave**	**12269 223rd Ave**	**12269 223rd Ave**	**12269 223rd Ave**	**12269 223rd St**
		Date	**10/18/2017**	**10/16/2018**	**10/24/2019**	**10/20/2011**	**10/18/2012**	**10/15/2013**	**10/22/2014**	**4/23/2015**	**12/14/2015**	**4/25/2016**	**10/20/2016**	**10/18/2017**
		Alt. Name (2020)	**N. Hildenbrand**	**N. Hildenbrand**	**N. Hildenbrand**	**D. Hipsag**	**D. Hipsag**	**D. Hipsag**	**D. Hipsag**	**D. Hipsag**	**D. Hipsag**	**D. Hipsag**	**D. Hipsag**	**D. Hipsag**
		Unique Well ID# (or MPCA ID)	**00813437**	**00813437**	**00813437**	**00626780**	**00626780**	**00626780**	**00626780**	**00626780**	**00626780**	**00626780**	**00626780**	**00626780**
Parameter	Units	MDH Human Health-Based Water Guidance Table												
Effective Date		04/27/2020												
Exceedance Key		No Exceed												
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.50	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.75	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 0.050	< 0.050	< 0.050	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.25	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.50	< 0.50	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 1.0	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	< 10	< 10	< 10	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *
Benzene	ug/l	2 HRL09 (1)	< 0.50	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.0	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.25	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 1.0	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 1.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 1.0	< 1.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0 ^	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 0.25	< 0.25	< 1.4	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10	< 10 ^	< 10	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10 *^
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0 ^	< 5.0	< 10	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 *^

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

	Location	22447 Tipton St. New	22447 Tipton St. New	22447 Tipton St. New	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd Ave	12269 223rd St
	Date	10/18/2017	10/16/2018	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/22/2014	4/23/2015	12/14/2015	4/25/2016	10/20/2016	10/18/2017
	Alt. Name (2020)	N. Hildenbrand	N. Hildenbrand	N. Hildenbrand	D. Hipsag	D. Hipsag	D. Hipsag	D. Hipsag	D. Hipsag	D. Hipsag	D. Hipsag	D. Hipsag	D. Hipsag
	Unique Well ID# (or MPCA ID)	00813437	00813437	00813437	00626780	00626780	00626780	00626780	00626780	00626780	00626780	00626780	00626780
Parameter	Units	MDH Human Health-Based Water Guidance Table											
Effective Date		04/27/2020											
Exceedance Key		No Exceed											
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0 ^	< 1.0	< 1.0 ^	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *
Tetrahydrofuran	ug/l	600 HRL18	< 5.0 ^	< 5.0	< 10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 ^
Toluene	ug/l	70 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.10	< 0.10	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 0.050	< 0.050	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.0040	< 0.050	< 0.050
Xylene, total	ug/l	300 XYL HBV19 (1)	< 2.0	< 2.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters														
Alkalinity, total, as CaCO3	mg/l		175	181	217	240	238	228	254 B	247	270	--	279	294
Chemical Oxygen Demand	mg/l		< 10.0	< 10.0	< 10.0	5.1	11.7 B	< 5.0	< 5.0	--	< 10.0	--	< 10.0	< 10.0
Chloride	mg/l		< 0.5	< 0.5	< 1.0	7.9	8.33	10.1	9.69	11.4	12.1	--	11.4	12
Dissolved oxygen	mg/l		0.3	0.6	0.7	--	--	--	--	--	--	1.7	2.5	3.5
Nitrogen, ammonia, as N	mg/l		0.23	0.23 F1	0.23	< 0.050	< 0.050	< 0.050	< 0.050	--	< 0.020	--	< 0.020	< 0.020 F1
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.050	< 0.050	< 0.050	0.98	1.2	1.2	1.3	--	1.4	--	1.4	1.3
pH	pH units		7.93	7.82	7.55	7.44	6.90	7.24	7.86	7.41	7.60	7.51	7.52	7.60
Redox (oxidation potential)	mV		-100	-129	-20	--	--	--	--	--	--	-84	60.0	81
Solids, total dissolved	mg/l		194	194	161	247	297	297	304	--	316	--	349	336
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	--	< 4.0	< 4.0
Specific conductance @ 25 ºC	umhos/cm		327	328	325	471	613	487	474	523	566	550	570	567
Sulfate, as SO4	mg/l		--	--	--	--	--	--	--	20.8	--	--	--	--
Temperature	deg C		9.6	9.8	10.0	11.0	10.5	10.5	10.2	9.7	10.1	11.0	11.2	11.9
Turbidity	NTU		2.5	2.0	2.2	--	--	--	--	--	--	--	--	1.8
Total Metals														
Calcium	mg/l		40.5	45.6	43.2	--	--	--	--	78.7	74.3	--	74.9	75.6
Magnesium	mg/l		13.2	13.9	13.8	--	--	--	--	27.4	26.5	--	27.6	27.4
Potassium	mg/l		1.4	1.5	1.4	--	--	--	--	1.5	1.5	--	1.6	1.5
Sodium	mg/l		5.7	5.7	5.5	--	--	--	--	3.2	3.3	--	3.5	3.7

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

Location			12269 223rd Ave	12269 223rd St	12265 223rd Ave[1]	12265 223rd Ave[1]	12265 223rd Ave[1]	12265 223rd Ave[1]	12265 223rd Ave[1]	12265 223rd Ave[1]	12265 223rd Ave[1]	12265 223rd Ave[1]	12265 223rd Ave[1]
Date			10/16/2018	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/23/2015	4/25/2016	10/20/2016	10/18/2017
Alt. Name (2020)			D. Hipsag	D. Hipsag	A. Roberson	A. Roberson	A. Roberson	A. Roberson	A. Roberson	A. Roberson	A. Roberson	A. Roberson	A. Roberson
Unique Well ID# (or MPCA ID)			00626780	00626780	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)	(ZW00214)
Parameter	Units	MDH Human Health-Based Water Guidance Table											
Effective Date		04/27/2020											
Exceedance Key		No Exceed											
Volatile Organic Compounds													
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 0.050	< 0.050	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.50	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	< 10	< 10	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 1.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 0.25	< 1.4	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10 ^	< 10	< 20	< 20	< 20	< 20	< 10	< 10 ^	< 10	< 10	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0	< 10	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

		Location	**12269 223rd Ave**	**12269 223rd St**	**12265 223rd Ave[1]**	**12265 223rd Ave[1]**	**12265 223rd Ave[1]**	**12265 223rd Ave[1]**	**12265 223rd Ave[1]**	**12265 223rd Ave[1]**	**12265 223rd Ave[1]**	**12265 223rd Ave[1]**	**12265 223rd Ave[1]**
		Date	**10/16/2018**	**10/24/2019**	**10/20/2011**	**10/18/2012**	**10/15/2013**	**10/20/2014**	**4/23/2015**	**10/23/2015**	**4/25/2016**	**10/20/2016**	**10/18/2017**
		Alt. Name (2020)	**D. Hipsag**	**D. Hipsag**	**A. Roberson**	**A. Roberson**	**A. Roberson**	**A. Roberson**	**A. Roberson**	**A. Roberson**	**A. Roberson**	**A. Roberson**	**A. Roberson**
		Unique Well ID# (or MPCA ID)	**00626780**	**00626780**	**(ZW00214)**	**(ZW00214)**	**(ZW00214)**	**(ZW00214)**	**(ZW00214)**	**(ZW00214)**	**(ZW00214)**	**(ZW00214)**	**(ZW00214)**
Parameter	Units	MDH Human Health-Based Water Guidance Table											
Effective Date		04/27/2020											
Exceedance Key		No Exceed											
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0	< 1.0 ^	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HBV19 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.10	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 0.050	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.0040	< 0.050	< 0.050
Xylene, total	ug/l	300 XYL HBV19 (1)	< 2.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters													
Alkalinity, total, as CaCO3	mg/l		277	312	197	158	186	206	166	169	--	165	168
Chemical Oxygen Demand	mg/l		< 10.0	< 10.0	18.1	< 5.0	6.1	< 5.0	--	< 10.0	--	< 10.0	< 10.0
Chloride	mg/l		11.7	12.6	14.3	13.7	18.6	16.3	17.2	15.5	--	15.4	13
Dissolved oxygen	mg/l		2.1	2.5	--	--	--	--	--	--	0.3	0.6	0.4
Nitrogen, ammonia, as N	mg/l		< 0.020	< 0.020	0.12	0.094	0.055	0.41	--	0.061	--	0.072	0.069
Nitrogen, nitrate + nitrite, as N	mg/l		1.0	0.86	< 0.050	< 0.050	< 0.050	< 0.050	--	< 0.050	--	< 0.050	< 0.050
pH	pH units		7.58	7.50	7.62	7.45	7.60	7.61	7.49	7.94	7.83	7.78	7.76
Redox (oxidation potential)	mV		99	111	--	--	--	--	--	--	-99	-102.0	-50
Solids, total dissolved	mg/l		343	320	231	287	277	337	--	248	--	289	288
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	--	< 4.0	< 4.0
Specific conductance @ 25 ºC	umhos/cm		560	555	421	474	452	442	434	422	436	453	448
Sulfate, as SO4	mg/l		--	--	--	--	--	--	48.6	--	--	--	--
Temperature	deg C		11.5	11.2	9.7	10.7	9.6	9.4	9.7	11.0	10.0	11.3	9.7
Turbidity	NTU		1.0	1.3	--	--	--	--	--	--	--	--	1.7
Total Metals													
Calcium	mg/l		80.8	81.8	--	--	--	--	65.2	63.1	--	58.9	58.1
Magnesium	mg/l		27.3	29.0	--	--	--	--	18.8	18.0	--	18.4	17.3
Potassium	mg/l		1.5	1.5	--	--	--	--	1.5	1.5	--	1.6	1.4
Sodium	mg/l		3.4	3.5	--	--	--	--	4.3	4.6	--	4.7	4.4

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

Location			12265 223rd Ave[1]	12265 223rd Ave[1]	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave
Date			10/16/2018	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/23/2015	4/25/2016	10/20/2016	10/18/2017	10/16/2018
Alt. Name (2020)			A. Roberson	A. Roberson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson
Unique Well ID# (or MPCA ID)			(ZW00214)	(ZW00214)	00655131	00655131	00655131	00655131	00655131	00655131	00655131	00655131	00655131	00655131
Parameter	Units	MDH Human Health-Based Water Guidance Table												
Effective Date		04/27/2020												
Exceedance Key		No Exceed												
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 0.050	< 0.050	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.050	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.50	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	< 10	< 10	< 20	< 20	< 20	< 20	< 10	< 10 ^	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 1.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 0.25	< 1.4	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10 ^	< 10	< 20	< 20	< 20	< 20	< 10	< 10 ^	< 10	< 10	< 10	< 10 ^
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0	< 10	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

		Location	12265 223rd Ave[1]	12265 223rd Ave[1]	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave	12163 223rd Ave
		Date	10/16/2018	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/23/2015	4/25/2016	10/20/2016	10/18/2017	10/16/2018
		Alt. Name (2020)	A. Roberson	A. Roberson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson	K. Erickson
		Unique Well ID# (or MPCA ID)	(ZW00214)	(ZW00214)	00655131	00655131	00655131	00655131	00655131	00655131	00655131	00655131	00655131	00655131
Parameter	Units	MDH Human Health-Based Water Guidance Table												
Effective Date		04/27/2020												
Exceedance Key		No Exceed												
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0	< 1.0 ^	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HBV19 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.10	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 0.050	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.0040	< 0.050	< 0.050	< 0.050
Xylene, total	ug/l	300 XYL HBV19 (1)	< 2.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters														
Alkalinity, total, as CaCO3	mg/l		166	196	271	265	297	7120	270	283 4	--	287	307	319
Chemical Oxygen Demand	mg/l		< 10.0	< 10.0	10.8	5.0	< 5.0	< 5.0	--	< 10.0	--	< 10.0	< 10.0	< 10.0
Chloride	mg/l		11.8	11.6	10.7	10.1	10.7	10.1	12.1	11.3	--	14.1	16.3	15.5
Dissolved oxygen	mg/l		0.7	0.8	--	--	--	--	--	--	0.9	1.2	0.7	1.0
Nitrogen, ammonia, as N	mg/l		0.072	0.063	< 0.050	< 0.050	< 0.050	0.098	--	< 0.020	--	< 0.020	< 0.020	< 0.020
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.050	< 0.050	1.8	1.9	1.4	1.3	--	1.2	--	1.5	1.4	1.2
pH	pH units		7.72	7.50	7.48	7.52	7.60	7.47	7.44	7.78	7.59	7.58	7.56	7.55
Redox (oxidation potential)	mV		-20	20	--	--	--	--	--	--	-85	138.0	68	99
Solids, total dissolved	mg/l		276	287	272	337	329	336	--	315	--	358	372	375
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	--	< 4.0	< 4.0	< 4.0
Specific conductance @ 25 ºC	umhos/cm		432	427	516	573	555	530	537	517	544	599	628	621
Sulfate, as SO4	mg/l		--	--	--	--	--	--	22.3	--	--	--	--	--
Temperature	deg C		9.6	9.5	9.3	9.5	9.6	9.4	9.6	9.0	9.0	9.2	9.3	9.8
Turbidity	NTU		1.1	1.3	--	--	--	--	--	--	--	--	--	0.8
Total Metals														
Calcium	mg/l		62.2	58.6	--	--	--	--	79.1	78.5	--	79.4	83.9	93.1
Magnesium	mg/l		17.3	16.9	--	--	--	--	27.9	27.3	--	29.5	30.8	31.9
Potassium	mg/l		1.5	1.4	--	--	--	--	1.5	1.6	--	1.6	1.6	1.8
Sodium	mg/l		4.1	3.9	--	--	--	--	3.0	3.3	--	3.6	3.7	3.7

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

		Location	12163 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	12183 223rd Ave	22272 Quinn St
		Date	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/22/2015	4/25/2016	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/20/2011
		Alt. Name (2020)	K. Erickson	C.Corrow	C.Corrow	C.Corrow	C.Corrow	C.Corrow	C.Corrow	C.Corrow	C.Corrow	C.Corrow	C.Corrow	C.Corrow	P. Hipsag
		Unique Well ID# (or MPCA ID)	00655131	(ZW00215)	(ZW00215)	(ZW00215)	(ZW00215)	(ZW00215)	(ZW00215)	(ZW00215)	(ZW00215)	(ZW00215)	(ZW00215)	(ZW00215)	00527979
Parameter	Units	MDH Human Health-Based Water Guidance Table													
Effective Date		04/27/2020													
Exceedance Key		No Exceed													
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 2.0
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75	< 1.0	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,2,3-Trichlorobenzene	ug/l		< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 0.050	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.050	< 0.050	< 0.050	< 3.0
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 1.0
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
1,3-Dichloropropane	ug/l		< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.25	< 1.0
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
2,2-Dichloropropane	ug/l		< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 2.0
Acetone	ug/l	3000 HBV17 (1)	< 10	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 20
Allyl chloride	ug/l	30 HRL94	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0
Benzene	ug/l	2 HRL09 (1)	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 2.0
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 2.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0
Bromomethane	ug/l	10 HRL93	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 2.0
Butylbenzene	ug/l		< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Butylbenzene, sec	ug/l		< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Butylbenzene, tert	ug/l		< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 1.0
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Chlorodibromomethane	ug/l	10 HRL93	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 2.0
Chloroethane	ug/l	ND RAA16	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 2.0
Chloroform	ug/l	20 HRL18	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.0
Chloromethane	ug/l		< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 2.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Ethyl ether	ug/l	200 RAA16 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0
Hexachlorobutadiene	ug/l	1 HRL93	< 1.4	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 1.4	< 2.0
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10 ^	< 10	< 20
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 10	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 3.0

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

		Location	**12163 223rd Ave**	**12183 223rd Ave**	**12183 223rd Ave**	**12183 223rd Ave**	**12183 223rd Ave**	**12183 223rd Ave**	**12183 223rd Ave**	**12183 223rd Ave**	**12183 223rd Ave**	**12183 223rd Ave**	**12183 223rd Ave**	**12183 223rd Ave**	**22272 Quinn St**
		Date	**10/24/2019**	**10/20/2011**	**10/18/2012**	**10/15/2013**	**10/20/2014**	**4/23/2015**	**10/22/2015**	**4/25/2016**	**10/20/2016**	**10/18/2017**	**10/16/2018**	**10/24/2019**	**10/20/2011**
		Alt. Name (2020)	**K. Erickson**	**C.Corrow**	**C.Corrow**	**C.Corrow**	**C.Corrow**	**C.Corrow**	**C.Corrow**	**C.Corrow**	**C.Corrow**	**C.Corrow**	**C.Corrow**	**C.Corrow**	**P. Hipsag**
		Unique Well ID# (or MPCA ID)	**00655131**	**(ZW00215)**	**(ZW00215)**	**(ZW00215)**	**(ZW00215)**	**(ZW00215)**	**(ZW00215)**	**(ZW00215)**	**(ZW00215)**	**(ZW00215)**	**(ZW00215)**	**(ZW00215)**	**00527979**
Parameter	Units	MDH Human Health-Based Water Guidance Table													
Effective Date		04/27/2020													
Exceedance Key		No Exceed													
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0 ^	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 3.0
Methylene chloride	ug/l	5 HRLMCL	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 2.0
Naphthalene	ug/l	70 HRL13	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0
Propylbenzene	ug/l		< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Styrene	ug/l		< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.0
Toluene	ug/l	70 HBV19 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.10	< 1.0
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.0040	< 0.050	< 0.050	< 0.050	< 0.050	< 1.0
Xylene, total	ug/l	300 XYL HBV19 (1)	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.0
General Parameters															
Alkalinity, total, as CaCO3	mg/l		350	186	173	195	4030	219	202	--	232	227	214	246	217
Chemical Oxygen Demand	mg/l		< 10.0	6.4	< 5.0	7.1	5.4 B	--	< 10.0	--	< 10.0	< 10.0	11.8	< 10.0	12.7
Chloride	mg/l		18.3	2.3	3.74	4.33	5.71	6.6	5.71	--	6.04	5.5	5.32	5.8	16.2
Dissolved oxygen	mg/l		1.1	--	--	--	--	--	--	0.3	0.7	0.5	0.5	0.9	--
Nitrogen, ammonia, as N	mg/l		< 0.020	< 0.050	< 0.050	< 0.050	0.084	--	< 0.020	--	< 0.020	< 0.020	< 0.020	< 0.020	< 0.050
Nitrogen, nitrate + nitrite, as N	mg/l		1.3	< 0.050	< 0.050	< 0.050	< 0.050	--	< 0.050	--	< 0.050	< 0.050	< 0.050	< 0.050	1.8
pH	pH units		7.42	7.54	7.51	7.58	7.45	7.54	7.82	7.65	7.69	7.66	7.63	7.39	7.47
Redox (oxidation potential)	mV		87	--	--	--	--	--	--	-98	-124.0	-55	-25	11	--
Solids, total dissolved	mg/l		390	163	242	222	258	--	233	--	279	285	259	289	223
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	--	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Specific conductance @ 25 ºC	umhos/cm		639	352	395	379	431	432	413	450	502	456	454	452	446
Sulfate, as SO4	mg/l		--	--	--	--	--	25.6	--	--	--	--	--	--	--
Temperature	deg C		9.4	10.5	10.1	10.2	12.0	9.9	9.9	9.7	11.5	10.8	10.3	10.4	10.6
Turbidity	NTU		1.5	--	--	--	--	--	--	--	--	2.3	1.8	2.4	--
Total Metals															
Calcium	mg/l		90.6	--	--	--	--	62.3	61.3	--	60.4	58.9	62.7	62.1	--
Magnesium	mg/l		31.9	--	--	--	--	20.1	19.8	--	21.2	20.4	20.9	21.5	--
Potassium	mg/l		1.6	--	--	--	--	1.7	1.7	--	1.8	1.6	1.7	1.6	--
Sodium	mg/l		3.7	--	--	--	--	4.9	5.4	--	5.4	4.9	4.7	4.7	--

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

Location			22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St
Date			10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/22/2015	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015
Alt. Name (2020)			P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	Mattson	Mattson	Mattson	Mattson	Mattson
Unique Well ID# (or MPCA ID)			00527979	00527979	00527979	00527979	00527979	00527979	00527979	00527979	00527979	00638355	00638355	00638355	00638355	00638355
Parameter	Units	MDH Human Health-Based Water Guidance Table														
Effective Date		04/27/2020														
Exceedance Key		No Exceed														
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 0.050	< 0.050	< 0.050	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0
1,3-Dichloropropane	ug/l		< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
2,2-Dichloropropane	ug/l		< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10	< 10	< 20	< 20	< 20	< 20	< 10
Allyl chloride	ug/l	30 HRL94	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0
Butylbenzene	ug/l		< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Butylbenzene, sec	ug/l		< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Butylbenzene, tert	ug/l		< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	ug/l	100 HRL93	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^
Chloroethane	ug/l	ND RAA16	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^
Ethyl benzene	ug/l	40 HBV19 (1)	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 1.4	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 20	< 20	< 20	< 10	< 10	< 10	< 10	< 10 ^	< 10	< 20	< 20	< 20	< 20	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.0	< 10	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

		Location	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22272 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St
		Date	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/22/2015	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015
		Alt. Name (2020)	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	P. Hipsag	Mattson	Mattson	Mattson	Mattson	Mattson
		Unique Well ID# (or MPCA ID)	00527979	00527979	00527979	00527979	00527979	00527979	00527979	00527979	00527979	00638355	00638355	00638355	00638355	00638355
Parameter	Units	MDH Human Health-Based Water Guidance Table														
Effective Date		04/27/2020														
Exceedance Key		No Exceed														
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0 ^	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0
Propylbenzene	ug/l		< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Styrene	ug/l		< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.0	< 10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HBV19 (1)	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	< 0.050	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10
Xylene, total	ug/l	300 XYL HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters																
Alkalinity, total, as CaCO3	mg/l		218	190	3960	210	201	195	207	209	266	238	186	173	4270	196
Chemical Oxygen Demand	mg/l		6.9	< 5.0	< 5.0	--	< 10.0	< 10.0	< 10.0	15.1	< 10.0	< 5.0	< 5.0	8.3	< 5.0	--
Chloride	mg/l		15.8	20.4	19.3	22.2	21.6	21.9	23.5	23.9	27.3	5.8	5.27	6.02	5.83	6.3
Dissolved oxygen	mg/l		--	--	--	--	--	1.9	1.4	1.5	0.9	--	--	--	--	--
Nitrogen, ammonia, as N	mg/l		< 0.050	< 0.050	< 0.050 F1	--	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.050	< 0.050	< 0.050	< 0.050	--
Nitrogen, nitrate + nitrite, as N	mg/l		2.1	2.0	2.1	--	2.1	2.1	2.0	2.0	1.6	< 0.050	< 0.050	< 0.050	< 0.050	--
pH	pH units		7.20	7.25	7.50	7.37	7.77	7.60	7.63	7.58	7.60	7.57	7.71	7.74	7.57	7.34
Redox (oxidation potential)	mV		--	--	--	--	--	130.0	25	80	99	--	--	--	--	--
Solids, total dissolved	mg/l		275	250	296	--	238	259	314	308	290	225	266	254	245	--
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	--	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	--
Specific conductance @ 25 ºC	umhos/cm		496	487	467	482	443	479	482	497	520	438	432	428	459	471
Sulfate, as SO4	mg/l		--	--	--	20.1	--	--	--	--	--	--	--	--	--	25.6
Temperature	deg C		10.5	10.1	10.2	9.5	10.2	10.6	10.7	10.6	10.4	10.0	9.8	9.9	9.9	9.3
Turbidity	NTU		--	--	--	--	--	--	1.4	1.0	0.8	--	--	--	--	--
Total Metals																
Calcium	mg/l		--	--	--	62.2	61.1	58.9	60.2	70.2	71.2	--	--	--	--	57.7
Magnesium	mg/l		--	--	--	21.5	20.6	21.8	21.3	23.2	24.7	--	--	--	--	21.2
Potassium	mg/l		--	--	--	1.3	1.4	1.5	1.3	1.5	1.4	--	--	--	--	1.5
Sodium	mg/l		--	--	--	2.6	2.8	2.9	2.8	3.0	3.1	--	--	--	--	3.7

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

Location			22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.
Date			10/22/2015	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/23/2015	10/20/2016	10/18/2017
Alt. Name (2020)			Mattson	Mattson	Mattson	Mattson	Mattson	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.
Unique Well ID# (or MPCA ID)			00638355	00638355	00638355	00638355	00638355	00626766	00626766	00626766	00626766	00626766	00626766	00626766	00626766
Parameter	Units	MDH Human Health-Based Water Guidance Table													
Effective Date		04/27/2020													
Exceedance Key		No Exceed													
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 1.0	< 0.75	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.0	< 1.0	< 0.050	< 0.050	< 0.050	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 0.50	< 0.50	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	< 10	< 10	< 10	< 10	< 10	< 20	< 20	< 20	< 20	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 0.50
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 1.0	< 1.0	< 1.0	< 1.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0 ^
Hexachlorobutadiene	ug/l	1 HRL93	< 1.0	< 1.0	< 0.25	< 0.25	< 1.4	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 0.25
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10	< 10	< 10	< 10 ^	< 10	< 20	< 20	< 20	< 20	< 10	< 10 ^	< 10	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0	< 5.0 ^

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

Location			22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	22130 Quinn St	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.
Date			10/22/2015	10/20/2016	10/18/2017	10/16/2018	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/20/2014	4/23/2015	10/23/2015	10/20/2016	10/18/2017
Alt. Name (2020)			Mattson	Mattson	Mattson	Mattson	Mattson	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.	Ridges Develop.
Unique Well ID# (or MPCA ID)			00638355	00638355	00638355	00638355	00638355	00626766	00626766	00626766	00626766	00626766	00626766	00626766	00626766
Parameter	Units	MDH Human Health-Based Water Guidance Table													
Effective Date		04/27/2020													
Exceedance Key		No Exceed													
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0 ^
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 ^
Toluene	ug/l	70 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 1.0	< 1.0	< 0.10	< 0.10	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.10	< 0.050	< 0.050	< 0.050	< 0.050	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.050	< 0.050
Xylene, total	ug/l	300 XYL HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters															
Alkalinity, total, as CaCO3	mg/l		208	208	218	219	239	202	176	182	3890	172	185	183	187
Chemical Oxygen Demand	mg/l		< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	10.8	< 5.0	< 5.0	6.1 B	--	< 10.0	< 10.0	< 10.0
Chloride	mg/l		6.11	5.9	4.54	4.08	4.3	< 1.0	< 1	< 1	< 1	< 1.0	< 0.5	< 0.5	< 0.5
Dissolved oxygen	mg/l		--	0.4	0.6	0.8	0.3	--	--	--	--	--	--	6.9	2.9
Nitrogen, ammonia, as N	mg/l		< 0.020	0.038	< 0.020	< 0.020	< 0.020	0.27	0.23	0.18	0.51	--	0.18	0.23	0.23
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050 F1	--	< 0.050	< 0.050	< 0.050
pH	pH units		7.96	7.72	7.74	7.25	7.08	7.82	8.25	8.19	7.58	7.53	7.97	7.87	7.80
Redox (oxidation potential)	mV		--	143.0	-35	65	85	--	--	--	--	--	--	-10.0	25
Solids, total dissolved	mg/l		214	249	257	271	258	196	202	191	209	--	168	207	232
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	< 4.0	< 4.0
Specific conductance @ 25 ºC	umhos/cm		419	424	430	432	428	326	350	352	344	342	319	348	344
Sulfate, as SO4	mg/l		--	--	--	--	--	--	--	--	--	< 4.0	--	--	--
Temperature	deg C		9.9	9.9	10.2	10.0	10.0	10.2	10.0	10.0	9.9	9.4	10.0	10.2	10.5
Turbidity	NTU		--	--	1.3	1.7	1.2	--	--	--	--	--	--	--	3.0
Total Metals															
Calcium	mg/l		57.4 4	53.8	52.3	57.3	58.3	--	--	--	--	46.4	45.7 4	44.0	46.8
Magnesium	mg/l		20.2	20.2	19.6	20.3	21.4	--	--	--	--	14.9	14.3	15.1	15.4
Potassium	mg/l		1.5	1.5	1.4	1.5	1.5	--	--	--	--	1.2	1.2	1.3	1.3
Sodium	mg/l		3.8	3.8	3.7	3.5	3.6	--	--	--	--	5.4	5.7	6.0	6.2

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

	Location		**Ridges Develop.**	**Ridges Develop.**	**12685 221st Ave NW**	**12685 221st Ave NW**	**12685 221st Ave NW**	**12781 221st Ave NW**	**12781 221st Ave NW**	**12781 221st Ave NW**	**12901 221st Ave NW**	**12901 221st Ave NW**
	Date		**10/16/2018**	**10/24/2019**	**5/29/2015**	**10/23/2015**	**11/07/2016**	**5/29/2015**	**10/23/2015**	**11/07/2016**	**7/07/2016**	**10/21/2016**
	Alt. Name (2020)		**Ridges Develop.**	**Ridges Develop.**	**J. Jackson**	**J. Jackson**	**J. Jackson**	**R. Jones**	**R. Jones**	**R. Jones**	**J. Thompson**	**J. Thompson**
	Unique Well ID# (or MPCA ID)		**00626766**	**00626766**	**00439871**	**00439871**	**00439871**	**00416125**	**00416125**	**00416125**	**--**	**--**
Parameter	Units	MDH Human Health-Based Water Guidance Table										
Effective Date		04/27/2020										
Exceedance Key		No Exceed										
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.50	< 0.50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 5.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 0.050	< 0.050	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.50	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 1.0	< 4.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 0.50	< 0.50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 1.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 5.0	< 1.0 ^	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 1.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 0.25	< 1.4	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10 ^	< 10	< 10	< 10 ^	< 10	< 10	< 10 ^	< 10	< 10	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0	< 10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

		Location	**Ridges Develop.**	**Ridges Develop.**	**12685 221st Ave NW**	**12685 221st Ave NW**	**12685 221st Ave NW**	**12781 221st Ave NW**	**12781 221st Ave NW**	**12781 221st Ave NW**	**12901 221st Ave NW**	**12901 221st Ave NW**
		Date	**10/16/2018**	**10/24/2019**	**5/29/2015**	**10/23/2015**	**11/07/2016**	**5/29/2015**	**10/23/2015**	**11/07/2016**	**7/07/2016**	**10/21/2016**
		Alt. Name (2020)	**Ridges Develop.**	**Ridges Develop.**	**J. Jackson**	**J. Jackson**	**J. Jackson**	**R. Jones**	**R. Jones**	**R. Jones**	**J. Thompson**	**J. Thompson**
		Unique Well ID# (or MPCA ID)	**00626766**	**00626766**	**00439871**	**00439871**	**00439871**	**00416125**	**00416125**	**00416125**	**--**	**--**
Parameter	Units	MDH Human Health-Based Water Guidance Table										
Effective Date		04/27/2020										
Exceedance Key		No Exceed										
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.10	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 4.0	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 0.050	< 0.10	< 0.10	< 0.050	< 0.10	< 0.10	< 0.050	< 0.0040	< 0.050
Xylene, total	ug/l	300 XYL HBV19 (1)	< 2.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters												
Alkalinity, total, as CaCO3	mg/l		182	225	153	152 4	152	171	165	172	172	170
Chemical Oxygen Demand	mg/l		< 10.0	< 10.0	--	< 10.0	< 10.0	--	< 10.0	< 10.0	--	117
Chloride	mg/l		< 0.5	< 1.0	15.9	17.3	17.3	2.0	2.38	5.09	3.2	1.74
Dissolved oxygen	mg/l		3.0	3.5	--	--	0.2	--	--	0.2	0.8	0.2
Nitrogen, ammonia, as N	mg/l		0.80	0.24	--	0.035	< 0.020	--	0.098	0.091 F1	--	0.086
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.050	< 0.050	--	< 0.050	< 0.050	--	< 0.050	< 0.050	--	< 0.050
pH	pH units		7.58	7.48	7.94	8.19	7.50	7.88	8.26	7.81	7.95	8.03
Redox (oxidation potential)	mV		36	58	--	--	-89.0	--	--	-148.0	-103.0	-144.0
Solids, total dissolved	mg/l		185	210	--	232	281	--	169	227	--	191
Solids, total suspended	mg/l		< 4.0	5.6	--	< 4.0	5.2	--	< 4.0	< 4.0	--	< 4.0
Specific conductance @ 25 ºC	umhos/cm		366	352	460	403	435	379	309	384	380	357
Sulfate, as SO4	mg/l		--	--	51.0	--	--	24.6	--	--	21.9	--
Temperature	deg C		9.9	9.6	11.0	12.0	11.8	9.7	10.0	10.0	10.4	10.9
Turbidity	NTU		2.5	5.2	--	--	--	--	--	--	--	--
Total Metals												
Calcium	mg/l		47.9	45.2	59.4	60.1	57.2	48.7	45.4	49.2	45.8	43.1
Magnesium	mg/l		14.8	14.5	16.4	15.9	15.7	14.3	14.2	15.5	14.9	15.0
Potassium	mg/l		1.2	1.2	1.2	1.3	1.3	1.6	1.5	1.7	1.5	1.4
Sodium	mg/l		5.6	5.4	3.3	3.5	3.7	9.3	6.8	7.2	5.8	6.2

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

		Location	22017 Elk Lake Rd NW	22017 Elk Lake Rd NW	13175 221st Ave NW	13175 221st Ave NW	22205 Elk Lake Rd	22205 Elk Lake Rd	22205 Elk Lake Rd	22275 Elk Lake Rd NW	22275 Elk Lake Rd NW	22248 Elk Lake Rd
		Date	7/07/2016	10/21/2016	7/07/2016	10/21/2016	5/29/2015	10/23/2015	11/07/2016	4/10/2017	10/18/2017	4/10/2017
		Alt. Name (2020)	C. Thompson	C. Thompson	G. Ruis	G. Ruis	M. Barnier	M. Barnier	M. Barnier	C. Thompson	C. Thompson	D. Thompson
		Unique Well ID# (or MPCA ID)	00535970	00535970	--	--	00625475	00625475	00625475	00720300	00720300	00608116
Parameter	Units	MDH Human Health-Based Water Guidance Table										
Effective Date		04/27/2020										
Exceedance Key		No Exceed										
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 0.75	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.050	< 0.050	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 0.25	< 0.25
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0 *
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0
Hexachlorobutadiene	ug/l	1 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 0.25	< 0.25	< 0.25
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10	< 10	< 10	< 10	< 10	< 10 ^	< 10	< 10	< 10	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 ^	< 5.0

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

			Location	22017 Elk Lake Rd NW	22017 Elk Lake Rd NW	13175 221st Ave NW	13175 221st Ave NW	22205 Elk Lake Rd	22205 Elk Lake Rd	22205 Elk Lake Rd	22275 Elk Lake Rd NW	22275 Elk Lake Rd NW	22248 Elk Lake Rd
			Date	7/07/2016	10/21/2016	7/07/2016	10/21/2016	5/29/2015	10/23/2015	11/07/2016	4/10/2017	10/18/2017	4/10/2017
			Alt. Name (2020)	C. Thompson	C. Thompson	G. Ruis	G. Ruis	M. Barnier	M. Barnier	M. Barnier	C. Thompson	C. Thompson	D. Thompson
			Unique Well ID# (or MPCA ID)	00535970	00535970	--	--	00625475	00625475	00625475	00720300	00720300	00608116
Parameter	Units	MDH Human Health-Based Water Guidance Table											
Effective Date		04/27/2020											
Exceedance Key		No Exceed											
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 *	< 5.0 ^	< 5.0 *
Toluene	ug/l	70 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.10	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.0040	< 0.050	< 0.0040	< 0.050	< 0.10	< 0.10	< 0.050	< 0.050	< 0.050	< 0.050
Xylene, total	ug/l	300 XYL HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters													
Alkalinity, total, as CaCO3	mg/l		174	176	164	161	154	139	147	--	193	--
Chemical Oxygen Demand	mg/l		--	< 10.0	--	< 10.0	--	< 10.0	< 10.0	--	< 10.0	--
Chloride	mg/l		2.8	3.21	19.2	21.8	14.7	14.4	15.5	--	3.66	--
Dissolved oxygen	mg/l		0.6	0.4	0.6	0.3	--	--	0.2	1.5	0.5	1.2
Nitrogen, ammonia, as N	mg/l		--	0.030	--	0.054	--	0.15	0.17	--	0.34	--
Nitrogen, nitrate + nitrite, as N	mg/l		--	< 0.050	--	< 0.050	--	< 0.050	< 0.050	--	< 0.050	--
pH	pH units		7.91	7.97	7.93	7.93	7.87	8.13	7.81	8.24	7.99	8.19
Redox (oxidation potential)	mV		-102.0	-145.0	-79.0	-142.0	--	--	-83.0	-20.0	20	-15.0
Solids, total dissolved	mg/l		--	232	--	285	--	248	283	--	262	--
Solids, total suspended	mg/l		--	8.0	--	< 4.0	--	< 4.0	< 4.0	--	< 4.0	--
Specific conductance @ 25 ºC	umhos/cm		386	381	420	451	431	387	435	397	396	405
Sulfate, as SO4	mg/l		24.7	--	59.1	--	49.8	--	--	--	--	--
Temperature	deg C		9.9	9.9	10.9	10.5	9.7	9.9	9.8	9.3	9.6	9.1
Turbidity	NTU		--	--	--	--	--	--	--	--	2.6	--
Total Metals													
Calcium	mg/l		53.4	54.2	65.0	67.9	59.5	61.9	59.9 4	--	50.6	--
Magnesium	mg/l		11.5	12.6	14.6	16.2	14.7	15.0	14.9	--	16.7	--
Potassium	mg/l		1.1	1.1	1.4	1.5	1.3	1.4	1.4	--	1.6	--
Sodium	mg/l		3.3	3.4	3.3	3.4	3.3	3.8	3.8	--	4.8	--

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

			Location	22248 Elk Lake Rd	22823 Elk Lake Rd	22823 Elk Lake Rd	12275 239th Ave NW	12275 239th Ave NW	12275 239th Ave NW	12275 239th Ave NW	12275 239th Ave NW	12275 239th Ave NW	12275 239th Ave NW
			Date	10/18/2017	5/29/2015	10/23/2015	11/03/2011	10/18/2012	10/15/2013	10/20/2014	10/23/2015	10/20/2016	10/18/2017
			Alt. Name (2020)	D. Thompson	J. Kanz	J. Kanz	Sherper	Sherper	Sherper	Sherper	Sherper	Sherper	Sherper
			Unique Well ID# (or MPCA ID)	00608116	00450132	00450132	00525310	00525310	00525310	00525310	00525310	00525310	00525310
Parameter	Units	MDH Human Health-Based Water Guidance Table											
Effective Date		04/27/2020											
Exceedance Key		No Exceed											
Volatile Organic Compounds													
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.50	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 0.50
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 0.050	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 0.050
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Acetone	ug/l	3000 HBV17 (1)	< 10	< 10	< 10	< 20	< 20	< 20	< 20	< 10	< 10	< 10
Allyl chloride	ug/l	30 HRL94	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Benzene	ug/l	2 HRL09 (1)	< 0.50	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 0.50
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0
Bromomethane	ug/l	10 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 1.0	< 1.0	< 1.0
Butylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 1.0 ^	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Chloroethane	ug/l	ND RAA16	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 1.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 1.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 1.0 ^	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 1.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0 ^	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0 ^
Hexachlorobutadiene	ug/l	1 HRL93	< 0.25	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 0.25
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10	< 10	< 10 ^	< 20	< 20	< 20	< 20	< 10 ^	< 10	< 10
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0 ^	< 5.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 5.0 ^

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

		Location	22248 Elk Lake Rd	22823 Elk Lake Rd	22823 Elk Lake Rd	12275 239th Ave NW	12275 239th Ave NW	12275 239th Ave NW	12275 239th Ave NW	12275 239th Ave NW	12275 239th Ave NW	12275 239th Ave NW
		Date	10/18/2017	5/29/2015	10/23/2015	11/03/2011	10/18/2012	10/15/2013	10/20/2014	10/23/2015	10/20/2016	10/18/2017
		Alt. Name (2020)	D. Thompson	J. Kanz	J. Kanz	Sherper	Sherper	Sherper	Sherper	Sherper	Sherper	Sherper
		Unique Well ID# (or MPCA ID)	00608116	00450132	00450132	00525310	00525310	00525310	00525310	00525310	00525310	00525310
Parameter	Units	MDH Human Health-Based Water Guidance Table										
Effective Date		04/27/2020										
Exceedance Key		No Exceed										
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 1.0 ^	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0 ^
Methylene chloride	ug/l	5 HRLMCL	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Naphthalene	ug/l	70 HRL13	< 1.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 1.0
Propylbenzene	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Styrene	ug/l		< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0 ^	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0 ^
Toluene	ug/l	70 HBV19 (1)	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 0.050	< 0.10	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.050	< 0.050
Xylene, total	ug/l	300 XYL HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters												
Alkalinity, total, as CaCO3	mg/l		178	166	172 4	234 B	285	198	202	208	216	225
Chemical Oxygen Demand	mg/l		< 10.0	--	< 10.0	< 5.0	6.6	11.8	8.0	< 10.0	< 10.0	< 10.0
Chloride	mg/l		6.01	< 0.50	< 0.5	6.8	9.56	14.5	16.6	20.4	20.5	21.2
Dissolved oxygen	mg/l		0.7	--	--	--	--	--	--	--	1.4	0.8
Nitrogen, ammonia, as N	mg/l		0.55	--	0.22	0.11	0.11	0.069	0.19	0.093	0.11	0.095
Nitrogen, nitrate + nitrite, as N	mg/l		< 0.050	--	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
pH	pH units		7.94	7.86	8.29	7.98	8.11	8.07	7.74	8.11	7.95	7.93
Redox (oxidation potential)	mV		-20	--	--	--	--	--	--	--	68.0	68
Solids, total dissolved	mg/l		260	--	146	273	288	292	295	235	309	328
Solids, total suspended	mg/l		< 4.0	--	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Specific conductance @ 25 ºC	umhos/cm		405	338	325	440	467	460	456	412	509	509
Sulfate, as SO4	mg/l		--	4.4	--	--	--	--	--	--	--	--
Temperature	deg C		10.2	9.1	10.2	9.4	8.9	9.0	9.9	9.2	9.2	9.2
Turbidity	NTU		7.0	--	--	--	--	--	--	--	--	3.3
Total Metals												
Calcium	mg/l		52.1	41.8	42.8	--	--	--	--	62.7	59.2	61.8
Magnesium	mg/l		15.5	13.2	13.4	--	--	--	--	25.0	25.8	25.9
Potassium	mg/l		1.7	1.2	1.4	--	--	--	--	1.6	1.6	1.6
Sodium	mg/l		4.5	6.0	6.7	--	--	--	--	4.1	4.2	4.1

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

Location			12275 239th Ave NW	12275 239th Ave	11611 225th Ave[2]	11611 225th Ave[2]	11611 225th Ave[2]	11611 225th Ave[2]	11611 225th Ave[2]	11611 225th Ave[2]	22191 Hwy 169[2]	22191 Hwy 169[2]	22191 Hwy 169[2]	22191 Hwy 169[2]
Date			10/16/2018	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/21/2014	10/23/2015	10/16/2018	10/20/2011	10/18/2012	10/15/2013	10/21/2014
Alt. Name (2020)			Sherper	T. Rohs	T. Schulze	T. Schulze	T. Schulze	T. Schulze	T. Schulze	T. Schulze	E. Toth	E. Toth	E. Toth	E. Toth
Unique Well ID# (or MPCA ID)			00525310	00525310	(ZW00217)	(ZW00217)	(ZW00217)	(ZW00217)	(ZW00217)	(ZW00217)	00437275	00437275	00437275	00437275
Parameter	Units	MDH Human Health-Based Water Guidance Table												
Effective Date		04/27/2020												
Exceedance Key		No Exceed												
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0
1,1,2-Trichloroethane	ug/l	3 HRL93	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2,3-Trichlorobenzene	ug/l		< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 0.050	< 0.050	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 0.050	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,3-Dichlorobenzene	ug/l		< 1.0	< 1.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 5.0	< 5.0	< 5.0	< 5.0
1,3-Dichloropropane	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 0.50	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
2,2-Dichloropropane	ug/l		< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0 ^	< 2.0	< 2.0	< 2.0	< 2.0
Acetone	ug/l	3000 HBV17 (1)	< 10	< 10	< 20	< 20	< 20	< 20	< 10	< 10	< 20	< 20	< 20	< 20
Allyl chloride	ug/l	30 HRL94	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0 *	< 2.0
Benzene	ug/l	2 HRL09 (1)	< 0.50	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0
Bromomethane	ug/l	10 HRL93	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0 *
Butylbenzene	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Butylbenzene, sec	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Butylbenzene, tert	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 0.25	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	ug/l	100 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Chlorodibromomethane	ug/l	10 HRL93	< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Chloroethane	ug/l	ND RAA16	< 1.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Chloroform	ug/l	20 HRL18	< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 1.0	< 1.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 4.0	< 4.0	< 4.0	< 2.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Cymene p- (toluene isopropyl p-)	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromomethane (methylene bromide)	ug/l		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 1.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0 ^	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethyl ether	ug/l	200 RAA16 (1)	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Hexachlorobutadiene	ug/l	1 HRL93	< 0.25	< 1.4	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 0.25	< 2.0	< 2.0	< 2.0	< 2.0
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 10 ^	< 10	< 20	< 20	< 20	< 20	< 10 ^	< 10 ^	< 20	< 20	< 20	< 20
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 5.0	< 10	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

Parameter	Units	MDH Human Health-Based Water Guidance Table	Location	12275 239th Ave NW	12275 239th Ave	11611 225th Ave[2]	11611 225th Ave[2]	11611 225th Ave[2]	11611 225th Ave[2]	11611 225th Ave[2]	11611 225th Ave[2]	22191 Hwy 169[2]	22191 Hwy 169[2]	22191 Hwy 169[2]	22191 Hwy 169[2]
			Date	10/16/2018	10/24/2019	10/20/2011	10/18/2012	10/15/2013	10/21/2014	10/23/2015	10/16/2018	10/20/2011	10/18/2012	10/15/2013	10/21/2014
			Alt. Name (2020)	Sherper	T. Rohs	T. Schulze	T. Schulze	T. Schulze	T. Schulze	T. Schulze	T. Schulze	E. Toth	E. Toth	E. Toth	E. Toth
			Unique Well ID# (or MPCA ID)	00525310	00525310	(ZW00217)	(ZW00217)	(ZW00217)	(ZW00217)	(ZW00217)	(ZW00217)	00437275	00437275	00437275	00437275
Effective Date		04/27/2020													
Exceedance Key		No Exceed													
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)		< 1.0	< 1.0 ^	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0 ^	< 3.0	< 3.0	< 3.0	< 3.0
Methylene chloride	ug/l	5 HRLMCL		< 1.0	< 5.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Naphthalene	ug/l	70 HRL13		< 1.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0
Propylbenzene	ug/l			< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Styrene	ug/l			< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Tetrachloroethylene	ug/l	4 HBV14 (1)		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0
Tetrahydrofuran	ug/l	600 HRL18		< 5.0	< 10	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HBV19 (1)		< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)		< 0.10	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93		< 1.0	< 4.0	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93		< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Vinyl chloride	ug/l	0.2 HRL18 (1)		< 0.050	< 0.050	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.050	< 1.0	< 1.0	< 1.0	< 1.0
Xylene, total	ug/l	300 XYL HBV19 (1)		< 2.0	< 3.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters															
Alkalinity, total, as CaCO3	mg/l			230	275	195	144	185	207	176	173	201	182	202	206
Chemical Oxygen Demand	mg/l			11.2	< 10.0	14.6	5.0	< 5.0	< 5.0	< 10.0 F1	< 10.0	14.9	6.0	< 5.0	7.4
Chloride	mg/l			19.6	22.0	< 1.0	< 1	< 1	< 1	0.748	1.19	27.8	27.3	30.8	32.3
Dissolved oxygen	mg/l			0.6	0.4	--	--	--	--	--	0.6	--	--	--	--
Nitrogen, ammonia, as N	mg/l			0.097	0.12	0.27	0.23	0.17	0.27	0.19	0.21	< 0.050	< 0.050	< 0.050	< 0.050
Nitrogen, nitrate + nitrite, as N	mg/l			< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
pH	pH units			7.82	7.65	7.99	7.98	8.00	7.94	8.40	7.98	7.80	7.83	7.82	8.27
Redox (oxidation potential)	mV			65	101	--	--	--	--	--	-73	--	--	--	--
Solids, total dissolved	mg/l			312	314	171	197	179	173	170	177	259	305	277	321
Solids, total suspended	mg/l			< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Specific conductance @ 25 ºC	umhos/cm			504	512	318	346	340	325	316	333	445	497	490	455
Sulfate, as SO4	mg/l			--	--	--	--	--	--	--	--	--	--	--	--
Temperature	deg C			9.2	9.7	9.6	9.8	9.6	10.5	9.4	9.7	9.2	9.4	9.4	9.2
Turbidity	NTU			0.9	1.5	--	--	--	--	--	0.8	--	--	--	--
Total Metals															
Calcium	mg/l			69.8	65.6	--	--	--	--	39.0	40.6	--	--	--	--
Magnesium	mg/l			27.6	26.8	--	--	--	--	15.1	15.3	--	--	--	--
Potassium	mg/l			1.7	1.6	--	--	--	--	1.5	1.5	--	--	--	--
Sodium	mg/l			4.2	4.1	--	--	--	--	8.3	8.2	--	--	--	--

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

Location			22715 Baldwin[2]	22715 Baldwin[2]	22715 Baldwin[2]	22915 Hwy 169[2]	22915 Hwy 169[2]	22915 Hwy 169[2]	22915 Hwy 169[2]	22915 Hwy 169[2]	22915 Hwy 169[2]	23385 Hwy 169[2]	23385 Hwy 169[2]	23385 Hwy 169[2]	23385 Hwy 169[2]
Date			10/20/2011	10/18/2012	10/21/2014	10/20/2011	10/18/2012	10/15/2013	10/21/2014	10/23/2015	10/16/2018	10/20/2011	10/18/2012	10/15/2013	10/21/2014
Alt. Name (2020)			J. Lawson	J. Lawson	J. Lawson	J. Toth	J. Toth	J. Toth	J. Toth	J. Toth	J. Toth	J. Spencer	J. Spencer	J. Spencer	J. Spencer
Unique Well ID# (or MPCA ID)			(ZW00216)	(ZW00216)	(ZW00216)	00545375	00545375	00545375	00545375	00545375	00545375	00531397	00531397	00531397	00531397
Parameter	Units	MDH Human Health-Based Water Guidance Table													
Effective Date		04/27/2020													
Exceedance Key		No Exceed													
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	ug/l	70 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,1,1-Trichloroethane	ug/l	5000 HRL18 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,1,2,2-Tetrachloroethane	ug/l	2 HRL94	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0
1,1,2-Trichloroethane	ug/l	3 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.75	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	ug/l	80 RAA16 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,1-Dichloroethylene	ug/l	200 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2,3-Trichlorobenzene	ug/l		< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0
1,2,3-Trichloropropane	ug/l	0.003 HRL13 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2,4-Trichlorobenzene	ug/l	4 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	ug/l	30 HBV19	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane (DBCP)	ug/l		< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 0.050	< 3.0	< 3.0	< 3.0	< 3.0
1,2-Dibromoethane (EDB)	ug/l	0.004 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2-Dichlorobenzene	ug/l	600 HRL93	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethylene, cis	ug/l	6 HRL18 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2-Dichloroethylene, trans	ug/l	9 HRL20 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,2-Dichloropropane	ug/l	5 HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	ug/l	30 HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,3-Dichlorobenzene	ug/l		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 1.0	< 1.0	< 5.0	< 5.0	< 5.0	< 5.0
1,3-Dichloropropane	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
1,3-Dichloropropene, cis	ug/l	2 DCP HRL94	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropene, trans	ug/l	2 DCP HRL94	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0
1,4-Dichlorobenzene	ug/l	10 HRL94 (1) ***	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
2,2-Dichloropropane	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Acetone	ug/l	3000 HBV17 (1)	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 10 ^	< 10	< 20	< 20	< 20	< 20
Allyl chloride	ug/l	30 HRL94	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0 *	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0 *	< 2.0
Benzene	ug/l	2 HRL09 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 0.50	< 2.0	< 2.0	< 2.0	< 2.0
Bromobenzene	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Bromodichloromethane	ug/l	3 HBV18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	ug/l	40 HRL93	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0
Bromomethane	ug/l	10 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Butylbenzene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Butylbenzene, sec	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Butylbenzene, tert	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Carbon tetrachloride	ug/l	1 HRL13 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.25	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	ug/l	100 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Chlorodibromomethane	ug/l	10 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Chloroethane	ug/l	ND RAA16	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Chloroform	ug/l	20 HRL18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, o	ug/l		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorotoluene, p	ug/l		< 4.0	< 4.0	< 2.0	< 4.0	< 4.0	< 4.0	< 2.0	< 1.0	< 1.0	< 4.0	< 4.0	< 4.0	< 2.0
Cumene (isopropyl benzene)	ug/l	300 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Cymene p- (toluene isopropyl p-)	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromomethane (methylene bromide)	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorodifluoromethane (Freon-12)	ug/l	500 RAA17	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorofluoromethane (Freon-21)	ug/l	20 RAA17	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethyl benzene	ug/l	40 HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethyl ether	ug/l	200 RAA16 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Hexachlorobutadiene	ug/l	1 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 0.25	< 2.0	< 2.0	< 2.0	< 2.0
Methyl ethyl ketone (2-butanone)	ug/l	4000 HRL94	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 10 ^	< 10 ^	< 20	< 20	< 20	< 20
Methyl isobutyl ketone (MIBK)	ug/l	300 HRL94	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 5.0	< 5.0	< 3.0	< 3.0	< 3.0	< 3.0

Table D2
Residential Water Supply Well Data (2011-2019)
Elk River Landfill
Elk River, Minnesota

		Location	22715 Baldwin[2]	22715 Baldwin[2]	22715 Baldwin[2]	22915 Hwy 169[2]	22915 Hwy 169[2]	22915 Hwy 169[2]	22915 Hwy 169[2]	22915 Hwy 169[2]	22915 Hwy 169[2]	23385 Hwy 169[2]	23385 Hwy 169[2]	23385 Hwy 169[2]	23385 Hwy 169[2]
		Date	10/20/2011	10/18/2012	10/21/2014	10/20/2011	10/18/2012	10/15/2013	10/21/2014	10/23/2015	10/16/2018	10/20/2011	10/18/2012	10/15/2013	10/21/2014
		Alt. Name (2020)	J. Lawson	J. Lawson	J. Lawson	J. Toth	J. Toth	J. Toth	J. Toth	J. Toth	J. Toth	J. Spencer	J. Spencer	J. Spencer	J. Spencer
		Unique Well ID# (or MPCA ID)	(ZW00216)	(ZW00216)	(ZW00216)	00545375	00545375	00545375	00545375	00545375	00545375	00531397	00531397	00531397	00531397
Parameter	Units	MDH Human Health-Based Water Guidance Table													
Effective Date		04/27/2020													
Exceedance Key		No Exceed													
Methyl tertiary butyl ether (MTBE)	ug/l	60 RAA13 (1)	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0
Methylene chloride	ug/l	5 HRLMCL	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Naphthalene	ug/l	70 HRL13	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 1.0	< 1.0	< 3.0	< 3.0	< 3.0	< 3.0
Propylbenzene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Styrene	ug/l		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Tetrachloroethylene	ug/l	4 HBV14 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 *	< 1.0
Tetrahydrofuran	ug/l	600 HRL18	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	ug/l	70 HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethylene (TCE)	ug/l	0.4 HRL15 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane (Freon-11)	ug/l	2000 HRL93	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0 ^	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 ^
Trichlorotrifluoroethane (Freon 113)	ug/l	200000 HRL93	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0
Vinyl chloride	ug/l	0.2 HRL18 (1)	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10	< 0.050	< 1.0	< 1.0	< 1.0	< 1.0
Xylene, total	ug/l	300 XYL HBV19 (1)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
General Parameters															
Alkalinity, total, as CaCO3	mg/l		265	216	233	247	188	213	206	206	205	217	196	170	165
Chemical Oxygen Demand	mg/l		12.7	< 5.0	< 5.0	13.0	< 5.0	< 5.0	< 5.0	11.6	10.5	6.7	< 5.0	< 5.0	5.8
Chloride	mg/l		12.5	10.9	12.7	28.4	24.3	28.9	27.1	30.7	30.2	< 1.0	< 1	< 1	< 1 F1
Dissolved oxygen	mg/l		--	--	--	--	--	--	--	--	0.6	--	--	--	--
Nitrogen, ammonia, as N	mg/l		< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.020	< 0.020	0.076	0.13	0.10	0.16
Nitrogen, nitrate + nitrite, as N	mg/l		9.6	9.6	9.8	0.19	0.49	0.81	0.93	0.84	0.34	< 0.050	< 0.050	< 0.050	< 0.050 F1
pH	pH units		7.60	8.09	7.73	7.67	7.96	7.92	7.67	7.92	7.62	8.17	8.26	8.19	8.04
Redox (oxidation potential)	mV		--	--	--	--	--	--	--	--	80	--	--	--	--
Solids, total dissolved	mg/l		316	347	316	256	302	294	330	265	318	159	183	169	190
Solids, total suspended	mg/l		< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Specific conductance @ 25 ºC	umhos/cm		562	566	495	472	518	503	479	450	532	318	347	350	330
Sulfate, as SO4	mg/l		--	--	--	--	--	--	--	--	--	--	--	--	--
Temperature	deg C		11.0	9.6	9.3	10.6	10.6	9.6	9.8	9.4	9.4	9.5	9.8	10.1	9.5
Turbidity	NTU		--	--	--	--	--	--	--	--	4.7	--	--	--	--
Total Metals															
Calcium	mg/l		--	--	--	--	--	--	--	73.6	71.3	--	--	--	--
Magnesium	mg/l		--	--	--	--	--	--	--	25.0	24.4	--	--	--	--
Potassium	mg/l		--	--	--	--	--	--	--	1.7	1.7	--	--	--	--
Sodium	mg/l		--	--	--	--	--	--	--	3.2	3.1	--	--	--	--

Data Footnotes and Qualifiers

Barr Standard Footnotes and Qualifiers

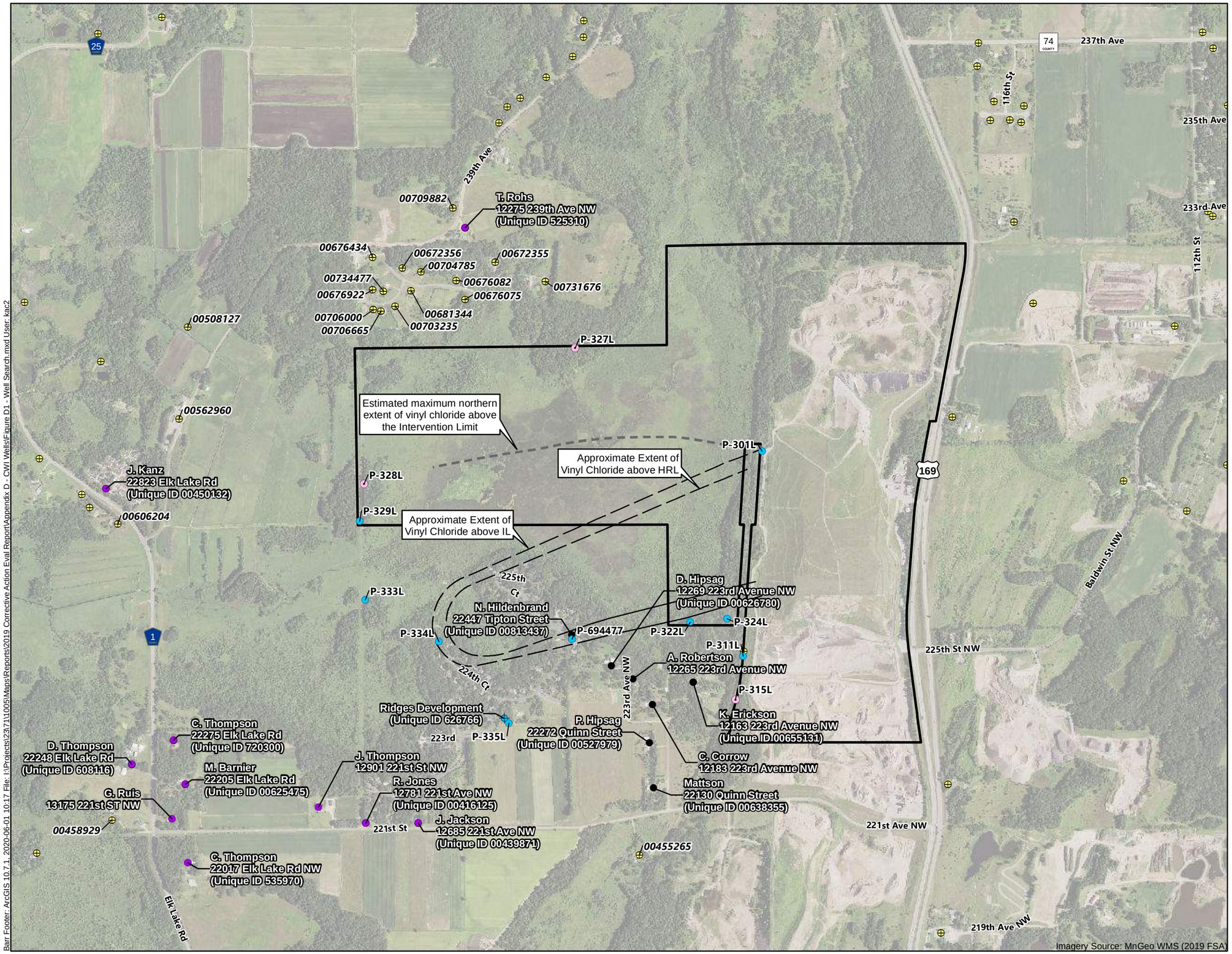
--	Not analyzed/Not available.
*	Estimated value, QA/QC criteria not met.
[1]	Well 12265 223rd was incorrectly listed as 11265 223rd in Permit SW-74
[2]	Upgradient well located east of Hwy 169 NW

TestAmerica Qualifiers

*	LCS or LCSD is outside acceptance limits.
^	ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC is outside acceptance limits.
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
B	Compound was found in the blank and sample.
F1	MS and/or MSD Recovery is outside acceptance limits.

MDH Human Health-Based Water Guidance Table

DCP	Value shown is 1,3-dichloropropene in the MDH criterion, however, the laboratory reports cis and trans isomers individually.
(1)	Value is representative of the lowest exposure duration published in the Minnesota Department of Health Human Health Advisory Table.
HBV14	Health Based Value 2014
HBV17	Health Based Value 2017
HBV18	Health Based Value 2018
HBV19	Health Base Value 2019.
HRL09	Health Risk Limit 2009
HRL13	Health Risk Limit 2013.
HRL15	Health Risk Limit 2015
HRL18	Health Risk Limit 2018.
HRL20	Health Risk Limit 2020
HRL93	Health Risk Limit 1993.
HRL94	Health Risk Limit 1994.
***	Dual guidance applies: See Dual Guidance for Drinking Water (https://www.health.state.mn.us/communities/environment/risk/guidance/dualguidance.html)
HRLMCL	Health Risk Limit; Maximum Contaminant Level.
ND	Not derived due to insufficient information.
RAA13	Risk Assessment Advice 2013
RAA16	Risk Assessment Advice 2016
RAA17	Risk Assessment Advice 2017.
XYL	Value shown is for the sum of the mixed o,m and p Xylene isomers.



Property Boundary

Domestic

Residential Well Location

Community Water Supply Well

Residential Well (Expanded Sampling Location, 2015-2017)

Existing Monitoring Locations

Monitoring Well

Piezometer

Notes:
1) Pertinent ERL lower outwash monitoring locations shown.

Feet
0 1,200 2,400

Figure D1

WELL SEARCH
Elk River Landfill
Elk River, Minnesota

Bar Footer: ArcGIS 10.7.1, 2020-06-01 10:17 File: I:\Projects\23\7110005\Maps\Reports\2019 Corrective Action Eval Report\Appendix D - CWI Wells\Figure D1 - Well Search.mxd User: kac2

Minnesota Unique Well No.

416125

County Sherburne
Quad Elk River
Quad ID 137D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 12/01/1990
Update Date 02/14/2014
Received Date

Well Name JONES, RANDY

Township Range Dir Section Subsections Elevation 989 ft.

33 26 W 4 CCCCCC Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
135 ft.	135 ft.	08/29/1986

Drilling Method Non-specified Rotary

Well Address
12781 221ST AV NW
ELK RIVER MN 55330

Drilling Fluid --

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
FINE SAND	BROWN		0	41
CLAY	BROWN		41	57
MEDIUM SAND	YELLOW		57	60
CLAY	BROWN		60	63
CLAY	GRAY		63	66
ROCKY CLAY	RED		66	75
MEDIUM SAND	YEL/BRN		75	90
CLAY	BROWN		90	100
MEDIUM SAND	BROWN		100	105
CLAY	RED		105	116
SAND	BROWN		116	120
SAND	GRAY		120	135

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☐ Yes ☑ No Above/Below 1 ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 131 ft.	10.79 lbs./ft.	

Open Hole from ft. to ft.

Screen YES Make JOHNSON 304 Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
3.3	18	4	131 ft. and 135 ft.

Static Water Level
50 ft. from Land surface Date Measured 08/29/1986

PUMPING LEVEL (below land surface)
60 ft. after 2 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer BAKER Model SNAPPY
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: Bentonite from 0 to 131 ft.

Located by: Minnesota Geological Survey
Method: Digitized - scale 1:24,000 or larger (Digitizing Table)

Unique Number Verification: Address verification
Input Date: 04/12/1995

System: *UTM - Nad83, Zone15, Meters* X: 453650 Y: 5024488

Nearest Known Source of Contamination
105 feet E direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☑ Not Installed Date Installed 09/09/1986
Manufacturer's name GRUNDFOS Model number SP4-8 HP 0.75 Volts 230
Length of drop Pipe 72 ft. Capacity 15 g.p.m Type Submersible Material Galvanized

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

Renner E.H. Well	71015	PRAUGHT, V.
License Business Name	Lic. Or Reg. No.	Name of Driller

First Bedrock
Last Strat sand-gray
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report

416125

Printed 11/30/2014
HE-01205-07

Minnesota Unique Well No.

439871

County Sherburne
Quad Elk River
Quad ID 137D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 08/19/1992
Update Date 02/14/2014
Received Date

Well Name JACKSON, JERRY

Township Range Dir Section Subsections Elevation 990 ft.

33 26 W 4 CCDCCB Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
138 ft.	137 ft.	06/09/1988

Drilling Method Non-specified Rotary

Well Address
12723 221 AV NW
ELK RIVER MN 55330

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
DRY SAND	BROWN		0	50
CLAY	BROWN		50	60
CLAY	GRAY		60	75
FINE SAND	BROWN		75	90
CLAY	BROWN		90	100
SAND	BROWN		100	120
CLAY	GRAY		120	125
MEDIUM SAND	GRAY		125	138

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☐ Yes ☑ No Above/Below 1 ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 133 ft.	10.79 lbs./ft.	

Open Hole from ft. to ft.

Screen YES Make JOHNSON 304 Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
4.5	18	4	133 ft. and 137 ft.

Static Water Level
50 ft. from Land surface Date Measured 06/09/1988

PUMPING LEVEL (below land surface)
70 ft. after 3 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer BAKER Model SNAPPY
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: Bentonite from 0 to 133 ft.

Located by: Minnesota Geological Survey
Method: Digitized - scale 1:24,000 or larger (Digitizing Table)

Unique Number Verification: Address verification
Input Date: 04/12/1995

System: *UTM - Nad83, Zone15, Meters* X: 453856 Y: 5024487

Nearest Known Source of Contamination
105 feet South East direction Septic tank/drain field type

Well disinfected upon completion? ☑ Yes ☐ No

Pump ☑ Not Installed Date Installed 07/08/1988
Manufacturer's name GRUNDFOS Model number 16S07-8 HP 0.75 Volts 230
Length of drop Pipe 84 ft. Capacity g.p.m Type Submersible Material Galvanized

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Renner E.H. Well	71015	PRAUGHT, V.

First Bedrock
Last Strat sand-gray
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report

439871

Printed 11/30/2014
HE-01205-07

Minnesota Unique Well No.

450132

County Sherburne
Quad Lake Fremont
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 05/21/1991
Update Date 02/14/2014
Received Date

Well Name CATO, NANCY

Township Range Dir Section Subsections Elevation 961 ft.

33 26 W 5 BAACCB Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
127 ft.	127 ft.	07/12/1988

Drilling Method Non-specified Rotary

Well Address
22824 ELK LAKE RD
ELK RIVER MN

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
SAND	BROWN	SOFT	0	9
CLAY	GRAY	SOFT	9	12
SAND	GRAY	SOFT	12	17
CLAY	GRAY	SOFT	17	28
SAND	BROWN	SOFT	28	33
CLAY & GRAVEL	BROWN	HARD	33	113
SAND & GRAVEL	BROWN	SOFT	113	127

Casing Type Plastic Joint No Information Drive Shoe? ☐ Yes ☑ No Above/Below 1 ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 113 ft.	lbs./ft.	6.25 in. to 127 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
2	15		ft. and 127 ft.
2	12	17	113 ft. and ft.
2	15		ft. and ft.

Static Water Level
4 ft. from Land surface Date Measured 07/12/1988

PUMPING LEVEL (below land surface)
110 ft. after 1 hrs. pumping 75 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: Neat Cement from 0 to 30 ft. 3 bags

Located by:
Method: GPS SA Off (averaged)
Unique Number Verification: Address verification
Input Date: 02/02/2011
System: *UTM - Nad83, Zone15, Meters*
X: 452641 Y: 5025816

Nearest Known Source of Contamination
56 feet _direction _type

Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 07/14/1988
Manufacturer's name AERMOTOR Model number SD20150 HP 1.5 Volts 230
Length of drop Pipe 69 ft. Capacity 25 g.p.m Type Submersible Material Steel (black or low carbon)

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

First Bedrock
Last Strat sand +larger-brown
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Mork Well Co.	02133	LAWRENCE, R.

County Well Index Online Report **450132** Printed 12/5/2014
HE-01205-07

Minnesota Unique Well Number

455265

County Sherburne
Quad Elk River
Quad ID 137D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 05/15/1991
Update Date 02/14/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
LAFSON, ELOF	33	26	W	9	ABABDD

Elevation 957 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

C/W 12210 221ST AV NW ELK RIVER MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND GRAVEL &	0	15	BROWN	HARD
CLAY	15	22	GRAY	SOFT
CLAY & GRAVEL	22	30	BROWN	SOFT
SAND & GRAVEL	30	37	BROWN	SOFT
CLAY & GRAVEL	37	83	BROWN	HARD
SAND & GRAVEL	83	101	BROWN	SOFT

Remarks

Well Depth 101 ft. **Depth Completed** 101 ft. **Date Well Completed** 12/06/1988

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☒ **Above/Below** 1 ft.

Casing Diameter	Weight	Hole Diameter
4 in. To 88 ft.	lbs./ft.	6.2 in. To 101 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set
2 in.	12	ft.	ft. 101 ft.
2 in.	10	12 ft.	88 ft. ft.
2 in.	12	ft.	ft. ft.

Static Water Level
15 ft. land surface Measure 12/06/1988

Pumping Level (below land surface)
84 ft. 1 hrs. Pumping at 50 g.p.m.

Wellhead Completion
Pitless adapter manufacturer MONITOR Model 8PL41UC1
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
neat cement	3 Sacks	0 ft.	30 ft.

Nearest Known Source of Contamination
61 feet Southeas Direction Septic tank/drain field Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 12/20/1988
Manufacturer's name LOWARA
Model Number 11AM05412 HP 0.5 Volt 230
Length of drop pipe 40 ft Capacity 10 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock Aquifer Quat. buried
Last Strat sand +larger-brown Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 454726 Y 5024353
Unique Number Verification Address verification Input Date 02/02/2011

Angled Drill Hole

Well Contractor
Mork Well Co. 02133 LAWRENCE, R.
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Well Index Report | **455265** | Printed on 05/31/2020 HE-01205-15

Minnesota Unique Well No.
458929

County Sherburne
Quad Elk River
Quad ID 137D

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 103I

Entry Date 01/25/1991
Update Date 02/14/2014
Received Date

Well Name THOMPSON, MATTHEW
Township Range Dir Section Subsections Elevation 951 ft.
33 26 W 5 CDDCBD Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
92 ft.	92 ft.	01/17/1990

Drilling Method Non-specified Rotary

Well Address
22112 ELK LAKE RD
ELK RIVER MN

Drilling Fluid Bentonite
Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
SANDY CLAY	BROWN	SOFT	0	48
CLAY	GRAY	MEDIUM	48	75
SAND	ORANGE	SOFT	75	92

Casing Type Plastic Joint No Information Drive Shoe? ☐ Yes ☑ No Above/Below 1 ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 81 ft.	lbs./ft.	6.25 in. to 92 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
2	12	12	81 ft. and 92 ft.

Static Water Level
25 ft. from Land surface Date Measured 01/17/1990

PUMPING LEVEL (below land surface)
78 ft. after 1 hrs. pumping 25 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model 8PL41UC1
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified
Grout Material: Neat Cement from 0 to 30 ft.

Located by:
Method: GPS SA Off (averaged)
Unique Number Verification: Address verification
Input Date: 02/02/2011
System: *UTM - Nad83, Zone15, Meters*
X: 452651 Y: 5024511

Nearest Known Source of Contamination
101 feet W direction Sewer type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 01/19/1990
Manufacturer's name LOWARA Model number 11AM07B12 HP 0.75 Volts 230
Length of drop Pipe 60 ft. Capacity 10 g.p.m Type Submersible Material Plastic

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

First Bedrock
Last Strat sand-orange
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

Mork Well Co.	02133	AESHLIMAN, S.
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report **458929** Printed 12/5/2014
HE-01205-07

Minnesota Unique Well Number

508127

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 12/01/1990
Update Date 06/02/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
PERL SOD	34	26	W	32	DBCDBA

Elevation 948 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
PEAT DIRT	0	5	BLACK	SOFT
PEAT DIRT	5	10	BLACK	SOFT
CLAY	10	35	GRAY	SOFT
SAND & COARSE	35	45	VARIED	MEDIUM
CLAY & SAND	45	105	RED	MED-HRD
CLAY	105	125	GRAY	SOFT
SANDSTONE-SHALE	125	130	VARIED	MED-HRD
SANDSTONE	130	190	WHT/TAN	MED-HRD
SANDSTONE	190	205		HARD
SANDSTONE	205	210		HARD

Remarks

Well Depth	Depth Completed	Date Well Completed
210 ft.	210 ft.	08/21/1989

Drill Method Non-specified Rotary **Drill Fluid** Qwik gel

Use irrigation **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint** Welded
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
12 in. To 135 ft.	lbs./ft.	18 in. To 135 ft.
		11 in. To 210 ft.

Open Hole From 135 ft. To 210 ft.

Screen? ☐ **Type** **Make**

Static Water Level
-1.5 ft. land surface Measure 08/21/1989

Pumping Level (below land surface)
18 ft. 6 hrs. Pumping at 1000 g.p.m.

Wellhead Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
bentonite		0 ft.	90 ft.
neat cement	1.25 Cubic yards	90 ft.	135 ft.

Nearest Known Source of Contamination
500 feet West Direction Volatile organic compounds Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☒ Not Installed Date Installed
Manufacturer's name
Model Number HP Volt
Length of drop pipe ft Capacity g.p. Typ

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock Mt.Simon Sandstone Aquifer Mt.Simon-
Last Strat Hinckley Sandstone Depth to Bedrock 125 ft
Located by Minnesota Geological Survey
Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or
System UTM - NAD83, Zone 15, Meters X 452971 Y 5026449
Unique Number Verification Information from Input Date 04/12/1995

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Bergerson-Caswell	27058	HOLMEN, G.

Minnesota Unique Well Number

525310

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 03/28/1996
Update Date 03/10/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
SHERPER, DON	34	26	W	33	BDCCBC

Elevation 984 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

C/W 12275 239TH AV NW ELK RIVER MN 55330

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND	0	25		
CLAY	25	55		
GRAVEL/ CLAY	55	85		
WATERSAND	85	110		

Remarks

OLD WELL SEALED #H58730.

Well Depth	Depth Completed	Date Well Completed
110 ft.	110 ft.	07/07/1995

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☒ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 105 ft.	2 lbs./ft.	8 in. To 36 ft.
		6.7 in. To 110 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set
2 in.	15	5 ft.	105 ft. 110 ft.

Static Water Level

19 ft. land surface Measure 07/11/1995

Pumping Level (below land surface)

60 ft. 1 hrs. Pumping at 40 g.p.m.

Wellhead Completion

Pitless adapter manufacturer MOINTOR Model SNAPPY

☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
bentonite	2 Sacks	6 ft.	36 ft.

Nearest Known Source of Contamination

53 feet North Direction Septic tank/drain field Type

Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 07/11/1995

Manufacturer's name AERMOTOR

Model Number 7T12 HP 0.75 Volt 230

Length of drop pipe 60 ft Capacity 12 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☒ Yes ☐ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. buried

Last Strat sand Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method GPS SA Off (averaged) (15 meters)

System UTM - NAD83, Zone 15, Meters X 454067 Y 5026827

Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Mac's Well Co.	86596	TORGERSON, S.

Minnesota Unique Well No.

527979

County Sherburne
Quad Elk River
Quad ID 137D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 10/13/1993
Update Date 02/14/2014
Received Date

Well Name

Township Range Dir Section Subsections Elevation 992 ft.

33 26 W 4 DCAACB Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
140 ft.	140 ft.	06/21/1993

Drilling Method Non-specified Rotary

Well Address
22272 QUINN ST
ELK RIVER MN 55330

Drilling Fluid Other

Well Hydrofractured? ☐ Yes ☐ No From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
CLAY & SAND	BROWN	SOFT	0	10
SILTY SAND & CLAY	LT. BRN	SOFT	10	74
CLAY	GRAY	HARD	74	90
CLAY & ROCKS	BROWN	HARD	90	126
SAND	YELLOW	SOFT	126	140

Casing Type Plastic Joint Welded Drive Shoe? ☑ Yes ☐ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 135 ft.	lbs./ft.	8 in. to 30 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
2	10	5	135 ft. and 140 ft.

Static Water Level
50 ft. from Land surface Date Measured 06/21/1993

PUMPING LEVEL (below land surface)
100 ft. after 3 hrs. pumping 15 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR BD Model 4A05.5
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: Neat Cement from 0 to 30 ft. 3 bags
Grout Material: Bentonite from 30 to 135 ft. 4 bags

Located by:
Method: GPS SA Off (averaged)
Unique Number Verification: Address verification
Input Date: 02/02/2011
System: *UTM - Nad83, Zone15, Meters*
X: 454759 Y: 5024764

Nearest Known Source of Contamination
50 feet W direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 06/22/1993
Manufacturer's name AERMOTOR Model number SD1250 HP 0.5 Volts 230
Length of drop Pipe 105 ft. Capacity 12 g.p.m Type Submersible Material Plastic

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Mc Alpine's Well Co.	27186	MCALPINE, T.

First Bedrock
Last Strat sand-yellow
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report

527979

Printed 11/30/2014
HE-01205-07

Minnesota Unique Well Number

535970

County Sherburne
Quad Elk River
Quad ID 137D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 02/15/1995
Update Date 02/14/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
THOMPSON,	33	26	W	8	ABBCDB

Elevation 979 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

C/W 12901 221ST AV ELK RIVER MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
FINE SAND	0	65	BROWN	MEDIUM
CLAY	65	160	BROWN	HARD
SAND	160	170	GRAY	MEDIUM

Remarks

Well Depth	Depth Completed	Date Well Completed
170 ft.	170 ft.	11/30/1994

Drill Method Non-specified Rotary **Drill Fluid** Other

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 160 ft.	lbs./ft.	8.8 in. To 30 ft.
		6.5 in. To 170 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set	
2.5 in.	12	10 ft.	160 ft.	170 ft.

Static Water Level

45 ft. land surface Measure 11/30/1994

Pumping Level (below land surface)

170 ft. 2 hrs. Pumping at 18 g.p.m.

Wellhead Completion

Pitless adapter manufacturer MERRILL Model SPP

☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
bentonite	3 Sacks	0 ft.	30 ft.

Nearest Known Source of Contamination

100 feet East Direction Septic tank/drain field Type

Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 11/30/1994

Manufacturer's name AERMOTOR

Model Number SD12 HP 0.5 Volt 220

Length of drop pipe 80 ft Capacity 10 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. buried

Last Strat sand-gray Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method GPS SA Off (averaged) (15 meters)

System UTM - NAD83, Zone 15, Meters X 452882 Y 5024294

Unique Number Verification Address verification Input Date 02/02/2011

Angled Drill Hole

Well Contractor

Drillco 27264 URAN, J.

Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Well Index Report | **535970** | Printed on 05/31/2020 HE-01205-15

Minnesota Unique Well No.

562960

County Sherburne
Quad Lake Fremont
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 11/21/1996
Update Date 02/14/2014
Received Date

Well Name ED FIELDS & SONS, INC

Township Range Dir Section Subsections Elevation 949 ft.

34 26 W 32 DCCACC Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
130 ft.	130 ft.	08/03/1996

Drilling Method Non-specified Rotary

Well Address
13000 238TH AV NW
MN

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☐ No From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
SANDY	BROWN	SOFT	0	30
CLAY & ROCKS	BROWN		30	60
CLAY	BROWN		60	100
MEDIUM SAND	BROWN	MEDIUM	100	120
GRAVEL & SANDSTONE MIX	BROWN	SOFT	120	130

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☐ Yes ☑ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 123 ft.	10.79 lbs./ft.	8.8 in. to 30 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
4.5	25	8	121 ft. and 130 ft.

Static Water Level
9 ft. from Land surface Date Measured 08/03/1996

PUMPING LEVEL (below land surface)
19 ft. after 3 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer BAKER Model SNAPPY
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: Bentonite from 0 to 121 ft. 1.3 yrds.

Located by:
Unique Number Verification: Address verification
System: *UTM - Nad83, Zone15, Meters*
Method: GPS SA Off (averaged)
Input Date: 11/12/2010
X: 452932 Y: 5026088

Nearest Known Source of Contamination
50 feet E direction Septic tank/drain field type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed 08/07/1996
Manufacturer's name GRUDFOS Model number 25S10-7 HP 1 Volts 230
Length of drop Pipe 42 ft. Capacity 25 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Renner E.H. Well	71015	PRAUGHT, V.

First Bedrock
Last Strat gravel (+larger)-brown
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report **562960** Printed 12/5/2014
HE-01205-07

Minnesota Unique Well No.
606204

County Sherburne
Quad Lake Fremont
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 103I

Entry Date 06/04/1998
Update Date 02/14/2014
Received Date

Well Name DUNHAM, HOWARD
Township Range Dir Section Subsections Elevation 955 ft.
33 26 W 5 BADCAB Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
89 ft.	89 ft.	11/25/1997

Drilling Method Non-specified Rotary

Well Address
22722 ELK LAKE RD
ELK RIVER MN 55330

Drilling Fluid Bentonite
Well Hydrofractured? ☐ Yes ☐ No From Ft. to Ft.
Use Domestic

Geological Material	Color	Hardness	From	To
SAND	BROWN	SOFT	0	40
CLAY	GRAY	MEDIUM	40	74
CLAY & GRAVEL	BROWN	MEDIUM	74	80
GRAVEL	BROWN	SOFT	80	89

Casing Type Plastic Joint No Information Drive Shoe? ☐ Yes ☑ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 84 ft.	1.9 lbs./ft.	6.5 in. to 89 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
2	12	5	84 ft. and 89 ft.

Static Water Level
12 ft. from Land surface Date Measured 11/25/1997

PUMPING LEVEL (below land surface)
84 ft. after 2 hrs. pumping 50 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model BULLDOG
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
HOWARD DUNHAM

Located by:
Unique Number Verification: Address verification
System: *UTM - Nad83, Zone15, Meters*
Method: GPS SA Off (averaged)
Input Date: 02/02/2011
X: 452686 Y: 5025676

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified
Grout Material: High solids bentonite from 0 to 30 ft. 0.17 yrds.
Grout Material: Cuttings from 30 to 84 ft.

Nearest Known Source of Contamination
33 feet South West direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 12/01/1997
Manufacturer's name AERMOTOR Model number T12-50 HP 0.5 Volts 230
Length of drop Pipe 40 ft. Capacity 10 g.p.m Type Submersible Material Plastic

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
McAlpine Bros., Inc.	27270	GOODIN, G.

First Bedrock
Last Strat gravel (+larger)-brown
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report

606204

Printed 12/5/2014
HE-01205-07

Minnesota Unique Well No.

608116

County Sherburne
Quad Elk River
Quad ID 137D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/04/1998
Update Date 05/19/2014
Received Date

Well Name THOMPSON, DICK

Township Range Dir Section Subsections Elevation 961 ft.

33 26 W 5 CDADBB Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
94 ft.	94 ft.	11/01/1997

Drilling Method Non-specified Rotary

Well Address
22248 ELK LAKE RD
ELK RIVER MN 55330

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
SAND	TAN	SOFT	0	38
CLAY	TAN	SOFT	38	46
CLAY	GRAY	SOFT	46	62
SAND, GRAVEL	TAN	SOFT	62	68
CLAY, GRAVEL	BROWN	SOFT	68	71
SAND	TAN	SOFT	71	94

Casing Type Plastic Joint Glued Drive Shoe? ☐ Yes ☑ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 85 ft.	lbs./ft.	8.5 in. to 30 ft.

Open Hole from ft. to ft.

Screen YES Make COOK Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
2	10	8	85 ft. and 94 ft.

Static Water Level
23 ft. from Land surface Date Measured 11/01/1997

PUMPING LEVEL (below land surface)
ft. after 1 hrs. pumping 40 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model 8PL41UC1
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: High solids bentonite from 0 to 30 ft.
Grout Material: Cuttings from 30 to 85 ft.

Located by:
Unique Number Verification: Address verification
System: *UTM - Nad83, Zone15, Meters*

Method: GPS SA Off (averaged)
Input Date: 02/02/2011
X: 452730 Y: 5024730

Nearest Known Source of Contamination
52 feet W direction Septic tank/drain field type

Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed 11/05/1997
Manufacturer's name RED JACKET Model number 75SESW1-12SBC HP 0.75 Volts 230
Length of drop Pipe 60 ft. Capacity 15 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

Well Contractor Certification

Mork Well Co.	02658	THOMPSON, S
License Business Name	Lic. Or Reg. No.	Name of Driller

First Bedrock
Last Strat sand-brown

Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report

608116

Printed 12/5/2014
HE-01205-07

Minnesota Unique Well No.

625475

County Sherburne
Quad Elk River
Quad ID 137D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 09/14/1999
Update Date 03/29/2011
Received Date

Well Name BARNIER, MARK

Township Range Dir Section Subsections Elevation 981 ft.

33 26 W 5 DCBDCC Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
113 ft.	113 ft.	02/24/1999

Drilling Method Non-specified Rotary

Well Address
22205 ELK LAKE RD
ELK RIVER MN

Geological Material	Color	Hardness	From	To
SAND	TAN	SOFT	0	55
CLAY	GRAY	SOFT	55	85
CLAY, GRAVEL	BROWN	SOFT	85	96
SAND	TAN	SOFT	96	113

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Domestic

Casing Type Plastic Joint Glued Drive Shoe? ☐ Yes ☑ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 104 ft.	lbs./ft.	8.5 in. to 30 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
2	10	8	104 ft. and 113 ft.

Static Water Level
48 ft. from Land surface Date Measured 02/24/1999

PUMPING LEVEL (below land surface)
ft. after 1 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model 8PL41UC1
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: High solids bentonite from 0 to 30 ft.
Grout Material: Cuttings from 30 to 104 ft.

Located by:
Unique Number Verification: Address verification
System: *UTM - Nad83, Zone15, Meters*
Method: GPS SA Off (averaged)
Input Date: 02/02/2011
X: 452941 Y: 5024649

Nearest Known Source of Contamination
60 feet W direction Septic tank/drain field type

Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 02/24/1999
Manufacturer's name RED JACKET Model number 75SESW1-12SBC HP 0.75 Volts 220
Length of drop Pipe 80 ft. Capacity 15 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☑ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Mork Well Co.	02658	THOMPSON, S.

First Bedrock
Last Strat sand-brown
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report

625475

Printed 11/30/2014
HE-01205-07

Minnesota Unique Well No.

626766

County Sherburne
Quad Lake Fremont
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 02/06/2002
Update Date 03/10/2014
Received Date

Well Name RIDGES OF RICE LAKE 1

Township Range Dir Section Subsections Elevation 987 ft.

33 26 W 4 CACDDB Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
325 ft.	325 ft.	08/23/2001

Drilling Method Non-specified Rotary

Well Address
22323 WATSON ST NW
ELK RIVER MN 55330

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Community Supply PWS ID 1710013 Source S01

Geological Material	Color	Hardness	From	To
SAND	BROWN	SOFT	0	50
CLAY	BROWN	SOFT	50	70
SANDY CLAY	BROWN	SOFT	70	80
MEDIUM SAND	BROWN	SOFT	80	85
SAND & CLAY	GRY/WHT	SOFT	85	110
GRAVEL	BROWN	MEDIUM	110	120
CLAY	BROWN	MEDIUM	120	130
MEDIUM SAND	BROWN	MEDIUM	130	170
SANDY CLAY	GRAY	MEDIUM	170	285
CLAY & SAND	GRAY	MEDIUM	285	310
MEDIUM SAND	GRAY	MEDIUM	310	325
SANDSTONE & SHALE (MEDIUM)		MEDIUM	325	325

Casing Type Steel (black or low carbon) Joint Welded Drive Shoe? ☐ Yes ☐ No Above/Below 2 ft.

Casing Diameter	Weight	Hole Diameter
8 in. to 294 ft.	28.55 lbs./ft.	16 in. to 325 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
6	25	20	295 ft. and 315 ft.
6	40	10	315 ft. and 325 ft.

Static Water Level
55 ft. from Land surface Date Measured 08/23/2001

PUMPING LEVEL (below land surface)
84 ft. after 8 hrs. pumping 400 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
ABB VFD CONTROLLER ACH401602532.
WITH DV/DT FILTER.

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: Neat Cement from 0 to 120 ft. 95 bags

Located by: Minnesota Department of Health Method: GPS SA Off (averaged)
Unique Number Verification: N/A Input Date: 05/14/2003
System: *UTM - Nad83, Zone15, Meters* X: 454203 Y: 5024894

Nearest Known Source of Contamination
100 feet E direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 10/02/2001
Manufacturer's name GRUNDFOS Model number 300S300-7 HP 30 Volts 460
Length of drop Pipe 106 ft. Capacity 400 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

First Bedrock Mt.Simon Sandstone
Last Strat Mt.Simon Sandstone
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock 325 ft.

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Renner E.H. Well	71015	PRAUGHT, V.

County Well Index Online Report

626766

Printed 11/30/2014
HE-01205-07

Minnesota Unique Well No.

626780

County Sherburne
Quad Lake Fremont
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/04/2002
Update Date 03/29/2011
Received Date

Well Name HIPSAG, DOUG

Township Range Dir Section Subsections Elevation 987 ft.

33	26	W	4	DBBDAB	Elevation Method	7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
151 ft.	150 ft.	09/21/2001

Drilling Method Non-specified Rotary

Well Address
12269 223RD AV NW
ELK RIVER MN 55330

Geological Material	Color	Hardness	From	To
SAND	BROWN	SOFT	0	15
CLAY	GRAY	MEDIUM	15	60
CLAY	GRAY	MEDIUM	60	75
MEDIUM SAND	BROWN	SOFT	75	88
CLAY	GRN/BRN	MEDIUM	88	145
GRAVEL	TAN	SOFT	145	151

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Domestic

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☐ Yes ☑ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 147 ft.	10.79 lbs./ft.	9 in. to 30 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
4	15	4	146 ft. and 150 ft.

Static Water Level
50 ft. from Land surface Date Measured 09/21/2001

PUMPING LEVEL (below land surface)
ft. after hrs. pumping 20 g.p.m.

Well Head Completion
Pitless adapter manufacturer BAKER Model SNAPPY
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: High solids bentonite from 0 to 30 ft. 4 bags

Located by:
Method: GPS SA Off (averaged)
Unique Number Verification: Address verification
Input Date: 02/02/2011
System: *UTM - Nad83, Zone15, Meters*
X: 454630 Y: 5025089

Nearest Known Source of Contamination
50 feet W direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 01/14/2002
Manufacturer's name GRUNDFOS Model number 22SQE10-190 HP 1 Volts 230
Length of drop Pipe 84 ft. Capacity 22 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

First Bedrock
Last Strat gravel (+larger)-brown
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

Renner E.H. Well	71015	PRAUGHT, V.
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report

626780

Printed 11/30/2014
HE-01205-07

Minnesota Unique Well No.
638355

County Sherburne
Quad Elk River
Quad ID 137D

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 103I

Entry Date 04/20/2000
Update Date 03/29/2011
Received Date

Well Name AIRHART, DONNA & STEVE
Township Range Dir Section Subsections Elevation 991 ft.
33 26 W 4 DCDACA Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
105 ft.	105 ft.	11/21/1999

Drilling Method Non-specified Rotary

Well Address
22130 QUINN ST NW
ELK RIVER MN 55330

Geological Material	Color	Hardness	From	To
GRAVEL			0	60
CLAY			60	80
WATERSAND			80	105

Drilling Fluid Bentonite
Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Domestic

Casing Type Plastic Joint No Information Drive Shoe? ☐ Yes ☑ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 95 ft.	2 lbs./ft.	8 in. to 30 ft.

Open Hole from ft. to ft.

Screen YES Make BIG FOOT Type plastic

Diameter	Slot/Gauze	Length	Set Between
4	12	10	95 ft. and 105 ft.

Static Water Level
35 ft. from Land surface Date Measured 11/22/1999

PUMPING LEVEL (below land surface)
80 ft. after 1 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model SNAPPY 4X1
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
ABANDONED WELL PERMANENTLY SEALED REPORT NO. H-65542.

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified
Grout Material: Bentonite from 6 to 36 ft. 2 bags

Located by:
Method: GPS SA Off (averaged)
Unique Number Verification: Address verification
Input Date: 02/02/2011
System: *UTM - Nad83, Zone15, Meters*
X: 454794 Y: 5024581

Nearest Known Source of Contamination
70 feet S direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 11/22/1999
Manufacturer's name AERMOTOR Model number T12-75 HP 0.75 Volts 230
Length of drop Pipe 80 ft. Capacity 12 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

Well Contractor Certification

First Bedrock
Last Strat sand
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

License Business Name	Lic. Or Reg. No.	Name of Driller
Mac's Well Co.	86596	MCALPINE, D.

County Well Index Online Report

638355

Printed 11/30/2014
HE-01205-07

Minnesota Unique Well No.

655131

County Sherburne
Quad Lake Fremont
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 05/29/2001
Update Date 03/29/2011
Received Date

Well Name ERICKSON, KEVIN & SHAVON

Township	Range	Dir	Section	Subsections	Elevation
33	26	W	4	DABCDC	974 ft.

Elevation Method: 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
132 ft.	132 ft.	01/09/2001

Drilling Method Non-specified Rotary

Well Address
12163 223RD AV NW
ELK RIVER MN 55330

Drilling Fluid: Bentonite

Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
ROCKY CLAY-FIRM	RED		0	18
SAND & GRAVEL	BROWN	SOFT	18	22
CLAY	TAN	SOFT	22	40
CLAY-FIRM	GRAY		40	70
SAND	BROWN	SOFT	70	79
ROCKY SAND & GRAVEL	BROWN	SOFT	79	89
ROCKY CLAY-FIRM	BROWN		89	116
ROCKY SAND	TAN	SOFT	116	132

Casing Type Plastic Joint No Information Drive Shoe? ☐ Yes ☑ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 122 ft.	lbs./ft.	6.5 in. to 132 ft.

Open Hole from ft. to ft.

Screen YES Make MONOFLEX Type plastic

Diameter	Slot/Gauze	Length	Set Between
4	8	10	122 ft. and 132 ft.

Static Water Level
43 ft. from Land surface Date Measured 01/04/2001

PUMPING LEVEL (below land surface)
53 ft. after 2 hrs. pumping 20 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model SNAPPY
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: High solids bentonite from 0 to 30 ft. 2 bags
Grout Material: Cuttings from 30 to 122 ft.

Located by:
Method: GPS SA Off (averaged)
Unique Number Verification: Address verification
Input Date: 02/02/2011
System: *UTM - Nad83, Zone15, Meters*
X: 454945 Y: 5025028

Nearest Known Source of Contamination
60 feet N direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 01/09/2001
Manufacturer's name RED JACKET Model number 75F211-12G12
HP 0.75 Volts 230
Length of drop Pipe 60 ft. Capacity 12 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

First Bedrock
Last Strat sand +larger-brown
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Praught M. Well Co.	86576	PRAUGHT, S.

County Well Index Online Report **655131** Printed 11/30/2014
HE-01205-07

Minnesota Unique Well Number

672355

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 05/13/2002
Update Date 03/28/2011
Received Date

Well Name	Township	Range	Dir	Section	Subsection
DRUK, TIM	34	26	W	33	CABACB

Elevation 948 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 23115 128TH ST ELK RIVER MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND	0	14	BROWN	SOFT
GRAVEL	14	26	BROWN	SOFT
CLAY	26	43	GRAY	MEDIUM
CLAY & GRAVEL	43	69	BROWN	MEDIUM
GRAVEL	69	89	YELLOW	SOFT

Remarks

Well Depth 89 ft. **Depth Completed** 89 ft. **Date Well Completed** 02/06/2002

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint** Unknown

Drive Shoe? Yes ☐ No ☒ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 89 ft.	1.9 lbs./ft.	6.5 in. To 89 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set
2 in.	12	5 ft.	84 ft. 89 ft.

Static Water Level

9 ft. land surface Measure 02/06/2002

Pumping Level (below land surface)

84 ft. 2 hrs. Pumping at 100 g.p.m.

Wellhead Completion

Pitless adapter manufacturer MONITOR Model 1IN BULLDO

☐ Casing Protection ☒ 12 in. above grade

☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
high solids bentonite	0.17 Cubic yards	0 ft.	30 ft.
cuttings		30 ft.	84 ft.

Nearest Known Source of Contamination

35 feet Northeas Direction Other Type

Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 02/18/2002

Manufacturer's name AERMOTOR

Model Number T12-50 HP 0.5 Volt 230

Length of drop pipe 40 ft Capacity 10 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous

First Bedrock Aquifer Quat. buried

Last Strat gravel (+larger)-yellow Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method GPS SA Off (averaged) (15 meters)

System UTM - NAD83, Zone 15, Meters X 454183 Y 5026690

Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor

Mc Alpine Brothers 27636 GOODIN, G.

Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

672356

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 05/30/2002
Update Date 03/28/2011
Received Date

Well Name	Township	Range	Dir	Section	Subsection
DRUK, TIM	34	26	W	33	CBBADC

Elevation 961 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 23255 128TH ST ELK RIVER MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND	0	25	BROWN	SOFT
CLAY	25	38	GRAY	MEDIUM
CLAY, GRAVEL	38	83	BROWN	HARD
GRAVEL	83	89	YELLOW	SOFT

Remarks

Well Depth	Depth Completed	Date Well Completed
89 ft.	89 ft.	03/08/2002

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint** Unknown
Drive Shoe? Yes ☐ No ☒ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 84 ft.	1.9 lbs./ft.	6.5 in. To 89 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set	
2 in.	12	5 ft.	84 ft.	89 ft.

Static Water Level

20 ft. land surface Measure 03/08/2002

Pumping Level (below land surface)

84 ft. 2 hrs. Pumping at 100 g.p.m.

Wellhead Completion

Pitless adapter manufacturer MONITOR Model 1 INCH BUL

☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
high solids bentonite	0.17 Cubic yards	0 ft.	30 ft.
cuttings		30 ft.	84 ft.

Nearest Known Source of Contamination

33 feet North Direction Septic tank/drain field Type

Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 03/22/2002

Manufacturer's name AERMOTOR

Model Number T12-50 HP 0.5 Volt 230

Length of drop pipe 40 ft Capacity 10 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous

First Bedrock Aquifer Quat. buried

Last Strat gravel (+larger)-yellow Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method GPS SA Off (averaged) (15 meters)

System UTM - NAD83, Zone 15, Meters X 453817 Y 5026672

Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor

Mc Alpine Brothers	27636	GOODIN, G.
Licensee Business	Lic. or Reg. No.	Name of Driller

Minnesota Unique Well Number

676075

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 11/01/2002
Update Date 03/28/2011
Received Date

Well Name	Township	Range	Dir	Section	Subsection
GWYNN, MIKE	34	26	W	33	CACBBB

Elevation 949 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 23128 128TH ST ELK RIVER MN 55330

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND	0	6	BLACK	SOFT
SAND, GRAVEL	6	20	TAN	SOFT
CLAY	20	49	GRAY	SOFT
SAND, GRAVEL	49	61	GRAY	SOFT
CLAY, GRAVEL	61	76	BROWN	SOFT
SAND	76	85	TAN	SOFT
CLAY	85	87	TAN	SOFT
SAND	87	100	TAN	SOFT

Remarks

Well Depth 100 ft. **Depth Completed** 100 ft. **Date Well Completed** 07/09/2002

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint** Glued

Drive Shoe? Yes ☐ No ☒ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 91 ft.	lbs./ft.	8.5 in. To 30 ft.
		6.5 in. To 100 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set	
2 in.	12	8 ft.	91 ft.	100 ft.

Static Water Level

9 ft. land surface Measure 07/09/2002

Pumping Level (below land surface)

ft. 1 hrs. Pumping at 60 g.p.m.

Wellhead Completion

Pitless adapter manufacturer MONITOR Model SNAPPY

☐ Casing Protection ☒ 12 in. above grade

☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
high solids bentonite	3 Sacks	0 ft.	30 ft.
cuttings		30 ft.	91 ft.

Nearest Known Source of Contamination

50 feet West Direction Septic tank/drain field Type

Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 07/16/2002

Manufacturer's name RED JACKET

Model Number 75F211- HP 0.75 Volt 230

Length of drop pipe 40 ft Capacity 15 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous

First Bedrock Aquifer Quat. buried

Last Strat sand-brown Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method GPS SA Off (averaged) (15 meters)

System UTM - NAD83, Zone 15, Meters X 454063 Y 5026546

Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor

Mork Well Co., Inc. 02730 THOMPSON, S.

Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

676082

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 08/20/2002
Update Date 03/18/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
	34	26	W	33	CBADAC

Elevation 951 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
FILL SAND	0	4	BLACK	SOFT
SAND	4	11	BROWN	SOFT
SANDY CLAY	11	19	TAN	SOFT
SAND, GRAVEL	19	31	TAN	SOFT
CLAY	31	44	GRAY	SOFT
CLAY, GRAVEL	44	63	BROWN	SOFT
SAND, GRAVEL	63	72	GRAY	SOFT
CLAY	72	76	BROWN	SOFT
SAND, GRAVEL	76	93	TAN	SOFT

Remarks
LIVONIA TOWNSHIP

Well Depth	Depth Completed	Date Well Completed
93 ft.	93 ft.	05/13/2002

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint** Glued
Drive Shoe? Yes ☐ No ☒ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 84 ft.	lbs./ft.	8.5 in. To 30 ft.
		6.5 in. To 93 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set	
2 in.	10	8 ft.	84 ft.	93 ft.

Static Water Level
10 ft. land surface Measure 05/13/2002

Pumping Level (below land surface)
ft. 1 hrs. Pumping at 40 g.p.m.

Wellhead Completion
Pitless adapter manufacturer MONITOR Model SNAPPY
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
high solids bentonite	3 Sacks	0 ft.	30 ft.
cuttings		30 ft.	84 ft.

Nearest Known Source of Contamination
56 feet Northeas Direction Septic tank/drain field Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 05/21/2002
Manufacturer's name RED JACKET
Model Number 75F211 HP 0.75 Volt 230
Length of drop pipe 40 ft Capacity 15 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous
First Bedrock Aquifer Quat. buried
Last Strat sand +larger-brown Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 454029 Y 5026620
Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor
Mork Well Co., Inc. 02730 THOMPSON, S.
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Well Index Report | **676082** | Printed on 05/31/2020
HE-01205-15

Minnesota Unique Well Number

676434

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date 02/28/2003
Update Date 07/15/2011
Received Date

Well Name	Township	Range	Dir	Section	Subsection
	34	26	W	33	CBBBAC

Elevation 957 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 23282 128TH ST NW MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
FILL	0	4	TAN	MEDIUM
SAND	4	17	BROWN	SOFT
CLAY	17	38	GRAY	MEDIUM
CLAY & GRAVEL	38	64	GRAY	MEDIUM
SAND	64	68	BROWN	SOFT
CLAY & GRAVEL	68	137	RED	HARD
SANDSTONE	137	210	TAN	HARD

Remarks

Well Depth	Depth Completed	Date Well Completed
210 ft.	210 ft.	12/12/2002

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint** Threaded
Drive Shoe? Yes ☒ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 141 ft.	10.7 lbs./ft.	9 in. To 30 ft.
		7 in. To 137 ft.
		4 in. To 210 ft.

Open Hole From 139 ft. To 210 ft.

Screen? ☐ **Type** **Make**

Static Water Level
10 ft. land surface Measure 12/12/2002

Pumping Level (below land surface)
ft. hrs. Pumping at 25 g.p.m.

Wellhead Completion
Pitless adapter manufacturer BAKER Model SNAPPY
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
well grouted, type unknown	4 Sacks	0 ft.	30 ft.

Nearest Known Source of Contamination
50 feet West Direction Septic tank/drain field Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 01/19/2003
Manufacturer's name GRUNDFOS
Model Number 16S07-8 HP 0.75 Volt 230
Length of drop pipe 42 ft Capacity 16 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous
First Bedrock Mt.Simon Sandstone Aquifer Mt.Simon
Last Strat Mt.Simon Sandstone Depth to Bedrock 137 ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 453701 Y 5026714
Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Renner E.H. Well	71015	ECKLAND, B.

Minnesota Unique Well Number

676922

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 09/09/2002
Update Date 03/28/2011
Received Date

Well Name	Township	Range	Dir	Section	Subsection
OLSON, MATT	34	26	W	33	CBBCDB

Elevation 951 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 12876 232ND AV NW ELK RIVER MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
GRAVEL	0	32	BROWN	SOFT
CLAY	32	38	GRAY	MEDIUM
CLAY & GRAVEL	38	92	BROWN	MEDIUM
GRAVEL	92	104	YELLOW	SOFT

Remarks

Well Depth 104 ft. **Depth Completed** 104 ft. **Date Well Completed** 07/29/2002

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☒ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 99 ft.	1.9 lbs./ft.	6.5 in. To 104 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set
2 in.	12	5 ft.	99 ft. 104 ft.

Static Water Level

20 ft. land surface Measure 07/29/2002

Pumping Level (below land surface)

99 ft. 2 hrs. Pumping at 100 g.p.m.

Wellhead Completion

Pitless adapter manufacturer MONITOR Model 1 INCH BUL

☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
high solids bentonite	0.17 Cubic yards	0 ft.	30 ft.
cuttings		30 ft.	99 ft.

Nearest Known Source of Contamination

35 feet West Direction Septic tank/drain field Type

Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 08/05/2002

Manufacturer's name AERMOTOR

Model Number T12-75 HP 0.75 Volt 230

Length of drop pipe 40 ft Capacity 15 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous

First Bedrock Aquifer Quat. buried
Last Strat gravel (+larger)-yellow Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 453700 Y 5026587
Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Mc Alpine Brothers	27636	GOODIN, G

Minnesota Unique Well Number

681344

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 10/31/2002
Update Date 03/28/2011
Received Date

Well Name	Township	Range	Dir	Section	Subsection
	34	26	W	33	CBBDDA

Elevation 958 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 12821 232ND AV ELK RIVER MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SANDY CLAY	0	5	BROWN	SOFT
SAND & GRAVEL	5	25	BRN/BLK	SOFT
CLAY	25	40	GRAY	SOFT
CLAY, SAND & GRAVEL	40	70	BRN/BLK	MED-HRD
GRAVEL	70	90	YELLOW	SOFT

Remarks

Well Depth	Depth Completed	Date Well Completed
90 ft.	90 ft.	09/04/2002

Drill Method Non-specified Rotary **Drill Fluid** Qwik gel

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint** Welded
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 86 ft.	lbs./ft.	4 in. To 86 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set
2 in.	12	4 ft.	86 ft. 90 ft.

Static Water Level

15 ft. land surface Measure 09/04/2002

Pumping Level (below land surface)

60 ft. 2 hrs. Pumping at 50 g.p.m.

Wellhead Completion

Pitless adapter manufacturer MERRILL Model MCK6.5

☒ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
high solids bentonite	2 Sacks	0 ft.	30 ft.
cuttings		30 ft.	86 ft.

Nearest Known Source of Contamination

50 feet Southeas Direction Septic tank/drain field Type

Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 09/09/2002

Manufacturer's name AERMOTOR

Model Number 12T75 HP 0.75 Volt 230

Length of drop pipe 60 ft Capacity 12 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous

First Bedrock Aquifer Quat. buried

Last Strat gravel (+larger)-yellow Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method GPS SA Off (averaged) (15 meters)

System UTM - NAD83, Zone 15, Meters X 453851 Y 5026583

Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor

McAlpine Well Drilling 27695 MCALPINE, T.

Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

703235

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date
Update Date 03/28/2011
Received Date 11/10/2003

Well Name	Township	Range	Dir	Section	Subsection
	34	26	W	33	CBCABD

Elevation 953 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 12845 232ND AV ELK RIVER MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SANDY CLAY	0	5	BROWN	SOFT
CLAY, SAND & GRAVEL	5	19	BRN/BLK	SOFT
CLAY	19	34	GRAY	MEDIUM
CLAY, SAND & GRAVEL	34	50	BRN/BLK	MED-HRD
CLAY & SAND	50	83	BROWN	SOFT
SAND	83	94	BRN/YEL	SOFT

Remarks

Well Depth 94 ft. **Depth Completed** 94 ft. **Date Well Completed** 10/01/2003

Drill Method Non-specified Rotary **Drill Fluid** Qwik gel

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint** Welded
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 90 ft.	lbs./ft.	6.5 in. To 90 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set
2 in.	12	4 ft.	90 ft. 94 ft.

Static Water Level
20 ft. land surface Measure 10/01/2003

Pumping Level (below land surface)
60 ft. 2 hrs. Pumping at 50 g.p.m.

Wellhead Completion
Pitless adapter manufacturer MERRILL Model MCK6.5
☒ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
cuttings		30 ft.	90 ft.
high solids bentonite	2 Sacks	ft.	30 ft.

Nearest Known Source of Contamination
50 feet Northeas Direction Septic tank/drain field Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 10/22/2003
Manufacturer's name AERMOTOR
Model Number 12T50 HP 0.5 Volt 230
Length of drop pipe 60 ft Capacity 12 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous
First Bedrock Aquifer Quat. buried
Last Strat sand Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 453788 Y 5026522
Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor
McAlpine Well Drilling 27695 MCALPINE, T.
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

704785

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date
Update Date 03/28/2011
Received Date 04/23/2004

Well Name	Township	Range	Dir	Section	Subsection
HARTUNGS,	34	26	W	33	CBABCD

Elevation 951 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 23195 128TH ST NW ELK RIVER MN 55330

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND & GRAVEL	0	25	BROWN	SOFT
CLAY & GRAVEL	25	42	TAN	SOFT
SAND & GRAVEL	42	105	BROWN	SOFT

Remarks

Well Depth	Depth Completed	Date Well Completed
105 ft.	105 ft.	02/11/2004

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☒ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 95 ft.	0 lbs./ft.	6.7 in. To 105 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** plastic **Make** BIG FOOT

Diameter	Slot/Gauze	Length	Set	
4 in.	15	10 ft.	95 ft.	105 ft.

Static Water Level
6 ft. land surface Measure 02/11/2004

Pumping Level (below land surface)
45 ft. 3 hrs. Pumping at 40 g.p.m.

Wellhead Completion
Pitless adapter manufacturer MAASS Model JC-4
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
high solids bentonite	4 Sacks	0 ft.	40 ft.
cuttings		40 ft.	95 ft.

Nearest Known Source of Contamination
50 feet South Direction Sewer Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 02/11/2004
Manufacturer's name STA-RITE
Model Number HP 1 Volt 230
Length of drop pipe 60 ft Capacity 12 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous
First Bedrock Aquifer Quat. buried
Last Strat sand +larger-brown Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 453891 Y 5026656
Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor

A. Ruppert Well	30714	RUPPERT, C
Licensee Business	Lic. or Reg. No.	Name of Driller

Minnesota Unique Well Number

706000

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date
Update Date 03/28/2011
Received Date 05/13/2004

Well Name	Township	Range	Dir	Section	Subsection
	34	26	W	33	CBCBAC

Elevation 953 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 12875 232ND AV NW ELK RIVER MN 55330

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND	0	15	BROWN	SOFT
SANDY CLAY	15	30	GRAY	MEDIUM
CLAY	30	57	BROWN	MEDIUM
SANDY CLAY	57	90	VARIED	SOFT
SAND & GRAVEL	90	105	VARIED	SOFT

Remarks

Well Depth 105 ft. **Depth Completed** 105 ft. **Date Well Completed** 02/24/2004

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint** Welded
Drive Shoe? Yes ☐ No ☒ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 95 ft.	lbs./ft.	8.7 in. To 30 ft.
		6.2 in. To 105 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** slotted pipe **Make** PVC

Diameter	Slot/Gauze	Length	Set	
4 in.	15	10 ft.	95 ft.	105 ft.

Static Water Level

15 ft. land surface Measure 02/24/2004

Pumping Level (below land surface)

90 ft. 2 hrs. Pumping at 30 g.p.m.

Wellhead Completion

Pitless adapter manufacturer WHITEWATER Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
high solids bentonite	3 Sacks	ft.	30 ft.

Nearest Known Source of Contamination

20 feet Southeas Direction Septic tank/drain field Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 03/12/2004
Manufacturer's name AERMOTOR
Model Number HP 1 Volt 220
Length of drop pipe 60 ft Capacity 20 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous

First Bedrock Aquifer Quat. buried
Last Strat sand +larger Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 453701 Y 5026509
Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Bergerson-Caswell	27058	LESTER, T.

Minnesota Unique Well Number

706665

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date
Update Date 03/28/2011
Received Date 03/11/2004

Well Name	Township	Range	Dir	Section	Subsection
	34	26	W	33	CBCBDA

Elevation 953 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 12861 232ND AV ZIMMERMAN MN

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SANDY CLAY	0	15	BROWN	SOFT
CLAY	15	25	GRAY	MEDIUM
CLAY	25	30	BROWN	MEDIUM
CLAY, GRAVEL, &	30	62	BRN/BLK	M.HARD
CLAY, SAND, &	62	83	BRN/BLK	SFT-MED
SAND	83	103	BRN/YEL	SOFT

Remarks

Well Depth 103 ft. **Depth Completed** 103 ft. **Date Well Completed** 02/25/2004

Drill Method Non-specified Rotary **Drill Fluid** Qwik gel

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint** Welded
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 99 ft.	lbs./ft.	6.5 in. To 99 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set	
2 in.	12	8 ft.	99 ft.	103 ft.

Static Water Level
20 ft. land surface Measure 02/25/2004

Pumping Level (below land surface)
60 ft. 4 hrs. Pumping at 25 g.p.m.

Wellhead Completion
Pitless adapter manufacturer MERRILL Model MCK6.5
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
cuttings		30 ft.	99 ft.
high solids bentonite	2 Sacks	ft.	30 ft.

Nearest Known Source of Contamination
50 feet Southeas Direction Septic tank/drain field Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 02/26/2004
Manufacturer's name AERMOTOR
Model Number 20T100 HP 1 Volt 230
Length of drop pipe 60 ft Capacity 20 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous
First Bedrock Aquifer Quat. buried
Last Strat sand Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 453731 Y 5026503
Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor
McAlpine Well Drilling 27695 MCALPINE, T.
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

709882

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 04/07/2008
Update Date 03/28/2011
Received Date 04/18/2008

Well Name	Township	Range	Dir	Section	Subsection
ISRAELSON,	34	26	W	33	BCDAAC

Elevation 963 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 12280 239TH AV NW ELK RIVER MN 55330

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
GRAVEL	0	10	BROWN	MEDIUM
GRAVEL & ROCK	10	50	BROWN	MEDIUM
CLAY	50	65	BROWN	SOFT
WATERSAND	65	97	BROWN	SOFT

Remarks

WELL TO BE SEALED ON PROPERTY OVER 50' AWAY TO BE SEALED IN SPRING

Well Depth 97 ft. **Depth Completed** 97 ft. **Date Well Completed** 03/04/2008

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 87 ft.	lbs./ft.	6.2 in. To 97 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** plastic **Make** BIGFOOT

Diameter	Slot/Gauze	Length	Set
4 in.	15	10 ft.	87 ft. 97 ft.

Static Water Level

17 ft. land surface Measure 03/04/2008

Pumping Level (below land surface)

60 ft. 1 hrs. Pumping at 75 g.p.m.

Wellhead Completion

Pitless adapter manufacturer MONITOR Model BULLDOG
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
neat cement	2 Sacks	ft.	97 ft.

Nearest Known Source of Contamination

77 feet East Direction Septic tank/drain field Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 03/05/2008
Manufacturer's name AEREMOTOR
Model Number T-12-50 HP 0.5 Volt 230
Length of drop pipe 60 ft Capacity 12 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☒ Yes ☐ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous

First Bedrock Aquifer Quat. buried
Last Strat sand-brown Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or
System UTM - NAD83, Zone 15, Meters X 454019 Y 5026904
Unique Number Verification Info/GPS from data Input Date 03/20/2008

Angled Drill Hole

Well Contractor

Macs Well and Pump Service 1913 MCALPINE, D.
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well No.

720300

County Sherburne
Quad Lake Fremont
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date
Update Date 03/29/2011
Received Date 11/01/2004

Well Name THOMPSON, COREY

Township Range Dir Section Subsections Elevation 960 ft.

33 26 W 5 DCBBAB Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
91 ft.	91 ft.	09/25/2004

Drilling Method Non-specified Rotary

Well Address
22275 ELK LAKE RD NW
ELK RIVER MN 55330

Drilling Fluid Qwik gel

Well Hydrofractured? ☐ Yes ☑ No From Ft. to Ft.

Use Domestic

Casing Type Plastic Joint Glued Drive Shoe? ☐ Yes ☑ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 82 ft.	lbs./ft.	8.5 in. to 30 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
2	10	8	82 ft. and 91 ft.

Geological Material	Color	Hardness	From	To
SAND	TAN	SOFT	0	29
CLAY	TAN	SOFT	29	54
SAND	GRAY	SOFT	54	69
CLAY	GRAY	SOFT	69	74
SAND	TAN	SOFT	74	91

Static Water Level
30 ft. from Land surface Date Measured 09/22/2004

PUMPING LEVEL (below land surface)
ft. after 1 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer BAKER Model SNAPPY
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No ☐ Not Specified

Grout Material: High solids bentonite from 0 to 30 ft. 4 bags
Grout Material: Cuttings from 30 to 82 ft.

Located by:
Method: GPS SA Off (averaged)
Unique Number Verification: Address verification
Input Date: 02/02/2011
System: *UTM - Nad83, Zone15, Meters*
X: 452896 Y: 5024823

Nearest Known Source of Contamination
60 feet N direction Other type

Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 09/23/2004
Manufacturer's name GRUNDFOS Model number SQE15C-220 HP 1.5 Volts 220
Length of drop Pipe 60 ft. Capacity 22 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

Well Contractor Certification

Thompson, Scott A.	71710	BECKWORTH, D
License Business Name	Lic. Or Reg. No.	Name of Driller

First Bedrock
Last Strat sand-brown
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report **720300** Printed 11/30/2014
HE-01205-07

Minnesota Unique Well Number

731676

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date
Update Date 03/28/2011
Received Date 11/17/2005

Well Name	Township	Range	Dir	Section	Subsection
KINGERY,	34	26	W	33	CAADBC

Elevation 958 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 23105 128TH ST NW ELK RIVER MN 55330

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND	0	10	BROWN	SOFT
CLAY	10	20	GRAY	MEDIUM
CLAY	20	55	BROWN	MEDIUM
SAND GRAVEL	55	104	TAN	SOFT

Remarks

Well Depth	Depth Completed	Date Well Completed
104 ft.	104 ft.	11/14/2005

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☒ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 94 ft.	lbs./ft.	6.5 in. To 104 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** plastic **Make** BIG FOOT

Diameter	Slot/Gauze	Length	Set	
4 in.	8	10 ft.	94 ft.	104 ft.

Static Water Level
13 ft. land surface Measure 11/10/2005

Pumping Level (below land surface)
90 ft. 2 hrs. Pumping at 40 g.p.m.

Wellhead Completion
Pitless adapter manufacturer MONITOR Model SNAPPY
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
cuttings		30 ft.	94 ft.
high solids bentonite	2 Sacks	ft.	30 ft.

Nearest Known Source of Contamination
50 feet South Direction Sewer Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 11/14/2005
Manufacturer's name AERMOTOR
Model Number T12-75 HP 0.75 Volt 230
Length of drop pipe 60 ft Capacity 12 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous
First Bedrock Aquifer Quat. buried
Last Strat sand +larger-brown Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 454380 Y 5026612
Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor
Praught M. Well Co. 86576 PRAUGHT, S
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

734477

County Sherburne
Quad Lake
Quad ID 137A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date
Update Date 03/28/2011
Received Date 12/21/2005

Well Name	Township	Range	Dir	Section	Subsection
HANLON, CHRIS	34	26	W	33	CBBCDA

Elevation 954 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Well 12818 232ND AV NW ELK RIVER MN 55330

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
GRAVEL & SAND	0	37	BROWN	SOFT
CLAY	37	42	GRAY	MEDIUM
CLAY & GRAVEL	42	85	BROWN	MEDIUM
SAND & GRAVEL	85	110	YELLOW	SOFT

Remarks

Well Depth 110 ft. **Depth Completed** 110 ft. **Date Well Completed** 10/08/2005

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint** Glued
Drive Shoe? Yes ☐ No ☒ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 100 ft.	1.9 lbs./ft.	6.5 in. To 110 ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** plastic **Make** BIGFOOT

Diameter	Slot/Gauze	Length	Set
4 in.	15	10 ft.	100 ft. 110 ft.

Static Water Level

17 ft. land surface Measure 10/08/2005

Pumping Level (below land surface)

100 ft. 2 hrs. Pumping at 100 g.p.m.

Wellhead Completion

Pitless adapter manufacturer MONITOR Model SNAPPY
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
cuttings	0	30 ft.	100 ft.
high solids bentonite	2 Sacks	ft.	30 ft.

Nearest Known Source of Contamination

32 feet North Direction Sewer Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 11/23/2005
Manufacturer's name GRUNDFOS
Model Number 22SQE10C- HP 1 Volt 230
Length of drop pipe 60 ft Capacity 22 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous

First Bedrock Aquifer Quat. buried
Last Strat sand +larger-yellow Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 453742 Y 5026582
Unique Number Verification Address verification Input Date 11/12/2010

Angled Drill Hole

Well Contractor

Alberg Water Services, LLC. 71701 MCALPINE, J.
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

813437

County Sherburne
Quad
Quad ID

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date
Update Date 02/23/2016
Received Date 11/19/2015

Well Name	Township	Range	Dir	Section	Subsection
HILDENBRAND,	33	26	W	4	DBB

Elevation **Elev. Method**

Address

C/W 22447 TIPTON ST NW ELK RIVER MN 55330

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
TOPSOIL	0	2	BROWN	SOFT
SAND	2	38	TAN	SOFT
SANDY CLAY	38	59	TAN	SOFT
CLAY W/ GRAVEL	59	75	GRAY	SOFT
GRAVEL	75	76	GRAY	SOFT
CLAY	76	85	GRAY	MEDIUM
CLAY W/ GRAVEL	85	89	BROWN	MEDIUM
SAND + GRAVEL	89	93	BROWN	SOFT
CLAY W/ GRAVEL	93	127	BROWN	MEDIUM
CLAY	127	136	TAN	MEDIUM
SAND	136	146	TAN	SOFT
CLAY W/ GRAVEL	146	191	BROWN	MEDIUM
SAND + GRAVEL	191	198	BROWN	SOFT
SANDY CLAY	198	230	GRAY	MEDIUM
SHALE + SANDROCK	230	240	TAN/BLU	MEDIUM
SANDROCK	240	300	WHT/YEL	MED-HRD

Remarks

Well Depth 300 ft. **Depth Completed** 300 ft. **Date Well Completed** 09/11/2015

Drill Method Non-specified Rotary **Drill Fluid** Qwik gel

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint** Threaded
Drive Shoe? Yes ☒ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 254 ft.	10.8 lbs./ft.	8.5 in. To 254 ft.
		4 in. To 300 ft.

Open Hole From 254 ft. To 300 ft.

Screen? ☐ **Type** **Make**

Static Water Level
40 ft. land surface Measure 09/11/2015

Pumping Level (below land surface)
ft. 3 hrs. Pumping at 75 g.p.m.

Wellhead Completion
Pitless adapter manufacturer AQUA SEAL Model T4X125
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
neat cement	50 Sacks	7 ft.	254 ft.

Nearest Known Source of Contamination
100 feet Southeas Direction Septic tank/drain field Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 09/11/2015
Manufacturer's name GRUNDFOS
Model Number 22SRE-190 HP 1 Volt 230
Length of drop pipe 60 ft Capacity 22 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous
First Bedrock Aquifer
Last Strat Depth to Bedrock ft
Located by
Locate Method
System UTM - NAD83, Zone 15, Meters X Y
Unique Number Verification Input Date

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Able Well, Inc.	1377	THOMPSON, S.

Appendix E

Cost Estimate Details

Cost Estimate Summary
Corrective Action Evaluation Report

ID	Alternative	Capital Cost	O&M (30 Year NPV)	Total Estimated Cost (2020 NPV)	Low Range (-30%)	High Range (+50%)
1	Residential Water Supply Replacement + Monitored Natural Attenuation	$ 690,000	$ 150,000	$ 840,000	$ 590,000	$ 1,300,000
2	Groundwater Extraction (ERL Property) with Onsite Treatment + Residential Water Supply + MNA	$ 2,100,000	$ 2,700,000	$ 4,800,000	$ 3,400,000	$ 7,000,000
3	Pre-subtitle D Landfill Excavation and Placement on Liner	$ 84,000,000	$ 6,000,000	$ 90,000,000	$ 63,000,000	$ 140,000,000
4	Groundwater Extraction (on-site & off-site) and Treatment (on-site)	$ 2,900,000	$ 6,200,000	$ 9,100,000	$ 6,400,000	$ 14,000,000

The opinion of probable remedial action cost is made on the basis of Barr's experience and qualifications and represents our best judgment as experienced and qualified professionals familiar with the project. The cost opinion is based on project-related information available to Barr at this time and includes a Detailed Analysis of Alternatives level of project definition. The opinion of cost may change as more information becomes available and regulatory negotiations proceed. In addition, since we have no control over the cost of labor, materials, equipment, or services furnished by others, or over the contractor's methods of determining prices, or over competitive bidding or market conditions, Barr cannot and does not guarantee that proposals, bids, or actual remedial action costs will not vary from the opinion of probable remedial action cost prepared by Barr.

Alt 1

Monitored Natural Attenuation + Residential Water Supply Replacement

Corrective Action Evaluation Report

No.	Item	Quantity	Unit	Unit Cost	Cost
1	Mobilization / Demobilization	1	LS	$ 32,000	$ 32,000
2	Drinking Water Well Installation & Connection	10	Ea	$ 20,000	$ 200,000
3	Drinking Water Quality Testing	10	Ea	$ 1,000	$ 10,000
4	Monitoring Well Site Preparation	1	LS	$ 30,000	$ 30,000
5	Monitoring Well Installation	2	Ea	$ 40,000	$ 80,000
6	Construction Contingency			25%	$ 88,000
Construction Cost Subtotal					$ 440,000
7	Well Installation Coordination with Residents	10	Ea	$ 10,000	$ 100,000
8	Engineering and Construction Administration			33%	$ 150,000
Engineering Cost Subtotal					$ 150,000
Estimated Capital Cost					**$ 690,000**
Operation and Maintenance		1	ANNUAL	$ 10,000	**$ 150,000**
				ESTIMATED TOTAL	**$ 840,000**
				High Range (+50%)	$ 1,260,000
				Low Range (-30%)	$ 590,000

Primary Assumptions:

-Engineering and construction administration based on A Guide to Developing and Documenting Cost Estimates During

-Assumes two distal monitoring wells to be installed in the wetland area.

-Assumes ten wells have increased analytical monitoring for continued tracking of natural attenuation processes.

-Total well completion depth will be approximately 300 feet below ground surface in Mt. Simon Aquifer

-Costs shown do not include any additive alternatives (i.e. Alternate Water Supply)

Alt 2

Groundwater Extraction and Treatment with Focused MNA and Residential Water Supply Replacement

Corrective Action Evaluation Report

No.	Item	Quantity	Unit	Unit Cost	Cost
1	Mobilization / Demobilization	1	LS	$ 72,540	$ 72,540
2	Site Preparation	1	LS	$ 10,000	$ 10,000
3	Extraction Well Installation - Mud Rotary Methods	3	Ea	$ 26,067	$ 78,200
4	Piezometer Installation - Sonic Methods	3	Ea	$ 15,000	$ 45,000
5	Trench Excavation and Backfill (to extraction wells)	1000	LF	$ 20.00	$ 20,000
6	Utility Bedding Soil	1000	LF	$ 2.00	$ 2,000
7	HDPE Forcemain - 2" Dia., SDR11 (well lines)	1000	LF	$ 3.50	$ 3,500
8	Directional Drilling 4" Dia. Line 8' Deep	7700	LF	$ 10.00	$ 77,000
9	HDPE Forcemain - 4" Dia. SDR11 (pipe around LF to east infilt. basin)	7700	LF	$ 6.00	$ 46,200
10	Pressure Testing and Quality Control	1	LS	$ 20,000	$ 20,000
11	Well Power Supply and Conduit	1000	LF	$ 11.00	$ 11,000
12	Forcemain Sheet Insulation	1000	LF	$ 12.50	$ 12,500
13	Water Treatment Structure	1	LS	$ 58,000	$ 58,000
14	Water Treatment Units	1	LS	$ 140,000	$ 140,000
15	Water Treatment Plumbing	1	LS	$ 20,000	$ 20,000
16	Equalization Tank, Controls, and Transfer Pumps	1	LS	$ 47,000	$ 47,000
17	Extraction Well Controls, Well Pumps, and Instrumentation	1	LS	$ 100,000	$ 100,000
18	Rapid Infiltration Basin	1	LS	$ 15,000	$ 15,000
19	Startup / Commissioning	1	LS	$ 20,000	$ 20,000
20	Construction Contingency			25%	$ 199,485
Construction Cost Subtotal					$ 997,425
21	Discharge Permitting	1	LS	$ 20,000	$ 20,000
22	Model Application	1	LS	$ 20,000	$ 20,000
23	Treatment Pilot Test	1	LS	$ 100,000	$ 100,000
24	Design Investigation	1	LS	$ 50,000	$ 50,000
25	Engineering and Construction Administration			26%	$ 260,000
Engineering Cost Subtotal					$ 450,000
Groundwater Extraction and Treatment Estimated Capital Cost					$ 1,400,000
Total Est. Capital Cost (incl. Res. Water Supply + MNA)					**$ 2,100,000**

Alt 2

Groundwater Extraction and Treatment with Focused MNA and Residential Water Supply Replacement

Corrective Action Evaluation Report

				30 YR NPV, 5% interest rate
Groundwater Extraction and Treatment Operation and Maintenance	1	ANNUAL	$ 165,000	$ 2,500,000
Total Operation and Maintenance (incl. Res. Water Supply + MNA)	1	ANNUAL	$ 175,000	**$ 2,700,000**

ESTIMATED TOTAL (incl. Res. Water Supply + MNA)	**$ 4,800,000**
High Range (+50%)	$ 7,200,000
Low Range (-30%)	$ 3,400,000

Primary Assumptions:

-Engineering and construction administration based on A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002)

-Three extraction wells will operate to achieve remedial goals.

-Total depth of extraction wells and piezometers will average 90 feet below ground surface.

-Infiltration basin will be installed on eastern side of ERL property within downgradient plume extents.

Alt 3

Pre-subtitle D Landfill Excavation and Placement on Liner

Corrective Action Evaluation Report

No.	Item	Quantity	Unit	Unit Cost	Cost
1	Waste Removal and Relining (Eng. Fees Included)	4900000	CY	$ 12.75	$ 62,483,221
2	Excavate and Fill Cover Soils	1000000	CY	$ 4.00	$ 4,000,000
3	Construction Contingency			25%	$ 15,620,805
Construction Cost Subtotal					$ 82,104,027
Landfill Excavation and Relining Capital Cost					$ 82,000,000
Total Est. Capital Cost (incl. Res. Water Supply + MNA + Grounwater Ext. & Treat)					**$ 84,000,000**

30 YR NPV, 5% interest rate

Landfill Excavation and Relining Operation and Maintenance Cost	**$ 3,300,000**
Total Operation and Maintenance Cost (incl. Res. Water Supply + MNA + Groundwater Ext & Treat.)	**$ 6,000,000**

ESTIMATED TOTAL	**$ 90,000,000**
High Range (+50%)	$ 140,000,000
Low Range (-30%)	$ 63,000,000

Primary Assumptions:

-Engineering and construction administration based on A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002)

-There is an estimated 4,900,000 CY of waste in the pre-Subtitle D unlined portion of the landfill.

-There is an estimated 1,000,000 CY of additional soil to be excavated and placed (i.e. cover).

-Unit costs obtained from *Focused Feasibility Study Report, Freeway Landfill and Freeway Dump,* October 2019, Prepared by Barr Engineering for the Minnesota Pollution Control Agency. Moderate height, moderate footprint alternative (2C).

Alt 4
Groundwater Extraction (on off-site) and Treatment
Corrective Action Evaluation Report

No.	Item	Quantity	Unit	Unit Cost	Cost
1	Mobilization / Demobilization	1	LS	$ 164,278	$ 164,278
2	Site Preparation / Access Matting to Nearest Road at Distal Locations	2800	LF	$ 91	$ 253,400
3	Extraction Well Installation - 6" Dia., 90 ft Depth, Mud Rotary	5	Ea	$ 26,067	$ 130,333
4	Piezometer Installation - 2" Dia., 90 ft Depth, Sonic	5	Ea	$ 15,000	$ 75,000
5	Forcemain - Heat Traced and Insulated (to distal wells)	5500	LF	$ 41.98	$ 230,868
6	Trench Excavation and Backfill	1000	LF	$ 20.00	$ 20,000
7	Utility Bedding Soil	1000	LF	$ 3.50	$ 3,500
8	HDPE Forcemain - 2" Dia., SDR11 (each well)	1000	LF	$ 3.50	$ 3,500
9	Directional Drilling - 4" Dia. Line 8' Deep	7700	LF	$ 10.00	$ 77,000
10	HDPE Forcemain - 4" Dia. SDR11 (pipe around LF to east infilt. basin)	7700	LF	$ 6.00	$ 46,200
11	Pressure Testing and Quality Control	1	LS	$ 33,200	$ 33,200
12	Insulation - 4" Thickness, 4' wide	1000	LF	$ 12.50	$ 12,500
13	Well Power Supply and Conduit	11000	LF	$ 11.00	$ 121,000
14	Water Treatment Structure	1	LS	$ 96,280	$ 96,280
15	Water Treatment Units	1	LS	$ 232,400	$ 232,400
16	Water Treatment Plumbing	1	LS	$ 33,200	$ 33,200
17	Equalization Tank, Controls, and Transfer Pumps	1	LS	$ 50,300	$ 50,300
18	Extraction Well, Controls, Well Pumps, and Instrumentation	1	LS	$ 166,000	$ 166,000
19	Rapid Infiltration Basin	1	LS	$ 24,900	$ 24,900
20	Startup / Commissioning	1	LS	$ 33,200	$ 33,200
21	Construction Contingency			25%	$ 451,765
Construction Cost Subtotal					$ 2,258,824
22	Discharge Permitting	1	LS	$ 20,000	$ 20,000
23	Model Application	1	LS	$ 20,000	$ 20,000
24	Treatment Pilot Test	1	LS	$ 100,000	$ 100,000
25	Design Investigation	1	LS	$ 50,000	$ 50,000
26	Engineering and Construction Administration			19%	$ 430,000
Engineering Cost Subtotal					$ 620,000
Estimated Capital Cost					**$ 2,900,000**

Alt 4
Groundwater Extraction (on off-site) and Treatment
Corrective Action Evaluation Report

					30 YR NPV, 5% interest rate
Operation and Maintenance	1	ANNUAL	$ 281,366	**$**	**6,200,000**

ESTIMATED TOTAL	**$**	**9,100,000**
High Range (+50%)	$	14,000,000
Low Range (-30%)	$	6,400,000

Primary Assumptions:

-Engineering and construction administration based on A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002)

-Five extraction wells will operate to achieve remedial goals.

-Lump sum construction unit costs scaled up from Alt 2 by 66% to account for extra wells, flow, and infrastructure.

-Total depth of extraction wells and piezometers will average 90 feet below ground surface.

Appendix F

Monitoring Well Network Considerations

Appendix F
Monitoring Well Network Considerations

The ERL monitoring network includes 39 monitoring wells, of which 25 are sampled three times per year. Monitoring network considerations are provided below based on the corrective action evaluation and feedback from MPCA and others:

- P-301L area – vinyl chloride concentrations were above the IL in sample from monitoring well P-301L during the three triannual sampling events in 2019 and not detected (<0.050 µg/L) in the April 2020 sample (Appendix A). This suggests well P-301L remains on the northern fringe of the vinyl chloride plume. Vinyl chloride concentrations at P-301L will be watched, and if necessary, an additional lower outwash monitoring well will be considered.

- P-694477 area - vinyl chloride was detected and confirmed in monitoring well P-694477 in October and December 2019 and was not detected (at an elevated reporting limit) in the April 2020 sample (Appendix A). As part of the corrective action implementation, unique well #626780 (which is sidegradient to the organics) is a candidate for replacement and conversion of the existing supply well to a lower outwash monitoring well that will provide monitoring data southeast of well P-694477.

- Northern Rice Lake/Tibbits Brook (RL/TB) - the County has suggested the installation of a monitoring well north of well P-325L in RL/TB. The installation of a well(s) in this area is a significant undertaking during installation and raises safety concerns for the individuals responsible for preparing the area for drilling, drilling and installing the well, and samplers who monitor the wells. ERL will provide access to the County to install the well (at the County's risk) if requested. Please contact Mr. Terry Johnson if you would like to schedule a site visit to conduct a site walk in RL/TB for reconnaissance purposes or to discuss our experience with creating access, drilling in RL/TB and a similar wetlands in Minnesota, and safety concerns.

  ERL will consider incorporating monitoring wells P-327L and P-328L to the monitoring network for sampling on an annual basis.

- Upgradient Lower Outwash Well – ERL will provide a plan to establish additional upgradient monitoring under separate cover.

EXHIBIT 16

Natural Wild Rice In Minnesota

A Wild Rice Study document submitted to the Minnesota Legislature by the Minnesota Department of Natural Resources February 15, 2008



Fiscal Disclosure

Pursuant to Minnesota Statutes, Section 3.197, we estimate that it cost approximately $72,614 to produce this report. This includes Minnesota Department of Natural Resources (MNDNR) staff time for conducting the inventory, attending meetings, drafting and reviewing the report and compiling comments and recommendations ($45,159) and meeting expenses, including travel, for consultation with the Technical and Partnership Teams ($1,772). In addition, costs accrued to other agencies and individuals participating on the Technical Team are $22,618 for time and $3,065 for travel. These costs do not include the costs of preceding research and public participation efforts conducted by the MNDNR or Team members prior to the requirement that this report be prepared.

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Executive Summary

Introduction

This report fulfills the requirements of Session Law 2007, Chapter 57, Article 1, Section 163 requiring the Commissioner of Natural Resources to prepare a study for natural wild rice that includes: (1) the current location and estimated acreage and area of natural stands; (2) potential threats to natural stands, including, but not limited to, development pressure, water levels, pollution, invasive species, and genetically engineered strains; and (3) recommendations to the house and senate committees with jurisdiction over natural resources on protecting and increasing natural wild rice stands in the state.

In fulfilling these requirements, the Minnesota Department of Natural Resources (MNDNR) established a Technical Team of wild rice experts from State, Tribal, and Federal governments, as well as academia and the private sector. The MNDNR also established a Partnership Team representing major stakeholders.

Importance of Natural Wild Rice

Nowhere has natural wild rice been more important, nor had a richer history, than in Minnesota. No other native Minnesota plant approaches the level of cultural, ecological, and economic values embodied by this species. Natural wild rice has been hand harvested as a source of food in the Great Lakes region for thousands of years.

The Ojibwe people have a special cultural and spiritual tie to natural wild rice. Known to their people as Manoomin, it is revered as a special gift from the Creator. In addition many immigrants to Minnesota adopted hand harvesting of natural wild rice as an annual ritual. Annual sales of state licenses for wild rice harvesting peaked in 1968 at over 16,000. In recent years, annual sales have averaged fewer than 1500. In many instances, though, tribal harvesters are not required to buy state licenses. It is thought that more than 3000 tribal members participate in wild rice harvesting, providing a statewide total (tribal and nontribal) of 4000-5000 individuals annually.

The value of natural wild rice to wildlife has been long appreciated by American Indians and was marveled at by early European explorers. Research since then has documented that wild rice provides food and shelter for many fish and wildlife species. It is one of the most important foods for waterfowl in North America. More than 17 species of wildlife listed in the MNDNR's Comprehensive Wildlife Conservation Strategy as "species of greatest conservation need" use wild rice lakes as habitat for reproduction or foraging.

Wild rice harvest has provided important economic benefits to local economies. As with other commodities, the price paid for unprocessed natural wild rice can vary considerably. Although pricing is mainly determined by supply, marketing also plays a role. During the past 70 years, the price of one pound of unprocessed wild rice has ranged from $0.10 in 1940 to $2.17 in 1966. Adjusted for inflation these prices in today's dollars are equivalent to $0.75 and $13 per pound, respectively. As an example, the 1966 harvest of 924,000 lbs would have been worth over $12 million today.

Prior to 1970, Minnesota provided half of the global market supply of wild rice. Most of this rice was from hand harvested natural stands. By 1990, the large-scale production of cultivated wild rice had expanded, and natural wild rice accounted for less than 10% of the global market supply. The total annual yield of cultivated and hand harvested wild rice in Minnesota today ranges from four to eight million pounds. A recent MNDNR survey found the average annual hand harvest of natural stands to be 430 pounds per individual.

Background

Although stands of natural wild rice occur most commonly in central and north-central Minnesota, the historic range of wild rice included all of the state. Based on the inventory conducted for this report, the range of natural wild rice today includes 55 counties in Minnesota. Stands of natural wild rice were present or occurred in recent history on approximately 1286 lakes and river/stream segments. These areas support a minimum of 64,328 acres of natural wild rice when growing conditions are favorable.

The greatest concentration of lakes supporting natural wild rice is in Aitkin (4,859 acres), Cass (8,323 acres), Crow Wing (3,751 acres), Itasca (8,448 acres), and St. Louis (8,939 acres) counties. These counties contain over 60% of the inventoried natural wild rice acreage in Minnesota. These counties also account for over 70% of the harvesting trips for natural wild rice.

Natural wild rice generally requires some moving water, with rivers, flowages, and lakes with inlets and outlets being optimal areas for growth. Wild rice grows well at depths of 0.5 to 3 feet of water, although some plants may be found in deeper waters. As an annual plant, natural wild rice develops each spring from seeds that fell into the water during a previous fall. Germination requires a dormancy period of three to four months of cold, nearly freezing water (35° F or colder). Seeds are unlikely to survive prolonged dry conditions.

The entire process, from germination of a new plant to dropping of mature seeds, requires about 110 to 130 days, depending on temperature and other environmental factors. Seeds begin ripening at the top of the stem and then ripen over several days on an individual plant. Plants within a stand ripen at different times because of genetic, developmental, and environmental variation. This staggered maturation process means that ripe seeds may be available within individual stands for several weeks, and across the entire range of natural wild rice in Minnesota for a month or longer.

The earliest laws and regulations concerning wild rice in Minnesota focused on wild rice harvest and date back more than 75 years. Today, there is a complex mix of tribal, federal, state, and local laws and regulations. These are associated with the formal recognition of the significance of natural wild rice and its protection, management, and harvest. The application of regulations varies by jurisdiction (i.e., tribal versus state) and geography (i.e., on-reservation versus off-reservation, or within various ceded territories). Regulatory authority governing different aspects of wild rice management occurs within several state agencies yet within state statutes there is no unifying policy to provide overall guidance in implementation.

Threats

Despite its rich history and abundance in Minnesota, natural wild rice faces many current and potential threats in this region. In general, any factor that can affect water quality, seasonal water levels, lakebed conditions, regional climate, aquatic vegetation, or the natural genetic diversity of wild rice could potentially threaten natural stands. These threats may work in concert or individually to damage wild rice stands.

Important threats that impact local stands of natural wild rice include changes in local hydrology due to dams and channelization, water-based recreation and shoreland development, and mining and other industrial activities. Although the impacts are to local stands, the cumulative effect of these threats can have statewide implications. Hydrological impacts and shoreland development are particularly important.

On a statewide and regional scale, the most important threats are the potential loss of genetic integrity, invasive species, and climate change. Nearly all of the concern expressed about wild rice genetics focuses on the potential of genetic engineering. Invasive species are an ongoing statewide issue impacting aquatic systems in general. Climate change has the potential for the greatest long-term impacts on natural wild rice.

As citizens become more distant from positive experiences with natural wild rice through harvesting, hunting, trapping, or wildlife watching, they are less likely to recognize the very real impacts that the previously noted threats could have on natural wild rice in Minnesota. This loss of appreciation, while not a direct threat to the wild rice resource, nevertheless increases the risks because the level of resource protection and management is often based on the perceived value of a resource.

Unfortunately wild rice harvesters are relatively few in number and have experienced a long-term decline, although the number of tribal harvesters has rebounded in recent years. Only about 4000-5000 people participate in hand harvesting natural stands of wild rice annually.

The future of natural wild rice in Minnesota will depend in large part on its protection and management by state and tribal natural resource agencies. The role of the agencies is complicated by the limitations of their authority and the challenges posed by multiple jurisdictions, annual variability of wild rice crops due to weather and other factors, and lack of information concerning the natural ecology of wild rice, historical losses, trends in abundance and distribution, threats to its future, and a better understanding of wild rice harvesters.

Recommendations

The following recommendations were developed with valuable input and discussion from the members of the Wild Rice Study Technical Team and Partnership Team. However, the MNDNR assumes sole responsibility for these recommendations as written and presented here.

MNDNR recognizes the importance of protecting natural wild rice beds from genetic modification and agrees with wild rice stakeholders that this protection is critical to the future of this resource. We strongly support the Minnesota Environmental Quality Board in adopting rules

that require an Environmental Impact Statement for a proposed release of genetically engineered wild rice (MS 116C.94 Subd.1b).

Recommendation 1

Recodify current wild rice harvest statutes and rules to remove duplication and inconsistencies.

Rationale: The state's wild rice statutes and rules have been developed and modified piecemeal over a long period of time. As a result they contain a number of inconsistencies and duplication.

Recommendation 2

Establish statutory policy guidance on wild rice and its management.

Rationale: Within state statutes there is no unifying policy that provides direction to agencies responsible for some aspect of wild rice management.

Recommendation 3

The MNDNR will convene an interagency workgroup in 2008 to identify desired statutory updates in harvest regulations.

Rationale: Harvest regulations and license fee structure should be reviewed by an interagency work group for suggested changes.

Recommendation 4

The MNDNR will designate and publish a list of important natural wild rice areas.

Rationale: Recognizing important wild rice areas and publishing the list would call attention to the importance of these areas, indicate management priorities, and provide a formal list that may prove useful for local units of government that are considering zoning and surface use restrictions.

Recommendation 5

The MNDNR will convene a standing interagency wild rice workgroup to share information and develop recommendations for inventory methodology and trend assessments, education and information outreach, lake planning and management, harvester recruitment and retention, and other management issues as they arise.

Rationale: Comprehensive protection and management of wild rice involves multiple agencies. Management needs include better inventory information including consistent methodology for trend analysis, documenting natural genetic diversity, and establishing long-term case studies on identified lakes.

Recommendation 6

Increase intensive natural wild rice lake management efforts and accelerate the restoration of wild rice stands within its historic range.

Rationale: Protecting and managing natural wild rice resources on many lakes requires active annual management activities to maintain free flowing outlets. Active management is also required to restore wild rice to wildlife habitat areas within its historic range. These efforts should be accelerated as funding, time, and opportunity permit.

Sacred Food and Medicine

Wild rice, or manoomin, is a sacred food and medicine integral to the religion, culture, livelihood, and identity of the Anishinaabeg. According to our sacred migration story, in the long ago a prophet at the third of seven fires beheld a vision from the Creator calling the Anishinaabe to move west (to a land previously occupied long ago) until they found the place "where food grows on the water." The Anishinaabeg of the upper Mississippi and western Great Lakes have for generations understood their connection to anishinaabe akiing (the land of the people) in terms of the presence of this plant as a gift from the Creator. In the words of White Earth's Tribal Historian, Andy Favorite, "Wild rice is part of our prophecy, our process of being human, our process of being Anishinaabe … we are here because of the wild rice. We are living a prophecy fulfilled."

In our Ojibwe language, manoomin is animate, grammatically referred to as "him/her" not "it," a non-human being, not just an inanimate "resource." It is both difficult and of utmost importance to adequately translate and appreciate this worldview in the language of mainstream culture and society with its scientific advisory boards for the study of humans and animals but not plants. According to Anishinaabe author, Basil Johnson, "…in essence each plant ... was a composite being, possessing an incorporeal substance, its own unique soul-spirit. It was the vitalizing substance that gave to its physical form growth, and self-healing." The Anishinaabeg believe that wild rice will always grow where they live. Menominee chief Chieg Nio'pet said his people did not need to sow rice because it would follow them wherever they went. He told of how Shawano Lake never had manoomin until the Menominee moved there. Similarly when they were banned from Lake Winnebago, the rice that had been plentiful there all but disappeared. Whatever happens to the land and to manooomin happens to the Anishinaabe.

Our ceremonies and aadizookanag -sacred stories- also tell of our people's relations with this plant. White Earth Anishinaabe, Joe LaGarde, notes that wild rice and water are the only two things required at every ceremony. Manoomin accompanies our celebrations, mourning, initiations, and feasts, as both a food and a spiritual presence. It holds special significance in traditional stories, which are only told during ricing time or when the ground is frozen. "In these stories, wild rice is a crucial element in the realm of the supernaturals and in their interactions with animals and humans; these legends explain the origin of wild rice and recount its discovery…" by Wenabozhoo, or Nanabozho, the principal manidoo or spirit in our sacred aadizookanag.

Manoomin is just as central to our future survival as our past. While we try to overcome tremendous obstacles to our collective health, the sacred food of manoomin is both food and medicine. "Wild rice is consequently a very special gift, with medicinal as well as nutritional values—belief reflected in the Ojibwe use of wild rice as a food to promote recovery from sickness as well as for ceremonial purposes." (Vennum 62). Manoomin is inextricably bound to the religion and identity of the Anishinaabeg. This is why these threats are potentially so devastating and why it is essential that the sanctity and integrity of this plant be preserved. If artificially produced or engineered varieties of wild rice were to compromise the wild manoomin that has existed in the lakes for thousands of years, it will compromise the Anishinaabe people and our way of life. Joe LaGarde puts it plainly, "If we lose our rice, we won't exist as a people for long. We'll be done too."

Erma Vizenor, Tribal Chairwoman, White Earth Nation
With the participation of Carlton College Students.

Introduction

This report fulfills the requirements of Session Law 2007, Chapter 57, Article 1, Section 163:

By February 15, 2008, the commissioner of natural resources must prepare a study for natural wild rice that includes: (1) the current location and estimated acreage and area of natural stands; (2) potential threats to natural stands, including, but not limited to, development pressure, water levels, pollution, invasive species, and genetically engineered strains; and (3) recommendations to the house and senate committees with jurisdiction over natural resources on protecting and increasing natural wild rice stands in the state.

In developing the study, the commissioner must contact and ask for comments from the state's wild rice industry, the commissioner of agriculture, local officials with significant areas of wild rice within their jurisdictions, tribal leaders within affected federally recognized tribes, and interested citizens.

In fulfilling these requirements, the Minnesota Department of Natural Resources (MNDNR) established a Technical Team of wild rice experts from State, Tribal, and Federal governments; the Minnesota cultivated wild rice industry; Ducks Unlimited; Save Our Rice Alliance (SORA), an organization of interested citizens who hand harvest natural wild rice; White Earth Land Recovery Project; the University of Minnesota; and the University of Wisconsin (Appendix A). The MNDNR also established a Partnership Team representing the Minnesota wild rice industry, the state commissioner of agriculture, the Association of Minnesota Counties, tribal leaders within affected federally recognized tribes, the United States Fish and Wildlife Service, Ducks Unlimited, Minnesota Waterfowl Association, and SORA (Appendix A).

The Technical Team, working with MNDNR staff, developed drafts of the wild rice study document for review by the Partnership Team. The collaboration of these two teams was instrumental in producing this document for MNDNR review and approval. The MNDNR is indebted to team members for their contributions of time, expertise, and hard work. It should be clear, however, that the MNDNR assumes sole responsibility for the content and recommendations of this document.

The wild rice study document and its appendices are intended to provide the reader with a thorough background on the importance of natural wild rice to Minnesota, its natural ecology and distribution, threats to its future, challenges in managing the resource, and recommendations to insure its abundance for future generations.

Importance of Natural Wild Rice in Minnesota

As directed by the legislature, the wild rice study document focuses on natural wild rice. For this study, we define natural wild rice as native species of wild rice (*Zizania*) that are growing in public waters and are not subject to cultivation. The simplest description of natural wild rice in Minnesota is that it is an annual aquatic grass that produces an edible grain.

This simple description, of course, does not do justice to this unique and valuable plant. History is replete with examples of its importance to wildlife and value to humans both nutritionally and culturally. Wild rice (manoomin to the Ojibwe) is a spiritually significant resource for Native Americans in the Great Lakes region, and it has been for centuries. Nowhere has this grain been more important, nor had a richer history, than in Minnesota. No state harbors more acres of natural wild rice than Minnesota (Moyle and Krueger 1964). No other native Minnesota plant approaches the level of cultural, ecological, and economic values embodied by natural wild rice.

Cultural Importance

Natural wild rice has been hand harvested as a source of food in the Great Lakes region for thousands of years. Evidence of its human use dates back to the Late Archaic and Early Woodland periods, more than 2000 years ago (Valppu 2000). Archeological evidence indicates that from the 1600s to the 1800s wild rice was a staple food for the Algonquian and Dakota peoples throughout the area now known as Minnesota. It has been important historically for gifting and trading, as well. For example, when Dakota Chief Wabasha hosted Zebulon Pike in 1805 he offered gifts of wild rice to the explorer (Vennum 1988).

The Ojibwe people have a special cultural and spiritual tie to natural wild rice. Their Migration Story describes how they undertook a westward migration from the eastern coast of North America. Tribal prophets had foretold that this migration would continue until the Ojibwe people found "the food that grows on water" (Benton-Banai 1988). That food was wild rice, known as manoomin, and is revered to this day by the Ojibwe as a special gift from the Creator (Ackley 2000; Schlender 2000).

Early European explorers and fur traders were impressed with the availability and nutritional quality of wild rice, and attempts were made to import it to Europe as early as 1790 (Oelke 2007). Many immigrants to Minnesota adopted hand harvesting of natural wild rice as an annual ritual. The importance of this harvest to European settlers lessened only when cultivated non-native grains became more readily available.

The tradition of hand harvesting natural wild rice continues to this day among both tribal and nontribal cultures. This tradition has been preserved through tribal code and state regulations that reflect traditional methods of harvesting. State statutes in Minnesota include regulations that restrict the maximum length (18 feet) and width (36 inches) of the harvesting boat, as well as the maximum weight (1 pound) and length (30 inches) of hand flails. The regulations also require that push poles have forks 12 inches or less in length. The use of any machine or mechanical device to harvest natural wild rice is generally prohibited.

Annual sales of state licenses for wild rice harvesting peaked in 1968 at over 16,000. In recent years, annual sales have averaged fewer than 1500. However, because in many instances tribal harvesters are not required to buy state licenses, state numbers do not adequately reflect the numbers of individuals participating in wild rice harvesting. It is thought that more than 3000 tribal members participate in wild rice harvesting providing the statewide total (tribal and nontribal) of 4,000 to 5,000 individuals.

Annual harvests can vary greatly. Rice productivity, weather, and harvester participation are all important factors. The MNDNR survey of state licensees from 2004 to 2006 found the average annual harvest to be 430 pounds per individual (MNDNR 2007). Aitkin, Cass, Crow Wing, Itasca, and St. Louis counties accounted for over 70% of the harvesting trips for natural wild rice. Estimates of annual harvest of natural stands in Minnesota between 1940 and 1972 ranged from 20 thousand to nearly 4 million pounds of unprocessed grain (Oelke et al. 1973).

Another aspect of the cultural importance of wild rice is its nutritional value. Noted for its importance as a whole grain, wild rice is an excellent source of complex carbohydrates, vitamins, minerals, fiber and protein. It is a particularly good source of potassium, zinc and riboflavin (Oelke 2007). Access to traditional foods is felt to be an important element of restoring individual and community health of the Ojibwe people (W. LaDuke, personal communication). Natural wild rice is one of the mainstays of traditional foods for the Ojibwe community.

Concerns for the preservation of hand harvesting traditions and related issues led to the formation in 2007 of a tribal and nontribal partnership called Save Our Rice Alliance (SORA). The stated mission of SORA is “To preserve and enhance the culture, economy, and sustainability of native wild rice” (A. Drewes, personal communication).

Ecological Importance

The value of natural wild rice to wildlife has been long appreciated by American Indians and was marveled at by early European explorers (Jenks 1900). Jonathan Carver traveled through eastern portions of North America in the 1760s and observed of wild rice that “the sweetness and nutritious quality of it attracts an infinite number of wild fowl of every kind which flock from distant climes to enjoy this rare repast, and by it become inexpressively fat and delicious” (Stoddard 1957).

Both migrating and resident wildlife rely on the nutritious and abundant seeds of natural wild rice. One acre of natural wild rice can produce more than 500 pounds of seed. These seeds have long been recognized as an important source of food during fall migrations (McAtee 1917). Martin and Uhler (1939) listed wild rice as the ninth most important source of food for ducks throughout the United States and Canada, and the third most important source of food for ducks in the eastern portions of the continent. Research conducted on the Chippewa National Forest found that natural wild rice was the most important food for mallards during the fall (Stoudt 1944). Although the value of wild rice to mallards, wood ducks, and ring-necked ducks is most commonly recognized, other ducks such as black ducks, pintail, teal, wigeon, redheads, and lesser scaup also use stands of wild rice (Rossman et al. 1982, Huseby 1997).

The stems of wild rice provide nesting material for such species as common loons, red-necked grebes, and muskrats; and critical brood cover for waterfowl. The entire wild rice plant provides food during the summer for herbivores such as Canada geese, trumpeter swans, muskrats, beaver, white-tailed deer, and moose (Martin et al.1951, Tester 1995). In addition, rice worms and other insect larvae feed heavily on natural wild rice. These, in turn, provide a rich source of food for blackbirds, bobolinks, rails, and wrens. In the spring, decaying rice straw supports a diverse community of invertebrates and thus provides an important source of food for a variety of wetland wildlife including birds, small fish, and amphibians. Indeed, every stage of growth of natural wild rice provides food for wildlife (McAtee 1917, Stoudt 1944).

As a result, wild rice lakes and streams are breeding and nesting areas for many species. More than 17 species of wildlife listed in the MNDNR's Comprehensive Wildlife Conservation Strategy (2006) as "species of greatest conservation need" use wild rice lakes as habitat for reproduction or foraging (Henderson 1980, Martin et al.1951). Listed bird species can be found in Table 1.

Table 1. Minnesota birds that utilize wild rice habitat and are listed in *Tomorrow's Habitat for the Wild and Rare* as species of special concern.

Birds of Special Concern	Life Cycle Stage
American Black Duck	Breeding and migration
Lesser Scaup	Migrant
Northern Pintail	Migration, Rare Breeder
Trumpeter Swan	Breeding and migration
American Bittern	Breeding and migration
Least Bittern	Breeding and migration
Red-necked Grebe	Breeding and migration
Common Loon	Breeding and migration
Sora Rail	Breeding and migration
King Rail	Casual migrant
Virginia Rail	Breeding and migration
Yellow Rail	Breeding and migration
Black Tern	Breeding and migration
Bobolink	Foraging and migration
Rusty Blackbird	Foraging and migration
Sedge Wren	Breeding and migration
Bald Eagle	Foraging and migration

Natural wild rice has other ecological values as well. Emergent aquatic plants such as wild rice, bulrush, and cattails protect shorelines and provide habitat for fish (Radomski and Goeman 2001). Dense stands of wild rice stabilize loose soils and form natural windbreaks that can limit the mixing of soil nutrients into the water column (Meeker 2000). In addition, natural wild rice has relatively high requirements for nutrients such as phosphorus and nitrogen (Oelke et al. 2000). During periods of rapid growth, which occurs in spring and summer, the plants sequester

these nutrients. Thus stands of natural wild rice counter the effects of nutrient loading and the potential increases in algal growth and lake turbidity.

Economic Importance

Prior to European settlement of Minnesota, natural wild rice was the most important grain available to native peoples, early explorers, and fur traders (Vennum1988). Properly dried, and stored in clean, dry conditions, uncooked wild rice has an estimated shelf life of up to 10 years. One pound yields up to ten and a half cups of cooked wild rice (Oelke 2007). As a dietary staple that was so easily stored and used, wild rice had considerable economic value. With the influx of immigrant settlers and the agricultural production of non-native grains, the overall economic value of wild rice waned. Nevertheless, harvest of natural wild rice continued to be popular in Minnesota. During the 1960s, sales of state licenses averaged over 10,000 per year.

The economic value of wild rice is reflected in the efforts of many to expand its occurrence into new waters. Native peoples have long sown wild rice to create additional sources of grain (Vennum 1988). Waterfowl hunters have commonly planted wild rice to attract ducks. The demand for seed of wild rice and other aquatic wildlife foods presumably fostered the establishment of Wildlife Nurseries, Inc. in Oshkosh, Wisconsin in 1898 (Oelke 2007). This firm continues selling wild rice for planting today. Conservation agencies have long participated in planting efforts as well, working to establish new stands of wild rice and perpetuate traditional areas (Moyle 1944b).

David Owens noted the potential benefits of cultivating wild rice as early as 1852 (Vennum 1988). In 1853, Oliver H. Kelley published an article discussing the merits of wild rice cultivation. Albert E. Jenks discussed wild rice cultivation as part of "agricultural development" in 1901. Yet not until 50 years later did James and Gerald Godward pioneer the first real efforts. They began production of cultivated wild rice in central Minnesota, near Merrifield, in 1950 (Oelke 2007).

The 1950s and 1960s may well have been the peak of modern hand harvesting of wild rice. From 1957 to 1963 the state of Minnesota sold an average of 10,012 wild rice harvest licenses (Table 2). The average annual harvest of unprocessed wild rice exceeded 2 million pounds or about 227 pounds per picker per year (Moyle and Krueger 1964).

Table 2. Hand harvesting of natural wild rice 1957-1963.

Year	Licenses sold	Harvest *
1957	7,535	1,057,000
1958	9,702	3,224,000
1959	9,332	2,067,000
1960	9,664	2,301,000
1961	14,660	2,772,000
1962	6,709	1,292,000
1963	12,482	3,212,000

*Harvest is in unprocessed pounds

As with other commodities, the price paid for unprocessed natural wild rice can vary considerably. Although pricing is mainly determined by supply, marketing also plays a role. During the past 70 years, the price of one pound of unprocessed wild rice has ranged from $0.10 in 1940 to $2.17 in 1966 (Oelke 2007). Adjusted for inflation these prices in today's dollars are equivalent to $0.75 and $13 per pound, respectively. The 1966 harvest of 924,000 lbs would have been worth over $12 million today. Since 1990, the price paid for unprocessed rice from the Leech Lake Reservation has varied between $1.00 and $1.50 per pound (R. Robinson,

Jr., personal communication). Sales during this period ranged from approximately 7,400 to 280,000 pounds.

Prior to 1970, Minnesota provided half of the global market supply of wild rice. Most of this rice was from hand harvested natural stands. By 1990, the large-scale production of cultivated wild rice had expanded, and natural wild rice accounted for less than 10% of the global market supply. Cultivated wild rice from Minnesota provided 40% of the market and California provided 50% (Lee 2000). California still leads the cultivated wild rice industry. The total annual yield of cultivated and hand harvested wild rice in Minnesota today ranges from four to eight million pounds.

Although cultivated rice dominates these production numbers, hand harvested natural wild rice remains a vital component of tribal and local economies in Minnesota. The MNDNR survey of 2004 – 2006 state license buyers found an average annual individual harvest of 430 pounds. In 2007, nearly 300,000 pounds of unprocessed rice were purchased from LLBO-licensed harvesters. At $1.50 per pound, this harvest generated more than $400,000 of income for tribal members (R. Robinson, Jr., personal communication).

Wild Rice Background

Taxonomy

Native North American wild rice is classified as a grass in the family *Poaceae* and the genus *Zizania*. The most common species throughout Minnesota is northern wild rice, or *Zizania palustris* L. (Ownbey and Morley, 1991). Two varieties of natural wild rice occur in this region and in other parts of the Upper Midwest: Z. *palustris* var. *palustris* and Z. *palustris* var. *interior* (Gleason and Cronquist, 1991; Flora of North America, 1993+).

A more southern and eastern species, *Zizania aquatica* L., is uncommon but thought by many to occur in Minnesota as well. The precise distribution of *Z. aquatica* is unclear because of differences in taxonomic interpretations and potentially overlapping ranges. *Z. aquatica* is physically larger than *Z. palustris* but its grain is more slender and difficult to harvest. Both of these species are native only to North America.

Distribution and Abundance

Minnesota historically harbored more acres of natural wild rice than any other state (Moyle and Krueger 1964). Despite losses of wild rice habitat, the importance of Minnesota as a center of natural wild rice abundance has actually increased as wild rice acreage has declined elsewhere in the United States. For thousands of years, wild rice thrived in shallow lakes, rivers, and streams left behind by melting glaciers. Although stands of natural wild rice occur most commonly in areas of glacial moraines, such as in central and north-central Minnesota, the historic range of wild rice included all of Minnesota (Moyle 1944b).

Its range also extended westward into the present-day Dakotas and eastward to the Atlantic coast. While not distributed evenly, wild rice likely occurred in many places where its ecological requirements were met. Because wild rice also was planted in areas where it did not occur naturally, it is sometimes difficult today to distinguish between historically natural stands and successfully seeded stands (Vennum 1988).

An updated inventory of the distribution and abundance of natural wild rice was compiled for this study by selected members of the Technical Team and the MNDNR (Appendix B). Data are from lake-habitat surveys, reported observations, and interviews with field personnel of state, federal, and tribal agencies. Although this inventory provides a marked improvement in our understanding of natural wild rice distribution in Minnesota, it should be considered a minimum estimate. The data for many wild rice lakes, streams and rivers is incomplete or totally lacking.

Based on this inventory, the range of natural wild rice today includes 55 counties in Minnesota (Figure 1). The only Minnesota counties without significant populations of natural wild rice are along the western and southwestern boundaries of the state. It should be noted, however, that historical records of wild rice include herbarium specimens that were collected in several western counties not documented by the current inventory. These counties include Pipestone, Cottonwood, Chippewa, Swift, Clay, and western Polk (Moyle 1939, Ownbey and Morley, 1991).

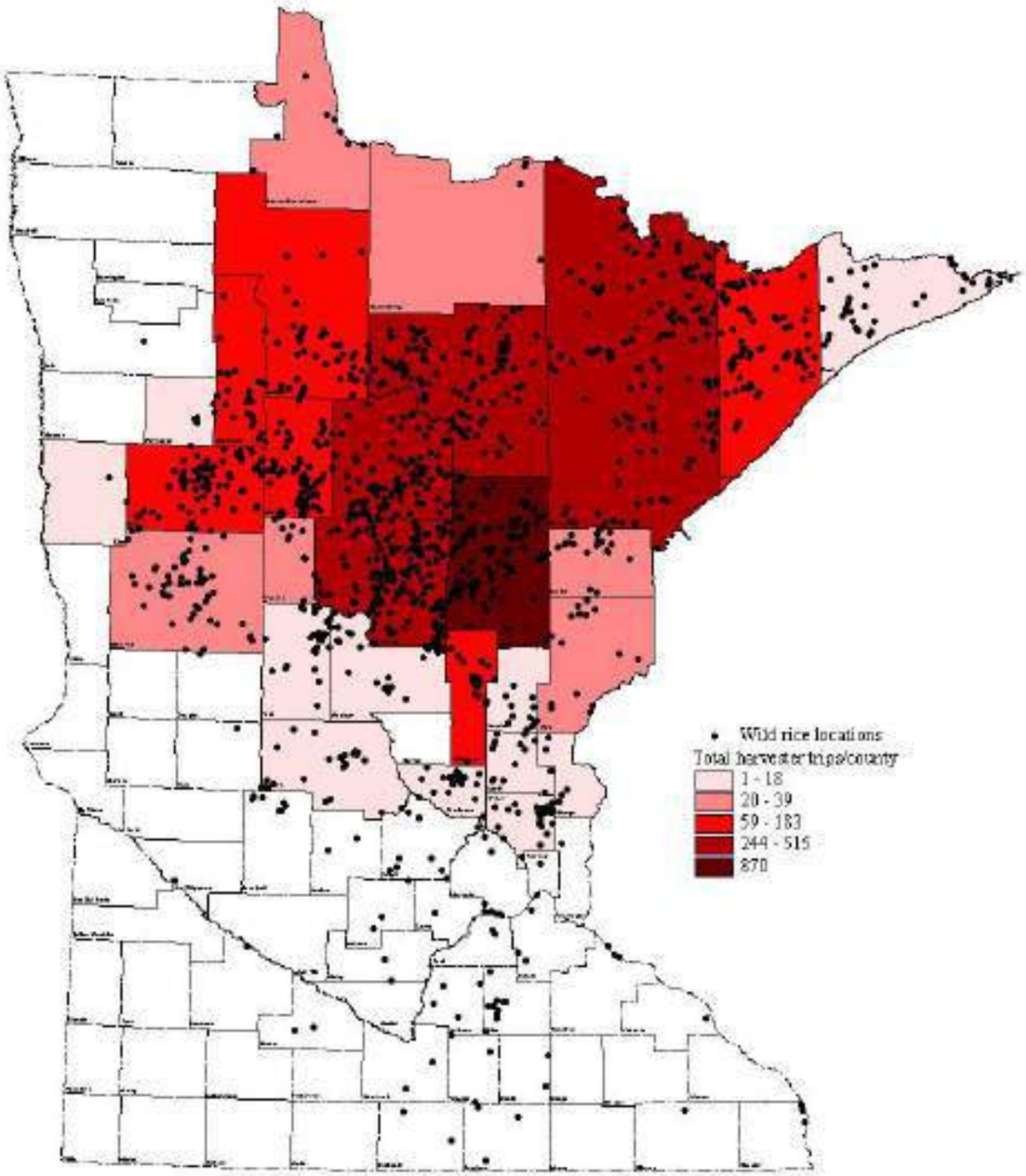


Figure 1. Distribution of wild rice lakes and wild rice harvesting pressure in Minnesota.

Stands of natural wild rice were present or occurred in recent history on approximately 1,286 lakes and river/stream segments (Figure 1). These areas support a minimum of 64,328 acres of natural wild rice when growing conditions are favorable. These areas vary from large, shallow lakes dominated by natural wild rice stands (i.e. Nature's Lake in Cass County) to significant bays within large fish lakes (i.e. Leech Lake) to a narrow fringe along lake/river shorelines. The greatest concentrations of lakes that support natural wild rice are in Aitkin (4,859 acres), Cass (8,323 acres), Crow Wing (3,751 acres), Itasca (8,448 acres), and St. Louis (8,939 acres) counties. These counties contain over 60% of the inventoried natural wild rice acreage in Minnesota. These counties also account for over 70% of the harvesting trips for natural wild rice (MNDNR 2006 harvest survey, Appendix C).

The abundance of natural wild rice in Minnesota today is largely due to abundant suitable habitat, favorable climate, and natural genetic variability that allows for environmental selection of traits that perform well under varying conditions. Studies in Wisconsin found sufficient genetic diversity between geographically separated stands of wild rice to potentially identify regional populations. Within-stand diversity also varied greatly, with larger and denser stands having greater genetic diversity (Waller et al. 2000).

Life History

While the historical range of natural wild rice illustrates its broad distribution, its specific occurrence and abundance is in large part dependent on local environmental conditions. For example, clear to moderately colored (stained) water is preferred, as darkly stained water can limit sunlight and may hinder early plant development.

Wild rice grows within a wide range of chemical parameters (i.e. alkalinity, salinity, pH, and iron; Meeker 2000). However, productivity is highest in water with a pH of 6.0 to 8.0 and alkalinity greater than 40 ppm. While researchers have observed that natural wild rice stands are relatively nutrient rich, excess levels of some nutrients, especially phosphorus, can have significant adverse effects on productivity (Persell and Swan 1986).

Natural wild rice generally requires some moving water, with rivers, flowages, and lakes with inlets and outlets being optimal areas for growth. Seasonal water depth is critical, however. Water levels that are relatively stable or decline gradually during the growing season are preferred. In particular, abrupt increases during the early growing season can uproot plants. Wild rice grows well at depths of 0.5 to 3 feet of water, although some plants may be found in deeper waters (M. McDowell, J. Persell personal communication).

Shallower sites can allow strong competition from perennial emergent plant species, while deeper sites can stress wild rice plants and limit seed production. Although wild rice may occur in a variety of lake bottoms, the most consistently productive stands are those with soft, organic sediment (Lee 1986). Nitrogen and phosphorus are limiting nutrients for wild rice (Carson 2002).

As an annual plant, natural wild rice develops each spring from seeds that fell into the water and settled into the sediment during a previous fall. Germination requires a dormancy period of three

to four months of cold, nearly freezing water (35° F or colder). Seeds are unlikely to survive prolonged dry conditions.

Seed germination typically occurs when the substrate and surrounding water temperatures reach about 40° F. Depending on water depth, latitude, and the progression of spring weather, wild rice germinates in Minnesota sometime in April, well ahead of most but not all perennial plants. Within three weeks, the seedlings develop roots and submerged leaves.

The emergent stage begins with the development of one or two floating leaves and continues with the development of several aerial leaves two to three weeks later. The floating leaves appear in late May to mid June in Minnesota, again dependent on water depth, latitude, and weather. Because of the natural buoyancy of the plant, it is at this stage of growth that wild rice is most susceptible to uprooting by rapidly rising water levels. Plants can be significantly stressed even when they remain rooted.

Natural wild rice begins to flower in mid to late July in Minnesota. Flowering times are dependent on both day length and temperature. Flowers are produced in a branching panicle. Female flowers (pistillate or seed-producing) occur at the top of the panicle on appressed branches. Male flowers (staminate or pollen-producing) occur on the lower portion of the panicle on nearly horizontal branches. Natural wild rice is primarily pollinated by wind. High temperatures and low humidity can negatively affect fertilization rates.

Cross-pollination is typical in natural wild rice stands because female flowers develop, become receptive, and are pollinated before male flowers on the same plant shed pollen. Cross-pollination is further enhanced by plant-to-plant variation in flowering times within stands. This cross-pollination within and among wild rice populations helps to preserve the genetic variability and thus biologic potential for wild rice to adapt to changing conditions such as the highly variable climate of the Great Lakes region.

The genetic variability that exists today in natural wild rice may be a critical determinant of whether stands of wild rice can adapt to long-term changes in regional climate. Studies in northern Wisconsin found sufficient genetic diversity among geographically distinct stands of natural wild rice to identify four regional populations. The degree of diversity within stands varied widely as well, with larger and denser stands having greater diversity (Waller et al. 2000).

Wild rice seeds are visible two weeks after fertilization, and they mature in four to five weeks. Immature seeds have a green outer layer that typically turns purplish black as the seed reaches maturity. Seeds begin ripening at the top of the stem and then ripen over several days on an individual plant. Plants within a stand ripen at different times because of genetic and developmental variation. In general, natural wild rice in rivers ripens earlier than that in lakes, rice in shallow waters earlier than that in deeper waters, and rice in northern Minnesota earlier than that in more southerly stands.

This staggered maturation process means that ripe seeds may be available within individual stands for several weeks, and across the entire range of natural wild rice in Minnesota for a month or longer. This extended period of “shattering”, or dropping of ripened seed, is an

important mechanism to ensure that some seeds will survive environmental conditions and perpetuate the natural stand. The entire process, from germination of a new plant to dropping of mature seeds, requires about 110 to 130 days, depending on water and air temperatures and other environmental factors.

Not all wild rice seeds germinate the following year. Seeds may remain dormant in the bottom sediment for many years to several decades if conditions are not suitable for germination. This mechanism allows wild rice populations to survive through years of high water levels or storms that reduce or eliminate productivity. Moreover, natural wild rice can germinate and re-colonize sites after other species have been reduced or eliminated by environmental disturbance (Meeker 2000).

Even under ideal growing conditions, populations of natural wild rice undergo approximately three to five year cycles in which productivity can vary greatly (Jenks 1900, Moyle 1944b, Pastor and Durkee Walker 2006, Durkee Walker et al. 2006). Highly productive years are frequently followed by a year of low productivity, that is then followed by a gradual recovery in wild rice yield (Moyle 1944b, Grava and Raisanen 1978, Atkins 1986, Lee 1986, Aiken et al. 1988, Archibold et al. 1989).

Recent studies suggest that oscillations in wild rice productivity may be caused in part by the accumulation of old straw from previous growth that inhibits plant growth and seed production (Pastor and Durkee Walker 2006, Durkee Walker et al. 2006). In particular, the amount of wild rice straw, its stage of decay, and its tissue chemistry likely affect nutrient availability, influence wild rice productivity, and thus drive cycling of wild rice populations (Durkee Walker, Ph.D. thesis 2008).

Legal Considerations

The earliest laws and regulations concerning wild rice in Minnesota date back more than 75 years. While some harvesting regulations existed through earlier session laws and statutes, comprehensive state regulation of the wild rice harvest was apparently first codified in 1939. These regulations controlled methods and locations of harvest to reduce damage to natural beds and to distribute the harvest.

Today, there is a complex mix of tribal, federal, state, and local laws and regulations. These are associated with the formal recognition of the significance of natural wild rice and its protection, management, and harvest. It is difficult to capture all the important details that exist within these myriad regulations in a summary overview. The application of regulations varies by jurisdiction (i.e., tribal versus state) and geography (i.e., on-reservation versus off-reservation, or within various ceded territories). In addition, some regulations may be changed over time.

The following discussion is not intended to provide a complete legal brief of the law as it relates to natural wild rice. Rather the intent is to indicate the complexity of this law and to make clear the multiple jurisdictions that have recognized legal interests in Minnesota wild rice.

Treaties and Tribal Regulations

Tribal regulations of the harvest and protection of wild rice within reservation boundaries vary from tribe to tribe. Therefore individual tribal governments or their natural resource departments should be contacted for details.

In addition to tribal regulations, treaties and other agreements with the U.S. government reserved off-reservation harvesting rights for some tribes. For example, the Ojibwe tribes that co-signed the Treaty of 1837 reserved the right to gather wild rice from the lands ceded in that treaty. These include an area that eventually became part of east-central Minnesota. The standing of these off-reservation rights was upheld by the U.S. Supreme Court in 1999. [1,2,3]

Similar off-reservation rights are reserved for other Ojibwe tribes in the 1854 ceded territory, in northeastern Minnesota. Rights of traditional tribal harvesting have also been preserved through other agreements between tribes and the U.S. government. For example, in the early 1900s the U.S. began buying lands adjacent to wild rice stands on Minnesota lakes. These were stands that had traditionally been harvested or lands that were to be used as rice camps by the Minnesota Chippewa Tribe (MCT). Lands were purchased and placed into trust status on Swamp, Mallard and Minnewawa Lakes in Aitkin County; on Basswood Lake in Becker County; on Leech, Mud, and Laura Lakes in Cass County; on Lower Dean Lake in Crow Wing County; on Sugar and Bowstring Lakes in Itasca County; on Onamia and Ogechie Lakes in Mille Lacs County; and on Star Lake in Ottertail County.

MCT members can harvest wild rice on these lakes with a tribal identification card issued under the sovereign authority of their respective tribal governments and current Minnesota statute (MS 84.10). Similarly, local tribal members can harvest wild rice on Rice Lake National Wildlife Refuge and on Tamarack National Wildlife Refuge under the 1936 Collier agreement between the U.S. Bureau of Indian Affairs and Bureau of Biological Survey (predecessor to the U.S. Fish and Wildlife Service).

This Wild Rice Study document is not intended to provide an indepth analysis of treaties and subsequent agreements affecting tribal harvest of wild rice in Minnesota. Tribal governments have sovereignty over the harvest of wild rice within the boundaries of their reservations. Some tribal governments also have the authority to regulate harvest by tribal members within certain ceded lands, while other tribal rights exist for specific off-reservation waters. The state of Minnesota has jurisdiction over the wild rice harvest by nontribal harvesters within ceded territories and over all off-reservation wild rice harvest outside of the ceded lands.

[1,2,3][Minnesota, et al., Petitioners v. Mille Lacs Band of Chippewa Indians et al. [No. 97-1337].

[2] See McClurken et al., 2003: 30 for a map of ceded lands in Minnesota under this and subsequent treaties.

[3] See McClurken et al., 2003: 486 for exact treaty language pertaining to cession of land and gathering wild rice.

State and Local Regulations

State laws addressing issues of wild rice in Minnesota date back to 1929 or perhaps earlier. These statutes state that wild rice and other aquatic vegetation is owned by the state and that a person may not acquire a property interest in or destroy wild rice except as allowed by law (MS 84.091). State statutes also regulate the harvest of natural wild rice with the exceptions of tribal jurisdictions and regulations, as noted above (MS 84.10, 84.15, 84.027, 84.28). State regulations address the methods and timing of natural wild rice harvest (MS 84.105, 84.111, and 84.152). In addition, several Agency rules also govern the harvest of wild rice in Minnesota (Minnesota Rules 6284.0300 to 6284.0700).

Because State statutes and rules affecting wild rice in Minnesota have been developed and modified over many years, they contain inconsistencies and duplications. These laws could be clarified and made more concise through recodification.

A long-standing tradition of tribal governments and the state of Minnesota involved posting of "closed" signage on selected individual lakes until the wild rice was deemed ripe for harvest. In 1996, after years of criticism from harvesters about particular decisions to open or close wild rice stands, a state law was passed that would open the ricing season on July 15 each year (MS 84.105). The new law also made it illegal to pick wild rice that is not ripe. Wild rice usually ripens in Minnesota between the third week of August and the second week of September, thus the new law was intended to employ a "pick when ripe" philosophy. The opening date was set early enough so that it would always precede the ripening of the rice, and it would also help avoid opening day rushes that can potentially damage rice stands.

One of the rationales behind the new state law was that most other plant products harvested from the wild are picked when the harvester judges them as ready for food, decorative, or medicinal use. Harvesting wild rice before it is ripe produces a product that has no value as a food or cash crop. The new law reduced the need for extensive MNDNR staff time and subjective judgments. It also helps avoid the opening day "stampede" that seems to be associated with all "opening days", which are often perceived as the best day based on "first-come, first-served".

Most of the treaties, agreements, and statutes discussed above are concerned with the harvest of the wild rice grain rather than with protection or enhancement of natural wild rice ecosystems. Harvest issues are moot if the wild rice resource is lost due to damage of natural stands. The viability of these stands often depends on active management.

For example, more than 200 wild rice lakes benefit annually from removal of beaver dams. These dams block the outlets of significant wild rice lakes, and their removal allows the outlets to flow freely; reducing the threat of excessive flooding of wild rice stands. The authority to remove beaver, beaver dams, and beaver lodges is found in MS 97A.045 Subd.1; 97A.401 Subd. 5; and 97B.655, Subd. 2. Without these statutes the current management efforts of the DNR and its partners (i.e., Ducks Unlimited) would be significantly restricted.

Wild rice and other aquatic plants are protected from unauthorized removal under the MNDNR Aquatic Plant Management Program (MS 103G.615). Guidelines prohibit the removal of

emergent aquatic plants, including wild rice, without an approved permit. Notable exceptions involve the building of duck hunting blinds and gaining access to open water from shorelines. Removal of aquatic plants is allowed for such access though removal is limited to an area 15 feet or less in width.

Less direct, although important, protection is also provided through shoreland protection laws and regulations (MS 103F.201 through 103F.221). This protection is based on a system of classification for lakes and rivers that applies different zoning regulations depending on classification. Classifications include three for lakes and six for rivers. These regulations are implemented by local units of government within a statewide statutory framework that dictates minimum standards. These standards address issues of shoreland development and uses such as sewage treatment, storm water management, minimum lot size and water frontage, building and septic system setbacks, building heights, subdivisions, and alterations of land and vegetation close to the shore.

The stakeholders group for a pilot project in the five-county north-central lakes area surrounding Brainerd raised concerns about increased shoreline development potentially threatening water quality and the traditional use of individual lakes. One result was the development of alternative shoreland management standards through an advisory committee. The alternative standards provide options for local governments to address specific shoreland issues identified in the five-county area. Subsequently, local governments outside the pilot area began considering elements of these alternative standards for use in their own shoreland ordinances.

In 2005, for example, Beltrami County initiated a review of all of their Natural Environment Lakes in cooperation with the MNDNR and Minnesota Pollution Control Agency (PCA). The MNDNR Section of Wildlife and Division of Ecological Resources procured funding to hire two 2-person crews to conduct site visits to inventory these lakes. Surveys were completed with additional funding from the MNDNR Section of Wildlife in 2006. As a result of this work and the input from a Citizen Advisory Committee, Beltrami County rewrote their shoreland ordinance and reclassified their Natural Environment Lakes. They created one additional lake class, Sensitive Area, with protection criteria intermediate between Natural Environment and the more protective Special Protection. The new Beltrami County Shoreland Ordinance was voted on and approved by the Beltrami County Board in December 2006 (R. Gorham personal communication).

Alternative shoreland management standards may include the promotion of conservation subdivisions over conventional subdivisions (i.e., lot and block); multiple classifications on a single lake (i.e. Natural Environment bay within a General Development lake); districts designated as Sensitive Areas for lakeshore segments so that development standards follow Natural Environment Lake class standards; and a new classification of Special Protection for lakes that have considerable wetland fringe, shallow depth, or unique fish and wildlife habitat.

While these alternative standards can provide protection for natural wild rice habitat, local governments too often lack information on the locations of significant stands of natural wild rice. An updated inventory of wild rice stands in Minnesota would help provide this information.

Further regulation of wild rice occurs through the Minnesota Department of Agriculture (MDA). The MDA has approval authority over the permit-regulated release of genetically modified organisms (GMO), which would include genetically engineered wild rice, under MS Chapter 18. MS Chapter 18 also provides for the issuance of export certificates for the international sale of wild rice. In addition, the MDA inspects and certifies that wild rice seed is free of weed contamination and meets germination standards, and that the labeling of packaged wild rice is truthful and accurate (MS Chapter 21).

The 2006 Minnesota Legislature provided the state Environmental Quality Board (EQB) additional authority over issues related to natural wild rice. The EQB is now required to notify interested parties if a permit to release genetically engineered wild rice is issued anywhere in the United States (MS 116C.92, Subd. 2). The 2006 legislation also requires that EQB adopt rules requiring an Environmental Impact Statement (EIS) for any proposed release and a permit for an actual release of genetically engineered wild rice (MS 116C.94 Subd.1b).

While two other State statutes further signify the importance of natural wild rice in Minnesota, they do not provide additional protection for the resource. One statute, adopted in 1977, recognizes wild rice as the State Grain of Minnesota (MS 1.148). This law needs to be amended, however, to accommodate revised scientific nomenclature.

Another important State statute is the labeling law for packaged wild rice (MS 30.49). This was adopted in 1989 following a joint effort between tribal governments and the Minnesota Cultivated Wild Rice Council. Consumers of wild rice benefit from this law in that it distinguishes among natural lake or river wild rice that is hand-harvested, wild rice that is machine-harvested, and wild rice that is cultivated. This legislation further distinguishes between wild rice that is grown in Minnesota and that which is grown outside of the state.

Threats to Natural Wild Rice in Minnesota

Despite its rich history and abundance in Minnesota, natural wild rice faces many current and potential threats in this region. In general, any factor that can affect water quality, seasonal water levels, lakebed conditions, regional climate, aquatic vegetation, or wild rice's natural genetic makeup could potentially threaten stands of natural wild rice. These threats may work in concert or individually to damage wild rice stands. The order in which the threats are presented in this report is not intended to portray or imply the significance of the threat. Instead these threats are divided into stand level or statewide level categories.

Stand-Level Threats

Hydrologic Changes

Wild rice is by its very nature a shallow water plant and sensitive to changes in water levels. The status of natural wild rice in Minnesota was particularly threatened in the late 1800s and 1900s by installations of dams to increase water levels for navigation, logging, flood control and power production. Although wild rice may persist at depths greater than three feet, these plants typically have poor or no seed production. Over time the plants will decline in numbers and density (Engel 1994). Although some aquatic plants will readily migrate to newly created shallow waters, wild rice apparently does so much less frequently. This may be due to limitations on its rate of seed dispersal.

Even when the normal runout elevation of a lake remains steady, heavy precipitation can cause an abrupt though temporary change in water level that can uproot aquatic plants. Natural wild rice is particularly susceptible to uprooting during its floating-leaf stage, which occurs in early summer. At this stage, any rapid increase in water level can cause damage to natural stands. Changes in lake outlets that reduce flow capacity can also significantly impact wild rice by increasing the frequency and severity of these temporary flood events. For example, permanent dams, beaver dams, culverts, and debris such as mats of vegetation can reduce outlet flow capacity and impact wild rice habitat (Ustipak 1983).

These factors can work in concert to produce cumulative effects. For example, culverts can attract beaver because the culvert is a much more restricted area than the creek or riverbed which channels through it. The roadbed often associated with culverts acts as a ready made dike that further contributes to the ease of blockage. As another example, dams and other outlets can be plugged by vegetation such as floating bogs that break loose in high winds. The effect of the dam in reducing outflows is compounded by the blockage raising water levels and increasing the probability of additional bog breaking off.

Changes in upstream watersheds can also reduce the productivity of natural wild rice stands. Drainage ditches and tiles, pumps, and channelization can increase the quantity and speed of waters moving downstream. The resulting peaks in water levels can produce the same effects as reduced outlet capacity by creating abrupt "bounces" or rapid increases in water depth. Increased sedimentation caused by drainage and channelization can also bury seeds and reduce germination.

Increased sedimentation can also increase the height of runout elevations and reduce outlet capacity. These changes can cause long-term damage to natural wild rice stands. The situation is acerbated by the installation of artificial dams. Removing the natural flushing action at outlets causes sediment to accumulate more readily (R. Ustipak, personal communication).

Dams that maintain stable water levels can have long-term deleterious effects on natural wild rice, as well. Water levels that are held stable year after year can create conditions that favor perennial vegetation and shoreline encroachments that impair wild rice habitat.

Recreational Water Use and Shoreland Development

Natural wild rice represents different things to different people. While some consider this native aquatic grass to be a nuisance, others value it greatly as a spiritual entity or as prime habitat for fish and wildlife.

Minnesota is a national leader in numbers of recreational boaters and anglers, with approximately 862,937 registrations for recreational watercraft. Although wild rice provides habitat for spawning fish and their offspring, stands of wild rice can be very frustrating for anglers to fish. Recreational boaters often consider wild rice to be a nuisance because it can be difficult to motor through. The strong stems of erect plants are easily tangled in propellers and may require removal by hand, often by forcibly cutting the tightly wrapped stems.

As a result, wild rice plants are often removed by boaters near docks, in navigational channels, and in other high-use areas. Removal can be direct or incidental due to cutting by propellers or dislodging by excessive wave action (Asplund 2000, Tynan 2000).

As the human population increases, so will the number of boaters. Predictions of demographic changes in Minnesota suggest that the areas of greatest population increases over the next 20

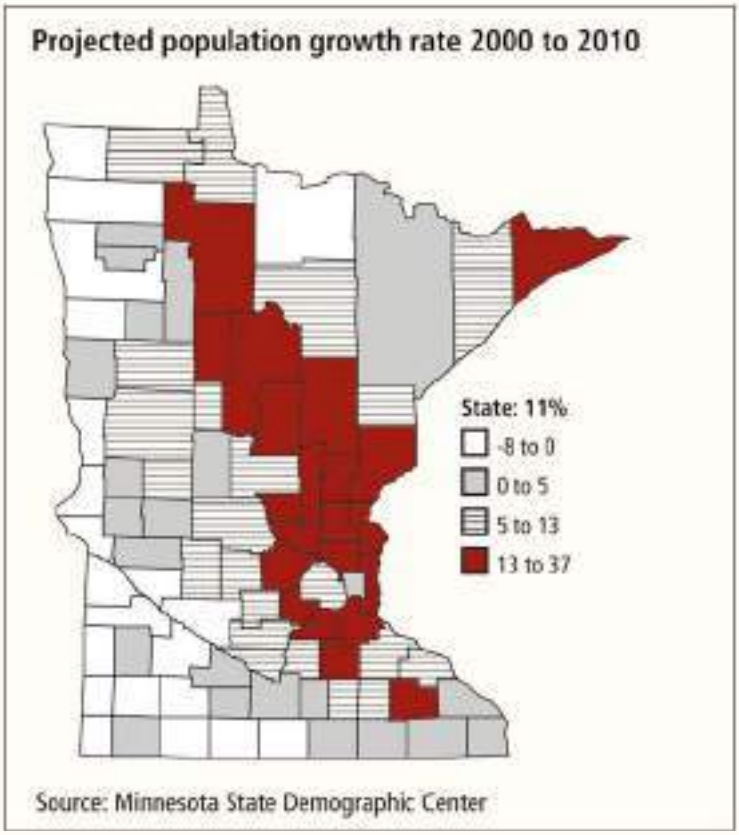


Figure 2. Greatest predicted population growth will occur within the primary range of wild rice in Minnesota.

years will include those counties that currently have the highest occurrence of natural wild rice (Figure 2, Minnesota Department of Administration 2007).

The damming of lakes to enhance recreational water use often corresponds with the increased development of shorelands. Shoreland development has increased dramatically in Minnesota, especially in those counties that include the greatest amount of habitat for natural wild rice. This development is often associated with installations of docks, removal of aquatic vegetation, and increases in nutrient-rich runoff.

Seasonal housing across the lake country of the upper Midwest jumped 500% during the past twenty years (United States Forest Service 2007). As lands bordering deeper lakes become more fully developed, prospective lakeshore buyers are increasingly considering lakes that are shallower, often well-vegetated, and more likely to support wild rice habitat.

The changing pattern of forestland ownership in Minnesota is adding to development pressure. Internationally-owned timber corporations are increasingly divesting of their land holdings as part of their fiscal management strategy. These lands have previously been managed somewhat as public lands and have been protected from development. However, as market values increase for shorelands and riparian areas, corporate stockholders are increasingly interested in selling these parcels. About seven million acres of forestland in Minnesota is privately owned, and predictions are that about one million of these acres may be sold for development (Myers 2006).

Such development often accompanies major changes in shorelines and near-shore vegetation (Radomski and Goeman 2001). Natural wild rice is often viewed only as a nuisance to boaters and other lakeshore users. Few shoreland owners consider the cumulative impacts of docks, vegetation removal, dredging, and runoff.

Although known violations of MNDNR Aquatic Plant Management permits do not always indicate which vegetative species were removed, wild rice is a common target where it occurs. A recent permit violation included the removal of 600 feet of natural wild rice from the shoreline of Upper Whitefish Lake in Crow Wing County. The violator was a new landowner who explained that the plants were an “eyesore”.

Wildlife Activity

Natural stands of wild rice provide excellent habitat for wildlife such as waterfowl and aquatic furbearers. The activities of these animals generally have minimal impact on wild rice stands. Although animals use plant stems for building overwater bird nests and muskrat houses, this activity usually affects only small areas. Moreover, wildlife activity often enhances overall aquatic habitat by creating stand diversity.

An exception to this is when beaver use wild rice stems and other vegetation to plug outlets. The resulting dam increases overall water levels and the probability of damage to natural stands by uprooting wild rice plants.

Birds generally have little impact on natural wild rice. For example, blackbirds, waterfowl and other birds can consume most of the ripening wild rice grain yet still leave more than 200 seeds per square foot (Haramis and Kearns 2004). Canada geese, though, can seriously damage stands of wild rice by grazing on emerging stems. For example, researchers monitored tidal marshes along the Patuxent River in Maryland and documented the loss of existing stands of wild rice due to season-long grazing by the geese (Haramis and Kearns 2004).

Although currently not common in Minnesota, some damage to rice stands has been attributed to Canada geese. High concentrations of geese on small lakes or impoundments have eliminated wild rice crops in some years through overgrazing of the emerging stems (R. Naplin and D. Rhode, personal communication). However, ongoing management of resident populations of Canada geese in Minnesota can limit this type of depredation through increased harvest levels . By contrast, shoreline development that converts communities of native vegetation to managed lawns can result in locally concentrated populations of geese that then may overgraze adjacent wild rice stands.

The effect of trumpeter swans on natural stands of wild rice is less clear. Populations of these native birds are slowly recovering after extirpation in the 1800s from most of their range. Anecdotal reports suggest that swans can damage natural stands of wild rice in particular areas (P. David and R. Naplin, personal communication). Nevertheless, low numbers of trumpeter swans combined with a preference for submergent vegetation suggest that these birds pose a minimal threat to natural wild rice (LaMontagne 2000, Norrgard 2006).

Some non-native species of wildlife do threaten stands of wild rice. These will be discussed below (Non-native Invasive Species section).

Plant Competition

Natural wild rice must compete for space, light, and nutrients with other aquatic plants, particularly perennial species (Rogosin 1951). Competitive species include submerged pondweeds (primarily *Potamogeton* L. spp.), floating leaved plants such as waterlilies (*Nuphar* J.E. Smith and *Nymphaea* L. spp.), and emergents such as cattail (*Typha* L. spp.) and pickerelweed (*Pontederia cordata* L.). Seasonal water levels play an important role in this competition (Meeker 2000). Natural wild rice may be favored at depths of one to two feet.

Pickerelweed may be an exception in at least three locations in Minnesota where ongoing management to benefit wild rice also found pickerelweed increasing significantly (N. Hansel-Welch, personal communication). Promising management responses have included lowering water levels in winter to freeze and desiccate pickerelweed roots, and cutting competitive species during spring and summer using airboats (McDowell, 2006) or harvesting machines (T. Howes, personal communication). However, maintaining stable water levels over many years may favor other species (D. Vogt, personal communication). Perennial species such as pickerelweed can establish footholds and thus gain the advantage in lakes that are maintained at constant levels. .

The seeds of natural wild rice can remain dormant for years until conditions are more favorable for germination. This trait allows rice to maintain long-term viability through years of low

productivity. Natural wild rice is well-adapted to annual fluctuations in water levels, while other species may be less suited to such changes.

Strong competition among native aquatic plants appears to be localized and specific to individual stands. It does not appear to be a significant factor limiting the distribution or abundance of natural wild rice in Minnesota (Meeker 2000, Norrgard 2006).

Mining and Other Industrial Activity

Mining and industrial activities can potentially adversely affect stands of natural wild rice. For example, this can occur when hydrology is altered in watersheds that support natural wild rice. Alterations can result from the pumping and dewatering of sites. This increases downstream flows (discussed earlier in Hydrologic Changes section) and subsequent depressions in groundwater in surrounding areas. The potential effects of groundwater depression are not well understood. Water levels in basins with higher gradients could be sufficiently lowered to cause shallow areas inhabited by wild rice to dry out.

Other adverse effects can result from the release of chemicals such as sulfate from mine pits and tailings. These chemicals can negatively affect wild rice as well as other plant and animal species in the area. Seepages from tailings can exceed the state established water quality criteria of 10 mg/L for wild rice waters. For example, sulfate has been measured at 1,000 mg/L in these seepages (Udd 2007). State agencies are working with mining companies to decrease sulfate concentrations in discharge waters. Tribal governments express strong concern over the cumulative impacts of the many historic, currently operational, and planned mines in northeastern Minnesota.

Statewide Threats

Loss of Natural Genetic Characteristics

The cultural, ecological, and economic value of natural wild rice distinguishes it as a unique natural resource in Minnesota. There is strong agreement among stakeholders that it is critically important to maintain the natural genetic diversity of natural stands of wild rice (Porter et al. 2000, LaDuke and Carlson 2003). This importance reflects an understanding of spiritual and cultural values, biological and ecological principles, and agricultural and economic realities.

Natural population diversity provides wild rice the ability to adapt to changing environmental conditions such as annual variations in temperature and precipitation. Maintaining natural genetic diversity provides the best chance for any species to survive variations related to global warming, for example (BSU-CRI 2007). Ongoing analyses continue to support the position that managing for high biodiversity will best insure the survival of plant and animal communities that have characterized the Great Lakes region for thousands of years.

The flower structure and timing of maturation of wild rice promotes cross-pollination within and among stands. Wind pollination further insures genetic diversity. Genetic variability allows for the natural selection of traits that perform best under different environmental conditions. Studies

in Wisconsin found sufficient genetic diversity between distinct stands of natural wild rice to identify potentially distinct regional populations. The degree of diversity within the stands also varied widely, with larger and denser stands being most diverse (Lu et al. 2005, Waller et al., 2000). The degree of genetic variability within and among natural stands of wild rice in Minnesota is not known. Thus our ability to recognize changes in the genetics of natural wild rice in this region is limited.

Although some studies of wild rice pollen travel have been conducted (Cregan 2004), more research is needed to understand the potential for genetic transfer among natural and cultivated stands. Drift of wild rice pollen may exceed that of other cultivated crops due to the small size of the pollen and its relatively slow settling rate (P. Bloom, personal communication). In addition, a study in Canada has provided evidence that wild geese, and perhaps ducks, can be important transporters of pollen to lake sediments (McAndrews et al. 2007). This raises the possibility that waterfowl may also serve as transporters of viable pollen.

Another means of introducing new genotypes into local populations is the intentional seeding of wild rice to restore historical sites or to develop new stands. Such plantings have a long history in Minnesota. For example, the demand for seeds of wild rice and other native plants helped to establish businesses such as Wildlife Nurseries, Inc. in 1898, in Oshkosh, Wisconsin (Oelke 2007). However, the risks associated with introducing nonlocal genes into local native gene pools are of increasing concern to many scientists (Maki and Galatowitsch 2004).

Plant breeding programs have developed strains of wild rice suitable for commercial production (Oelke 2007). Consistency in plant morphology, control of shattering, and disease resistance have been important objectives of these programs. Because wild rice pollen is airborne, some have expressed concerns about unplanned cross-pollination between cultivated stands and natural stands. At this point in time, however, traditional wild rice breeding programs are not thought to pose a threat to natural stands since the cultivated varieties reflect the selection of genes from within the naturally occurring gene pool (R. Porter, personal communication).

There have been concerns expressed about the potential impact of transgenic engineering. The dramatic increase in use of this technique to alter food crops has been followed by questions concerning its safety, economic losses, potential impact on the natural environment, regulatory framework and compliance, and the ability to mediate unplanned releases. One of the driving forces behind these concerns is evidence that current gene containment practices cannot achieve absolute protection from unwanted pollination (Thai 2005). The unplanned cross-pollination between cultivated crops such as creeping bentgrass and wild relatives has fueled the concerns of both environmentalists and agricultural producers (Haygood et al. 2003, Weiss 2006).

These concerns are evident in the international guidelines for sustainable forest management developed by the Forest Stewardship Council (FSC). The state of Minnesota has actively sought certification of its public forestlands under the Regional Forest Stewardship Standards published by the council. These standards specifically prohibit the use of genetically modified organisms within certified forests (Minnesota Forest Resource Council 2004).

While there are no known research programs in any country to produce transgenic varieties of wild rice (R. Phillips, personal communication), DNA of wild rice has been transferred to white rice (Abedinia et al., 2000). The very possibility of transgenic engineering wild rice generates deep cultural, economic, and ecologic concerns. These include issues surrounding Native American rights, food safety and nutritional value, protection of economic markets, patenting of species, and protection of natural resources that already face significant threats (LaDuke and Carlson 2003).

This controversy ultimately relates to differing worldviews and the valuation of risk and consequences. For some stakeholders, there is no level of acceptable risk. For others, the potential benefits of genetically engineered wild rice may be worth the possible consequences of escaped transgenic traits. A thorough analysis of the cultural, economic, and ecological consequences of genetic contamination of natural wild rice in Minnesota is required to assess potential impacts.

Transgenic alterations of some U.S. crops will likely continue for the foreseeable future. Traditional plant breeding will also continue. A better understanding of the natural genetic variability of wild rice in Minnesota would increase our understanding of the potential impacts of these activities. Efforts to restore native wild rice to its historical range should be encouraged. Studies of the natural variability and ecological requirements of natural wild rice in this region would enhance these efforts.

Non-native Invasive Species

Non-native invasive species impact every aspect of natural resource management in Minnesota. Protecting and managing natural stands of wild rice is no exception. The movement of watercraft from one wild rice lake to another creates the potential for transfer of invasive animals and plants.

The common carp (*Cyprinus carpio*) leads the way in historical presence and impact. Common carp feed primarily on invertebrates in bottom soils. Their feeding action dislodges plants and suspends fine particles into the water column. The increased turbidity, caused both by disturbed sediments and by algae stimulated by the phosphorus released from disturbed sediments, shades out aquatic plants. Turbidity then increases as non-vegetated lake bottoms are disturbed by wind. The reduction in aquatic vegetation also allows for increased boat traffic and wave action that can further dislodge plants such as wild rice (Pillsbury and Bergey 2000).

Natural stands of wild rice are negatively impacted by turbid conditions during early stages of growth and by disturbances to bottom soils and boat traffic in later stages. The common carp is primarily a problem today in southern Minnesota, where the species occurs in high densities. Carp likely contributed to the loss of natural wild rice from its historic range in this region (Norrgard, 2006). If the predicted changes in climate in northern Minnesota result in warmer waters, carp could achieve higher densities in that region and cause significant damage within the core of prime habitat for natural wild rice.

The non-native rusty crayfish (*Orconectes rusticus*) can directly impact wild rice by cutting stems of the plant. Although the extent of this depredation in Minnesota is not known, significant impacts of native crayfish on cultivated wild rice have been documented (Richards et al. 1995). Native to parts of some states in the Great Lakes region, rusty crayfish have invaded portions of Minnesota, Wisconsin, and Ontario, including areas that are important for wild rice. Rusty crayfish frequently displace the native crayfish, reduce the diversity and abundance of aquatic plants and invertebrates, and reduce some fish populations (MNDNR 2007).

Rusty crayfish were first documented in Minnesota in 1967, at Otter Creek in southern Minnesota. Twenty years later, a statewide survey documented their presence in many areas (Helgen 1990). To date, rusty crayfish have been found in 31 lakes and streams in 11 counties. They prefer areas where rocks, logs, or other debris provide cover. Preferred sediment types include clay, silt, sand, gravel, and rock. The soft organic sediments usually favored by wild rice do not seem to be favored by rusty crayfish and may help minimize their impact.

The non-native mute swan (*Cygnus olor*) can seriously threaten the sustainability of natural wild rice stands (P. Wilson, personal communication). To date, Minnesota has limited the number of these birds to only a few that are held in captivity. With continued efforts to identify free-ranging non-native swans and to respond rapidly with control measures, their impact on natural wild rice in Minnesota could be minimal.

Invasive plants such as purple loosestrife (*Lythrum salicaria* L.), curlyleaf pondweed (*Potamogeton crispus* L.), and Eurasian water milfoil (*Myriophyllum spicatum* L.) occur throughout much of the range of natural wild rice. Although these species may prefer water depths that do not favor wild rice, more research is needed to better understand the potential for competition. It is known that these invasive species can disrupt local aquatic ecosystems and lower habitat quality overall. However, it is also important to monitor the mechanisms of control to insure that these do not have unintended effects on natural wild rice.

Hybrid cattail (*Typha* x *glauca*), a cross of native and non-native cattail (*Typha latifolia* L. and *Typha angustifolia* L., respectively), competes directly with natural wild rice for shallow-water habitat. These plants aggressively form thick mats of roots that can float as water levels fluctuate. The bog-like mats expand across areas of shallow water and can plug lake outlets when broken off and blown by high winds.

Native sedge bogs often border wild rice lakes in northern regions. These bogs are increasingly being invaded and eventually dominated by hybrid cattails. High infestations of hybrid or non-native cattails near lake outlets can increase rates of sedimentation. This, in turn, can combine with the additional plant material to further decrease outlet capacity (R. Ustipak, personal communication).

A relatively new threat to natural stands of wild rice is the non-native flowering rush (*Butomus umbellatus* L.). Found in similar habitats as native bulrush (*Scirpus* L. spp.), which it resembles, flowering rush can persist in either emergent or submergent forms. Though its distribution in Minnesota is limited, its range is expanding. Flowering rush spreads primarily through

rootstalks. At a site in Idaho, flowering rush was documented to be out-competing other plants such as willow (*Salix* L. spp.) and cattail (MNDNR 2007).

Another potential threat to natural wild rice in Minnesota is the non-native form of phragmites, or common reed [*Phragmites australis* (Cav.) Trin.]. While phragmites appears in fossil records for North America as early as 40,000 years ago, the non-native form was likely introduced in the late 1700s in ship ballast from Europe. Common reed has since dominated Atlantic coastal marshes and migrated landward, particularly during the 1900s. To date, the non-native form of common reed has invaded natural areas in 18 states including Wisconsin and other Great Lakes states. Although it is still rare in Minnesota, this exotic has been observed in a few disturbed sites in the Minneapolis-St. Paul area and in Duluth harbor (L. Skinner, personal communication).

Although phragmites can spread by seed, the most aggressive growth occurs through rhizomes. Non-native phragmites forms a dense network of roots that can reach several feet in depth. It spreads horizontally by sending out rhizome runners that can grow ten or more feet in a single season if conditions are favorable. Very dense stands are formed, that include live stems as well as standing dead stems from the previous year. The stems of non-native phragmites often reach 15 feet in height along the Atlantic coast.

In a recent study of phragmites in wetlands at Long Point, Lake Erie, researchers found that the occurrence of phragmites increased exponentially in the late 1990s. Of the 31 stands analyzed, 28 (90%) were dominated by the non-native strain (Wilcox et al. 2003). Part of the rapid expansion of the non-native form may be related to its ability to weaken the root structure of adjacent plants through the secretion of gallic acid, which attacks a structural protein (tubulin) in the roots of competing plants (Murray 2007).

Climate Change

The warming of the earth is now evident from measurements and observations. These include increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising global sea levels. The average surface temperature of Earth has risen by about 1.3° F since 1850. The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC), published in 2007, projects that the average global surface temperature is likely to further increase by 3 to 7° F by the year 2100. This projection assumes a moderate level of action to reduce anthropogenic emissions of greenhouse gases.

According to the IPCC, the lower end of this range (i.e., a further warming of 3° F) represents a threshold for the earth beyond which irreversible and possibly catastrophic changes are likely. If the projections of global warming this century are met, most living things on Earth will likely face severe consequences.

What will predicted changes in climate mean for natural stands of wild rice in Minnesota?

Although climatologists agree that temperatures in this region will increase, predictions of precipitation vary (Figure 3, Kling et al. 2003). Some climate models predict that increasing temperatures will lead to increasing frequency and duration of droughts in the Dakotas and

western Minnesota. Hot, dry conditions can negatively impact the pollination of wild rice and thereby reduce its seed production.

Warmer temperatures will also reduce the severity of winters. The required cold temperature (35° F or less) dormancy of three to four months for wild rice seeds could be reduced, particularly in the southern portions of its range. In addition, warmer conditions often favor non-native species. In particular, warmer waters may increase the survival and spread of carp across Minnesota. Because wild rice lakes, rivers, and wetlands are interconnected, protection of wild rice habitat from carp could become very difficult.

Invasive species such as the non-native phragmites may also benefit from warmer temperatures. Many exotics, such as hydrilla *[Hydrilla verticillata* (L. f.) Royle] and water hyacinth *[Eichhornia crassipes* (Martius) Solms-Laub.] are limited by cold climates (Holm et al. 1977; Langeland 1996). Increased average temperatures may enable these extremely invasive non-native species to migrate and gain footholds in Minnesota. Species such as these could have severe impacts on wild rice waters.

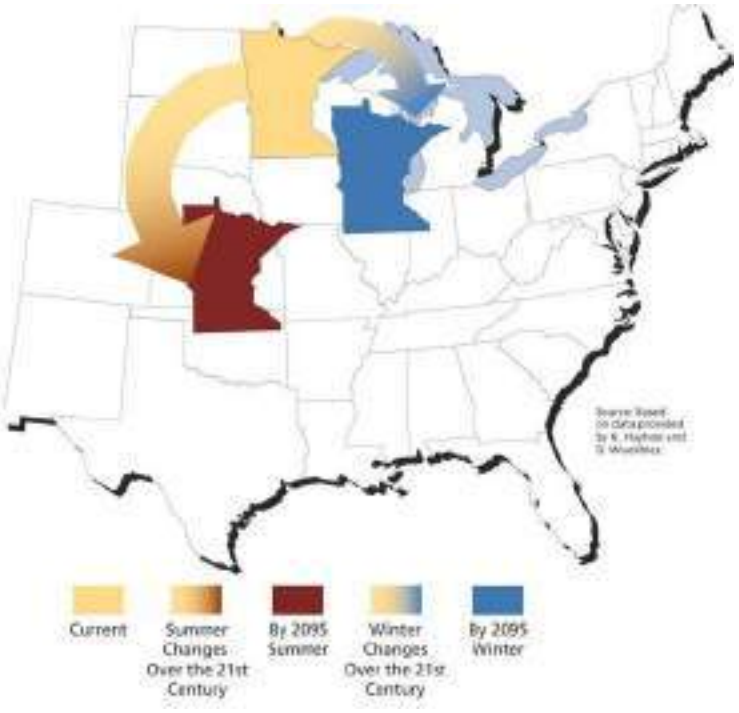


Figure 3. Predicted climate change will effectively alter Minnesota to reflect the climate of states to the south.

The frequency of dewpoints above 70° F is already trending upward in Minnesota (Seeley 2007a). Warm, humid conditions support diseases of wild rice such as brown spot (*Bipolaris oryzae* Luttrel and *Bipolaris sorokiniana* Luttrell) and other pathogens. For example, high humidity and sustained warm overnight temperatures in early August 2007 promoted the development of brown spot in many natural wild rice stands in Minnesota. Estimated crop losses in some stands were 70 to 90% (R. Ustipak, personal communication).

There is strong agreement that global warming will result in increased severity of individual weather events (Seeley 2006). According to Dr. Mark Seeley, University of Minnesota climatologist, 2007 may be representative of the future conditions in Minnesota. In August 2007, the U.S. Department of Agriculture declared 24 Minnesota counties to be in severe drought and eligible for federal assistance. Also in August 2007, the Federal Emergency Management Agency declared seven counties in southeastern Minnesota to be flood disasters, also eligible for federal assistance (Seeley 2007b).

In nearly two hundred years of weather history, there are no records of such extremes occurring in the same month of the same year in Minnesota. Increasing severity of storm events will cause more flooding and hence more abrupt changes in lake levels during the growing seasons of wild rice and other aquatic vegetation. Natural wild rice will be particularly susceptible to damage while in the floating-leaf stage.

The southern edge of the range for natural wild rice may already be receding northward. While many factors have likely contributed to a decline in range of natural wild rice, climate may well be involved.

Lack of Recruitment and Retention of Harvesters

As Minnesotans have fewer positive experiences with natural wild rice through harvesting, hunting, trapping, or wildlife watching, they are less likely to recognize or have concerns about its potential loss. They are also less likely to appreciate the severe impacts that the previously noted threats could have on wild rice, and thus on the historic and culturally rich quality of life in Minnesota. This loss of appreciation, while not a direct threat to rice in itself, nevertheless increases the risks for wild rice because the level of resource protection and management is often based on its perceived value.

The protection and management of natural wild rice relies not only on tribes and agencies, but on the users of the resource, as well. Harvesters support management activities through the purchase of annual licenses. Because they have a personal stake in the future of natural wild rice in Minnesota, they are the ones most likely to report activities that are damaging the resource. Harvesters are also great advocates for natural wild rice. They promote its value within the ricing community and to the state as a whole.

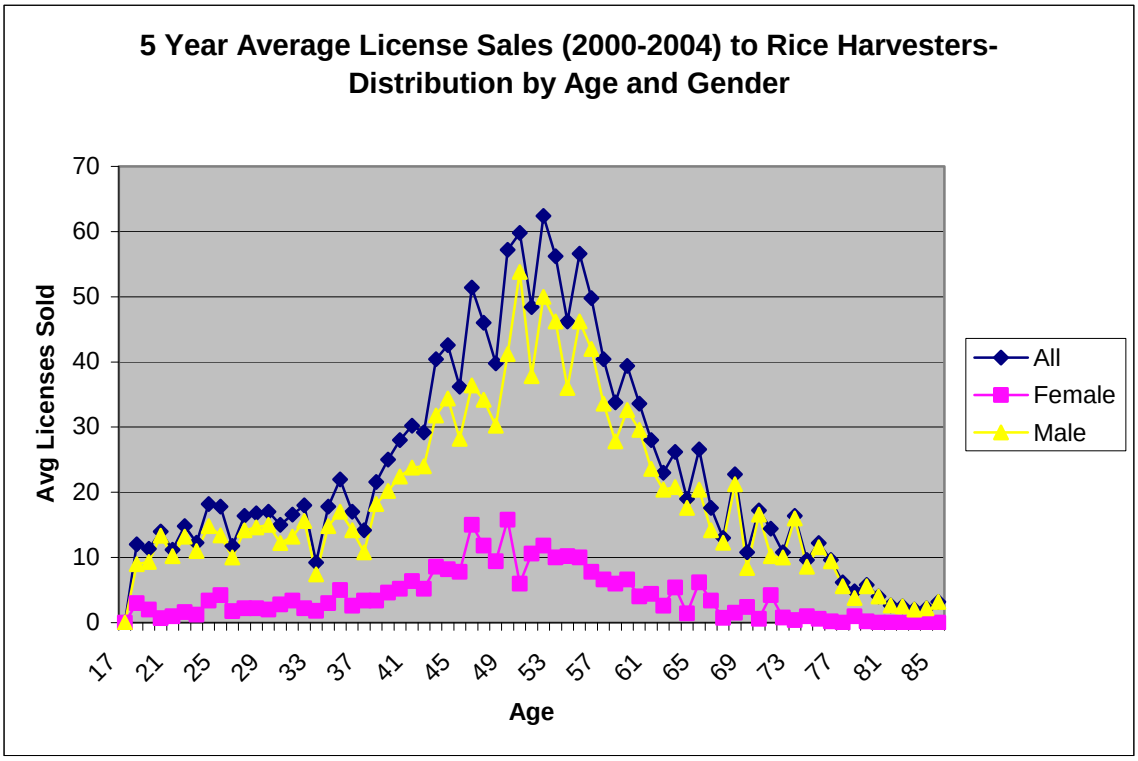


Figure 4. Age distribution of state licensed wild rice harvesters.

Wild rice harvesters are relatively few in numbers, though, and these numbers have declined over the last fifty years. During the 1960s, sales of state licenses in Minnesota averaged over 10,000 per year. Since 2000, these sales have averaged fewer than 1,500 annually. Harvesters under tribal regulations are not required to purchase a state license. Their numbers are estmated to exceed 3000 (R. Norrgard personal communication) and have likely experienced moderate increases in recent years (J. Persell, personal communication).

The MNDNR surveyed wild rice harvesters who purchased licenses from 2004 to 2006 to gather information on harvester characteristics and potential barriers to participation. This survey found that the majority of harvesters were male and at least 40 years old (82% and 81%, respectively). Figure 5 illustrates a similar age distribution from 2000 to 2004. Nearly all of the harvesters who responded had been introduced to wild rice harvesting by a friend or family member (87%).

Although most were satisfied with their harvest experience (82.3%), those surveyed identified several barriers to continuing this tradition. The most important barriers were time, knowing when to harvest, knowing where to harvest, and finding a wild rice processor. Other barriers included finding a ricing partner, physical challenges, financial expenses, finding a buyer, and having proper equipment.

Even for experienced harvesters, the difficulty of finding information on where and when to harvest can limit participation. For those living outside of natural wild rice areas, finding this information can be particularly difficult. For new harvesters, even finding a processor to finish the rice is a significant challenge.

Difficulty in acquiring harvest-related information may influence the distribution of harvesters and harvesting pressure on individual stands. The MNDNR 2006 survey revealed that only 25 lakes accounted for half of all harvesting trips. By contrast, the inventory of wild rice stands compiled for this document indicates that 119 lakes (100+ acres in size) account for more than half of the acreage of natural wild rice in Minnesota.

Addressing the educational or informational needs of Minnesotans interested in natural wild rice has been largely ignored. As with other natural resources in Minnesota, the lack of recruitment and retention of harvesters threatens the sustainability of natural wild rice in the state. Without readily available information and inspiring programs of education, public support of protection and management of the very resources that define Minnesota will likely decline.

Management Challenges

The future of natural wild rice in Minnesota will depend in large part on its protection and management by state and tribal natural resource agencies. The most important management issues relate to those threats identified in the previous section. The challenges that managers of natural wild rice face are further complicated because of limitations to their authority, inherent variability of wild rice production, and the need for additional information concerning wild rice in Minnesota.

Multiple Jurisdictions

Minnesota state statutes provide that ownership of wild rice and other aquatic vegetation is vested in the state (MS 84.091). State statutes also establish regulatory control over wild rice removal and harvest (MS 84.10, 84.15, 84.027, 84.28). Exceptions to state harvest regulations apply in geographic locations that are described by treaties and subsequent agreements, statutes, and rules (MS 84.10, MR 6284.0600 and 6284.0700). State and tribal enforcement officers often operate under temporary agreements until formal agreements are finalized.

The enforcement of harvest regulations in Minnesota is mainly stable and without major controversy. One issue still being discussed, however, is the posting of lakes as "closed" to wild rice harvest until it is determined that the grain is ripe. Both state and tribal governments have done this in the past on lakes that are popular with harvesters. In 1996, a new state law was passed that opened the ricing season on July 15 each year and made it illegal to pick rice that is not ripe (MS 84.105). Because wild rice usually ripens in Minnesota between the third week of August and the second week of September, the new law was intended to encourage a "pick when ripe" philosophy.

Most tribal governments have continued to post popular wild rice lakes within their jurisdictions. For many tribes, this practice is part of a long-standing tradition that relies on counsel provided by tribal committees. Tribes have urged the state to work cooperatively to post additional lakes. The position of the state, however, is that posting is unnecessary for the long-term health of the wild rice resource and the MNDNR currently has statutory authority only to post lakes as "closed" to "protect against undue depletion of the crop so as to retard reseeding or restocking of such area or so as to endanger its effective use as a natural food for waterfowl" (MS 84.15). In some cases, productive wild rice lakes are within both tribal and state jurisdictions. For these lakes, the differences in management philosophy have created conflicts between tribal and state agencies and with some harvesters.

Jurisdictional issues also arise over management of lake resources in general. Although the state of Minnesota has the responsibility of ownership of natural wild rice, the state includes many agencies, and each has its own mission and interest groups. No single agency or governmental entity in Minnesota assumes all of the responsibility for protecting natural wild rice. In public waters, the MNDNR takes the lead to regulate harvest and damage or removal of wild rice plants. Counties take the lead, within state statutory guidelines, to regulate shoreline development and most local recreational surface-water use. The Minnesota Pollution Control Agency regulates discharges to waters throughout the state; the Minnesota Department of

Agriculture assumes the lead for issues involving cultivated wild rice; and the state Environmental Quality Board has the lead responsibility to coordinate, notify, and evaluate any potential release of genetically engineered wild rice.

Within the MNDNR, the Division of Waters assumes the lead on shoreline regulations; the Division of Ecological Resources leads on aquatic plant management and invasive species; and the Division of Fish and Wildlife leads on habitat management for fisheries and wildlife values. The MNDNR Division of Enforcement is responsible for enforcement of natural resource regulations including the harvest of natural wild rice except when tribal regulations apply.

A formal, interdisciplinary planning process for Minnesota lakes does not exist. Lake management plans typically reflect the specific goals of the sponsoring entity. The plans often focus on aspects of either fisheries, wildlife, water quality, or vegetation without considering a comprehensive approach that addresses all of these components of a lake ecosystem.

Within Minnesota state statutes, there is no unifying policy of wild rice management that provides integration of these various agencies. By contrast, a unifying policy is clear regarding wetlands. Under public water laws, state statutes declare that it is in the public interest to increase the quantity, quality, and biological diversity of Minnesota's wetlands (MS 103A.201 subd. 2). A similar policy statement would help insure the sustainability of the natural wild rice resource in Minnesota.

Annual Crop Variability

Management by MNDNR and its conservation partners to maintain water levels beneficial to natural wild rice stands has never been greater. Water level monitoring, beaver control, debris removal, and invasive species management has annually taken place on more than 200 lakes and impoundments with significant wild rice stands. This management is based on the combined efforts of the Minnesota Department of Natural Resources, U. S. Fish and Wildlife Service, Ducks Unlimited, Tribal governments, and at least three lake associations. Much of the funding for these management efforts comes from the revenue generated by wild rice license sales.

Nevertheless, the expectations of those who value natural wild rice often exceed the capabilities of those responsible for protecting and managing this resource in Minnesota. A particularly difficult challenge for managers is the critical role that weather plays in wild rice development. Even when growing conditions have been exceptionally favorable, a single storm can reduce or even devastate the local harvest. At best, wild rice managers can “set the table” by maintaining free-flowing outlets or by setting appropriate runout elevations on water control structures. These management actions improve the harvest potential in good years and lessen the impact of poor conditions in less favorable years.

It can be easy for both user groups and managers to overlook the reality that natural wild rice has adapted to changing weather patterns through strategies that promote long-term survival rather than consistent annual abundance. The boom and bust cycle of natural wild rice has been recognized for centuries. This variation in annual productivity may be driven as much by seed dormancy and nutrient cycling as it is by variable weather. Resource managers, wild rice

harvesters, and other stakeholders must remember that productivity of natural wild rice is highly variable, both by stand and by year. Responsible management of this unique resource should strive to maximize its long-term sustainability in the Great Lakes region.

Information Needs

To effectively manage natural wild rice for future generations, resource managers need a better understanding of its natural ecology; its historical losses and patterns of abundance and distribution; threats to its sustainability; and the needs of harvesters.

While much has been learned about the ecology of wild rice over the last several decades, adequate information is still lacking on environmental tolerances and limiting factors such as water and sediment chemistry, seasonal water levels, and disturbance. This information will help create a better understanding of the historical reductions in wild rice distribution and provide much needed guidance for restoration of wild rice habitat.

In addition, a better understanding of ecological relationships in wild rice waters could guide strategies to counter threats such as mining and climate change. Improved ecological understanding would also provide much needed insight into the issues of invasive species. Of particular concern is the potential spread of carp, flowering rush, and exotic phragmites. Better assessments of the damage caused by rusty crayfish are needed as well.

Another concern is that basic information concerning the natural genetic makeup of native stands of wild rice is lacking. An understanding of the natural genetic variability of natural wild rice in the Great Lakes region and genetic drift between stands is critical. This information is needed to guide restoration efforts, particularly in the face of changing climate, and to help detect changes in diversity. We also need to better understand reproduction and its role in population genetics of natural wild rice.

More thorough information is needed on the distribution and overall acreage of natural wild rice in Minnesota. For this study, the MNDNR and the Wild Rice Study Technical Team revised and updated an earlier database of this information (Appendix B). While the recent revision is the most complete and detailed information of its kind for Minnesota, it still represents a gross estimate because information for many lakes, wetlands, rivers, and streams is incomplete or totally lacking. Further refinements and updates to this database are needed. In addition, refined methods are needed to improve the monitoring of annual productivity and the effects of management actions. This information would also help identify new opportunities for harvesters and better distribute harvesting pressure. With improved methods of monitoring and more complete databases, the overall health of the wild rice resource will be better managed.

Managers also need to better understand the harvesters of natural wild rice. What are annual trends? How can agencies and the wild rice community encourage retention of existing harvesters and recruit new people to continue this tradition? Who are the potential harvesters and what do they need in terms of ricing information, education, and support to be successful? The future of the wild rice resource in Minnesota may very well depend on the level of interest in its harvest and traditions.

Department of Natural Resources Recommendations

Introduction

This section is in response to the legislative request to include recommendations "on protecting and increasing natural wild rice stands in the state". The following recommendations were developed with valuable input and discussion from the members of the Wild Rice Study Technical Team and Partnership Team. However, the Minnesota Department of Natural Resources assumes sole responsibility for these recommendations as written and presented here.

MNDNR recognizes the importance of protecting natural wild rice beds from genetic modification and agrees with wild rice stakeholders that this protection is critical to the future of this resource. We strongly support the Environmental Quality Board in adopting rules that require an environmental impact statement for a proposed release of genetically engineered wild rice (MS 116C.94 Subd.1b).

Recommendation 1

Recodify current wild rice harvest statutes and rules to remove duplication and inconsistencies.
Rationale: The state's wild rice statutes and rules have been developed and modified piecemeal over a long period of time. As a result they contain a number of inconsistencies and duplication. Most of these changes relate to the harvest regulations (MS 84.27 – 84.91) although statutory recognition of wild rice as the state grain (MS 1.148) is also out of date in its nomenclature.

Recommendation 2

Establish statutory policy guidance on wild rice and its management.
Rationale: Within state statutes there is no unifying policy that provides direction to agencies responsible for some aspect of wild rice management. In contrast, the policy of the state is clear when it comes to wetlands. State statutes declare that it is in the public interest to increase the quantity, quality, and biological diversity of Minnesota's wetlands (MS 103A.201 subd. 2). A similar policy statement concerning natural wild rice would be useful guidance for state and local agencies. Suggested language includes "The legislature finds that natural wild rice in Minnesota provides public value by its contributions to fish and wildlife habitat, ecological diversity, environmental quality, recreational opportunities, cultural traditions, human sustenance, and economic well-being, and that it is in the public interest to protect existing natural wild rice stands, including their inherent genetic diversity, and restore wild rice to its historic range and abundance for its ecological, economic, and cultural values."

Recommendation 3

The DNR will convene an interagency workgroup in 2008 to identify desired statutory updates in harvest regulations.
Rationale: Harvest regulations and license fee structure should be reviewed by an interagency work group for suggested changes that would work towards resolution of posting lakes closed to harvest and regulating reservation border lakes, as well as encouraging recruitment and retention of wild rice harvesters. Possible changes include broadening the use of funds deposited in the wild rice account to allow for information and education, removal of the season framework, adding a combination (spouse) license, extending special one-day license, providing special one-day mentored license for resident and nonresident participants in formal education programs, and establishing a special youth day when mentors are not required to have a license.

Recommendation 4

The DNR will designate and publish a list of important natural wild rice areas.
Rationale: Recognizing important wild rice areas and publishing the list would call attention to the importance of these areas, indicate management priorities, and provide a formal list that may prove useful for local units of government that are considering zoning and surface use restrictions.

Recommendation 5

The DNR will convene a standing interagency wild rice workgroup to share information and develop recommendations for inventory methodology and trend assessments, education and information outreach, lake planning and management, harvester recruitment and retention, and other management issues as they arise.
Rationale: Comprehensive protection and management of wild rice involves multiple agencies. Management needs include better inventory information including consistent methodology for trend analysis, documenting natural genetic diversity, and establishing long-term case studies on identified lakes. This information will encourage sound restoration strategies and help foster the development of interdisciplinary lake management plans. In addition, the workgroup should focus on developing outreach information for harvesters, shoreline owners, realtors, boaters, and outdoor educators.

Recommendation 6

Increase intensive natural wild rice lake management efforts and accelerate the restoration of wild rice stands within its historic range.
Rationale: Protecting and managing natural wild rice resources on many lakes requires active annual management activities to maintain free flowing outlets. The MNDNR works cooperatively with other agencies and nonprofit organizations such as Ducks Unlimited to accomplish this management. Tribal agencies also conduct independent management efforts on specific lakes. In recent years these efforts have improved wild

rice habitat on approximately 200 lakes and impoundments annually. Additional funding could expand accomplishments beyond current efforts.

The MNDNR has also been involved to a lesser extent in restoring wild rice to wildlife habitat areas within the historic range of natural wild rice. These efforts should be accelerated as funding, time, and opportunity permit.

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Appendix A

Natural Wild Rice Study Development Process

Scope: This study provided an information document on natural wild rice developed with conservation partner input, review, and possible endorsement. The document included the current location and estimated acreage and area of natural stands; potential threats to natural stands, including, but not limited to, development pressure, water levels, pollution, invasive species, and genetically engineered strains; and recommendations to the house and senate committees with jurisdiction over natural resources on protecting and increasing natural wild rice stands in the state.

Format: The final document was formatted to include an Executive Summary, Introduction, Background, Threats, Management Challenges, Recommendations, and Appendices.

Process: A Partnership Team was organized to review, comment, and consider endorsement of the planning process, interim draft of the document, and the final draft to be released for public review. DNR Assistant Commissioner Bob Meier chaired the Partnership Team. Invited members of the Partnership Team included representatives from other agencies and organizations including DNR Tribal Liaison Paul Swenson, the DNR Divisions of Ecological Services, Enforcement and Waters, MN Department of Agriculture, Board of Water and Soil Resources, Minnesota legislature (Representatives Frank Moe and Sondra Erickson), U. S. Bureau of Indian Affairs, U. S. Fish and Wildlife Service, U. S. Natural Resources and Conservation Service, Minnesota Chippewa Tribe, Tribal representatives, Ducks Unlimited, MN Wild Rice Council, Minnesota Waterfowl Association, Save Our Rice Alliance, Minnesota Waters, and the Association of Minnesota Counties. The Partnership Team was offered the opportunity to submit dissenting reports to be included in the appendices.

A Technical Team was organized to propose the document development process, develop the draft document and incorporate revisions as the process proceeded. DNR Wetland Wildlife Program Leader Ray Norrgard chaired the team and assumed the role of lead writer. Invited members of the Technical Team will include DNR wildlife field staff Gary Drotts, Ann Geisen, Shelley Gorham, Beau Liddell, Rob Naplin and Regional Enforcement Supervisor Ken Soring, along with Michelle McDowell (Fish and Wildlife Service), Becky Knowles (Leech Lake Department of Resource Management), Rod Ustipak (Consultant), Jon Schneider (Ducks Unlimited), MN Wild Rice Council (Beth Nelson and Jon Dokter), Rachel Walker (University of Minnesota – St. Paul), Dr. Ron Phillips (University of Minnesota – St. Paul), Dr. Raymie Porter (University of Minnesota- Grand Rapids), Annette Drewes (University of Wisconsin), Thomas Howes (Fond du Lac Reservation), Darren Vogt (1854 Authority), Steve Smith and John Persell (Minnesota Chippewa Tribe), Mike Swan (White Earth Reservation), Andrea Hanks (White Earth Land Recovery Project), and Peter David (Great Lakes Indian Fish and Wildlife Commission).

Timelines: The process began with the passage of the 2007 legislative request and will end with a completed report to the legislature by February 15, 2008. The Technical Team met on August 14, 2007 to develop the final draft of the proposed document development process, and a draft outline of the final document. The Technical Team communicated by email and followed up with meetings on November 13, 2007 and January 7, 2008. The draft study document underwent 10 revisions in all. The Partnership Team met on September 19 and December 3, 2007 to review

the Technical Team's proposals. Review of the final working draft of the study document was conducted by mail. The final document will be presented to the legislature by February 15, 2008. Copies of the final document will be posted on the MNDNR website and available upon request through DNR regions and central office.

Partnership Team Roster

Organization	Name	Title
Association of Minnesota Counties	Anna Lee Garletz	Policy Analyst
Bois Forte DNR	Cory Strong	Commissioner
Bureau of Indian Affairs	Bob Jackson	
Clearwater County	Tom Anderson	County Commissioner
DNR Commissioner's Office	Bob Meier	Asst Commissioner/Policy
DNR Division of Ecological Resources	Lee Pfannmuller (Donna Perleberg)	Director
DNR Division of Enforcement	Mike, Hamm	Director
DNR Division of Waters	Kent, Lokkesmoe	Director
DNR Northwest Region Office	Paul Swenson	Tribal Liaison
Ducks Unlimited	Ryan Heiniger	Director, Cons Programs
Fond du Lac Resource Management	Reginald Defoe (Tom Howes)	Director
Grand Portage Tribal Council	Norman Deschampe	Chairman
Leech Lake DRM	Rich Robinson	Director
Mille Lacs Natural Resources	Curt Kalk	Commissioner
Minnesota Chippewa Tribe	Gary Frazer	Executive Director
Minnesota Legislature	Sondra Erickson	State Representative
Minnesota Legislature	Frank Moe	State Representative
Minnesota Waters	Bruce Johnson	Executive Director
Minnesota Wild Rice Council	Beth Nelson (Peter Imle, Ken Gunvalson)	President
MN Board of Water & Soil Resources	John Jaschke (Greg Larson)	Executive Director
MN Department of Agriculture	Gene, Hugoson (Chuck Dale, Chuck Dryke, Geir Friisoe)	Commissioner
MN Valley National Wildlife Refuge	Jim Leach (Barb Boyle)	Director
MN Waterfowl Association	Brad Nylin	Executive Director
Natural Resources Conservation Service	Bill Hunt	State Conservationist
Red Lake DNR	Al Pemberton	Director
Save Our Rice Alliance	Richard Draper	
White Earth DNR	Mike Swan (Doug McArthur)	Director
White Earth Land Recovery Project	Winona LaDuke	Founding Director

Technical Team Roster

First Name	Title	Organization
Peter David	Wildlife Biologist	Great Lakes Indian Fish and Wildlife Commission
Jon Dokter	Associate Director	Wild Rice Council
Annette Drewes	Ph.D Candidate Environmental Studies	University of Wisconsin-Madison Save Our Rice Alliance
Gary Drotts	Area Wildlife Supervisor	MN Department of Natural Resources
Ann Geisen	Wildlife Shallow Lakes Specialist	MN Department of Natural Resources
Shelley Gorham	Area Wildlife Supervisor	MN Department of Natural Resources
Andrea Hanks	Wild Rice Campaign Coordinator	White Earth Land Recovery Project (WELRP)
Tom Howes	Natural resources Manager	Fond du Lac Department of Resource Management
Becky Knowles	Plant Ecologist	LLBO DRM-Fish, Wildlife, and Plants
Beau Liddell	Area Wildlife Supervisor	MN Department of Natural Resources
Doug McArthur	Biologist	White Earth Dept. of Natural Resources
Michelle McDowell	Wildlife Biologist	Rice Lake National Wildlife Refuge
Rob Naplin	Area Wildlife Supervisor	MN Department of Natural Resources
Beth Nelson	President	Wild Rice Council
Ray Norrgard	Wetland Wildlife Program Leader	MN Department of Natural Resources
John Persell	Biologist	LLBO DRM-Fish, Wildlife, and Plants
Ron Phillips	Regents Professor	University of Minnesota
Raymie Porter	Research	University of Minnesota
Jon Schneider	Manager MN Conservation Programs	Ducks Unlimited
Steve Smith	Acting Director - Water Quality	Minnesota Chippewa Tribe
Ken Soring	NE Regional Enforcement Supervisor	MN Department of Natural Resources
Mike Swan	Director	White Earth Dept. of Natural Resources
Rod Ustipak	Consultant	
Darren Vogt	Wildlife Biologist	1854 Treaty Authority
Rachel Walker	Ph.D Candidate Water Resources	University of Minnesota

Appendix B

Wild Rice Distribution and Abundance in Minnesota

EXECUTIVE SUMMARY

Project Leader
Gary Drotts
Minnesota Department of Natural Resources
Area Wildlife Supervisor - Brainerd

Purpose

To further the understanding of natural wild rice distribution and abundance in Minnesota, Minnesota Department of Natural Resources (MNDNR) staff and other Technical Team members of the Natural Wild Rice in Minnesota Legislative Study undertook an effort to consolidate and update existing natural wild rice inventory information. The following objectives guided inventory design and development.

1. Consolidate various data/information on the location (i.e. lake, wetland, or river segment) of natural wild rice stands in Minnesota.
2. Determine size and natural wild coverage for each location.
3. Determine type of water level management structure (if present) on each location and primary management authority.
4. Document Tribal, Treaty and/or State authority for each location.
5. Determine natural wild rice harvest potential, harvest pressure, and access for each location.
6. Provide a starting point for a useable data framework/information system for the long-term protection, management and monitoring of natural wild rice in Minnesota.

Methods

An existing dataset (Microsoft Access) maintained by the MNDNR Shallow Lake Program provided the starting point for this effort. This dataset originated in the late 1980's based on a review and consolidation of the best existing data sources at that time (i.e. MNDNR Enforcement wild rice lists, tribal rice camps, etc.) followed up with field interviews to MNDNR Area Wildlife and Tribal offices in the primary natural wild rice range. This initial assessment found over 700 lakes in 31 counties totaling 1.5 million basin acres contained approximately 61,000 acres of natural wild rice.

Since this initial dataset was formed, various MNDNR, federal, treaty and tribal authorities have accomplished a significant amount of additional inventory work. This information was reviewed, consolidated and added to the initial dataset and sent out for review to MNDNR Area Wildlife and Treaty/Tribal authorities for their comments and input. Return information was entered into a finalized dataset.

Primary information collected consisted of a location (i.e county, basin name), basin area and estimated natural wild rice coverage. For basins having a significant stand of natural wild rice, additional information was requested as to: water level management restrictions (i.e. dam at outlet); general wild rice location within the basin; treaty/tribal authority; and harvest potential, pressure and access.

Information sources

Information sources included the following:

- Minnesota DNR – initial survey data, 2006 Wild Rice Harvesters Survey, Fisheries lake surveys, Wildlife/shallow lake surveys, aquatic plant management permits, and aquatic plant survey data from Ecological Resources.
- Treaty/Tribal - 1854 Treaty Authority, Great Lakes Indian Fish and Wildlife Commission, Fond Du Lac Indian Reservation, Mille Lacs Indian Reservation, Leech Lake Indian Reservation, and, White Earth Indian Reservation.
- U.S. Fish and Wildlife Service, National Wildlife Refuge System

Results

Inventory results note that stands of natural wild rice were present or occurred in recent history on 1,292 lakes or river/stream segments in Minnesota. Of these 1,286 locations, 777 have information on natural wild rice coverage, which totals approximately 64,328 acres. The remaining 509 locations that currently do not have coverage information are primarily small lakes/wetlands on the edge of the current natural wild rice range (southern and western Minnesota) or river/stream segments.

On a county basis, the greatest concentration of natural wild rice locations is in St. Louis (8,939 acres), Itasca (8,448 acres), Cass (8,323 acres), Aitkin (4,859 acres), and Crow Wing (3,751 acres). These five counties contain over 60% of the inventoried natural wild rice acreage in Minnesota.

Recommendations

- This inventory should be considered a work in progress. Further edits and review are needed, especially for small lakes/wetlands on the edge of current natural wild rice range and the numerous river/stream segments that may been missed in this inventory.
- A procedure to review and update this inventory on a regular basis (every 5-10 years) should be undertaken.
- Information gathered on harvest potential, pressure and access to these natural wild rice locations should be listed/posted on appropriate web sites (i.e. MNDNR web site).

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Aitkin	Aitkin	01004000	850	298
Aitkin	Anderson	01003100	97	30
Aitkin	Bear	01006400	127	1
Aitkin	Big Sandy	01006200	9,380	94
Aitkin	Birch	01020600	449	5
Aitkin	Blind	01018800	323	39
Aitkin	Brown	01007800	97	34
Aitkin	Camp	01009800	127	30
Aitkin	Clear	01010600	123	20
Aitkin	Cornish Pool	01042700	600	30
Aitkin	Davis	01007101	76	30
Aitkin	Deer	01008600	47	3
Aitkin	Elm Island	01012300	656	30
Aitkin	Farm Island	01015900	2,025	20
Aitkin	Fleming	01010500	326	1
Aitkin	Flowage	01006100	720	432
Aitkin	Gun	01009900	735	60
Aitkin	Hammal	01016100	376	1
Aitkin	Hay	01005900	133	1
Aitkin	Hickory	01017900	183	10
Aitkin	Jenkins	01010000	127	1
Aitkin	Jewett State WMA - Impoundment	01038300	180	30
Aitkin	Johnson	01013100	27	6
Aitkin	Killroy	01023800	23	4
Aitkin	Kimberly State WMA - Lower Pool	01043300	300	30
Aitkin	Kimberly State WMA - Upper Pool	01041100	900	76
Aitkin	Krilwitz	01IMP002	30	6
Aitkin	Lily	01008800	50	2
Aitkin	Little Hill River State WMA - Pool 1	01043300	135	18
Aitkin	Little McKinney	01019700	26	6
Aitkin	Little Pine	01017600	126	1
Aitkin	Little Prairie	01001600	78	1
Aitkin	Little Red Horse Lake	01005200	32	3
Aitkin	Little Willow River State WMA - Upper Pool	W0642001	50	20
Aitkin	Little Willow State WMA - Lower Pool	01033200	140	50
Aitkin	Mallard	01014900	354	320
Aitkin	Mandy	01006800	107	27
Aitkin	Minnewawa	01003300	2,451	130
Aitkin	Monson	01012600	48	25
Aitkin	Moose	01014000	148	117
Aitkin	Moose River	01r4		

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Aitkin	Moose Willow State WMA - Moose Pool	01035800	900	89
Aitkin	Moose Willow State WMA - Willow Pool	01043100	300	50
Aitkin	Moulton	01021200	282	1
Aitkin	Mud (Grayling Marsh WMA, pool 1)	01002900	400	1
Aitkin	Mud (Little White Elk)	01019400	135	68
Aitkin	Nelson	01001000	71	1
Aitkin	Newstrom	01009700	97	76
Aitkin	Pine	01000100	391	4
Aitkin	Portage	01006900	387	5
Aitkin	Prairie River	01r6		
Aitkin	Rat	01007700	442	45
Aitkin	Rat House	01005300	122	100
Aitkin	Red	01010700	97	4
Aitkin	Rice	01000500	83	50
Aitkin	Rice (Big)	01006700	3,635	1,700
Aitkin	Rice River	01r1	190	25
Aitkin	Ripple	01014600	676	50
Aitkin	Ripple River	01r3		
Aitkin	Rock	01007200	366	50
Aitkin	Round	01013700	634	1
Aitkin	Salo Marsh State WMA - Pool	01041500	690	76
Aitkin	Sanders	01007600	55	36
Aitkin	Sandy River	01006000	368	200
Aitkin	Sandy River	01r2		
Aitkin	Savanna	01001400	86	1
Aitkin	Savanna River	01r5		
Aitkin	Section Ten	01011500	440	52
Aitkin	Section Twelve	01012000	167	1
Aitkin	Shovel	01020000	230	207
Aitkin	Sissabagamah	01012900	386	39
Aitkin	Sitas	01013200	59	5
Aitkin	Sixteen	01012400	18	1
Aitkin	Sjodin	01031600	43	28
Aitkin	Spectacle	01015600	107	1
Aitkin	Spirit	01017800	523	26
Aitkin	Split Rock	01000200	27	1
Aitkin	Spruce	01015100	80	80
Aitkin	Steamboat	01007102	59	15
Aitkin	Stony	01001700	52	5
Aitkin	Sugar	01008400	23	1
Aitkin	Sugar	01008700	416	1
Aitkin	Swamp	01009200	270	1

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Aitkin	Tamarack River	01r7		
Aitkin	Twenty	01008500	153	119
Aitkin	Unnamed (L. Wolf)	01002000	19	1
Aitkin	Unnamed (Rice)	01041900	16	1
Aitkin	Unnamed (Round Lake Pothole)	01028500	15	12
Aitkin	Unnamed (Upper Blind)	01033100	14	3
Aitkin	Unnamed (W. Washburn)	01026200	14	1
Aitkin	Washburn	01011100	73	4
Aitkin	Waukenabo	01013600	819	49
Aitkin	West	01028700	51	20
Aitkin	White Elk	01014800	780	350
Anoka	Carlos Avery WMA - Pool 1	W9001001	180	15
Anoka	Carlos Avery WMA - Pool 13	W9001013	586	2
Anoka	Carlos Avery WMA - Pool 14	W9001014	749	15
Anoka	Carlos Avery WMA - Pool 15	W9001015	365	1
Anoka	Carlos Avery WMA - Pool 16	W9001016	67	
Anoka	Carlos Avery WMA - Pool 17	W9001017	185	
Anoka	Carlos Avery WMA - Pool 2	W9001002	683	20
Anoka	Carlos Avery WMA - Pool 22	W9001022	141	10
Anoka	Carlos Avery WMA - Pool 23	W9001023	1,600	
Anoka	Carlos Avery WMA - Pool 24	W9001024	35	2
Anoka	Carlos Avery WMA - Pool 26	W9001026	200	5
Anoka	Carlos Avery WMA - Pool 3	W9001003	186	120
Anoka	Carlos Avery WMA - Pool 5	W9001005	52	25
Anoka	Carlos Avery WMA - Pool 6	W9001006	200	1
Anoka	Carlos Avery WMA - Pool 7	W9001007	240	3
Anoka	Carlos Avery WMA - Pool 9	W9001009	269	120
Anoka	Carlos Avery WMA - Pool 9(2)	W9001011	71	30
Anoka	East Twin	02002000	171	1
Anoka	Grass	02011300		
Anoka	Grass	02009200		
Anoka	Hickey	02009600	41	
Anoka	Little Coon	02003200	486	10
Anoka	Pickerel	02013000	303	25
Anoka	Rice	02000800		
Anoka	Rice	02004300		
Anoka	Rice Creek	02r1		
Anoka	Rondeau	02001500	552	
Anoka	Rum River	02r2		
Anoka	Swan	02009800	273	33
Anoka	West Twin	02003300	18	
Becker	Abners	03003900	100	80

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Becker	Albertson	03026600	73	
Becker	Aspinwall	03010400	178	18
Becker	Axberg	03066000	47	
Becker	Balsam	03029200	148	10
Becker	Bass	03048000	28	
Becker	Bass	03008800	208	10
Becker	Bean	03041100	19	
Becker	Big Basswood	03009600	586	304
Becker	Big Rat	03024600	1,102	110
Becker	Big Rush	03010300	1,128	20
Becker	Blackbird	03019700	284	42
Becker	Blueberry	03000700	160	2
Becker	Booth	03019800	48	43
Becker	Buffalo	03035000	444	89
Becker	Bullhead	03031200	39	6
Becker	Bush	03021200	110	40
Becker	Cabin	03034600	38	
Becker	Camp Seven	03015100	78	8
Becker	Carman	03020900	217	30
Becker	Chippewa	03019600	960	288
Becker	Dahlberg	03057700	77	
Becker	Dead	03016000	296	
Becker	Dinner	03004400	53	11
Becker	Eagen	03031800	85	
Becker	Equay	03021900	73	7
Becker	Flat	03024200	1,970	197
Becker	Gull Creek	03r2		
Becker	Gyles	03006600	42	16
Becker	Halverson	03041200	18	
Becker	Height of Land	03019500	3,943	197
Becker	Hubbel Pond	03024000	561	168
Becker	Indian Creek Imp.	03r4		
Becker	Johnson	03019900	181	40
Becker	Kneebone	03009000	149	15
Becker	Little Basswood	03009200	105	31
Becker	Little Dinner	03004500	12	5
Becker	Little Flat	03021700	235	211
Becker	Little Mud	03002200	25	6
Becker	Little Rice	03023900	110	21
Becker	Little Round	03030200	565	
Becker	Lower Egg	03021000	171	75
Becker	Lyman WPA	03IMP003		

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Becker	Manomin Creek	03r5		
Becker	Mary Yellowhead	03024300	68	7
Becker	Mud	03012000	170	
Becker	Mud	03002300	85	42
Becker	Mud	03006700	88	83
Becker	Mud	03001600	86	
Becker	Ottertail River	03r1		
Becker	Pearl	03048600	268	
Becker	Rice	03028500	51	
Becker	Rice	03017300	37	
Becker	Rice	03029100	245	196
Becker	Rice	03020100	245	245
Becker	Rock	03029300	1,198	240
Becker	Round	03015500	1,094	
Becker	Schultz	03027800	103	82
Becker	Shell	03010200	3,147	169
Becker	Shipman	03000500	71	1
Becker	Spindler	03021400	185	125
Becker	Tamarack	03024100	2,227	245
Becker	Tamarack NWR - Ogemash Pool	03IMP002	71	20
Becker	Tea Cracker	03015700	122	30
Becker	Town	03026400	117	35
Becker	Trieglaff	03026300	111	56
Becker	Twin Island	03003300	71	5
Becker	Two Inlets	03001700	643	40
Becker	Unnamed	03008700	23	
Becker	Unnamed	03060000	59	
Becker	Unnamed	03059800	36	
Becker	Unnamed	03059900	34	
Becker	Unnamed	03014000	43	
Becker	Unnamed	03109300	72	7
Becker	Unnamed	03077600	20	10
Becker	Unnamed	03071600	25	12
Becker	Unnamed	03043400	21	17
Becker	Upper Egg	03020600	493	24
Becker	Wild Rice River	03r3		
Becker	Winter	03021600	117	43
Becker	Wolf	03010100	1,453	10
Beltrami	Big	04004900	3,565	250
Beltrami	Big Rice	04003100	642	96
Beltrami	Bootleg	04021100	308	185
Beltrami	Burns	04000100	131	105

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Beltrami	Campbell	04019600	462	23
Beltrami	Carr	04014100	51	8
Beltrami	Cass	04003000	15,958	10
Beltrami	Clearwater	04034300	1,039	
Beltrami	Cranberry	04012300	77	46
Beltrami	Dutchman	04006700	171	
Beltrami	Erickson	04006800	111	50
Beltrami	George	04017500	89	18
Beltrami	Grant Creek	04r1		
Beltrami	Grass	04021600	233	
Beltrami	Gull	04006400	170	34
Beltrami	Heart	04027100	10	
Beltrami	Irving	04014000	644	97
Beltrami	Kitchi	04000700	1,850	185
Beltrami	Little Puposky	04019700	158	95
Beltrami	Little Rice	04017000	72	
Beltrami	Little Rice	04001500	123	60
Beltrami	Little Rice Pond	04002300		
Beltrami	Little Turtle	04015500	464	23
Beltrami	Manomin	04028600	288	144
Beltrami	Marquette	04014200	578	
Beltrami	Medicine	04012200	458	69
Beltrami	Mississippi	04r2		
Beltrami	Moose	04001100	617	96
Beltrami	Moose	04034200	133	
Beltrami	Norman	04002900	61	8
Beltrami	Pimushe	04003200	1,350	135
Beltrami	Puposky	04019800	2,120	236
Beltrami	Rabideau	04003400	723	217
Beltrami	Rice	04017400	55	
Beltrami	Rice	04012100	36	
Beltrami	Rice	04025000	124	
Beltrami	Rice Pond	04005900	247	123
Beltrami	Three Island	04013400	836	125
Beltrami	Turtle River	04011100	1,664	
Beltrami	Upper Red	04003501	119,271	
Beltrami	Whitefish	04030900	126	
Blue Earth	Rice	07005900		
Blue Earth	Rice Creek	07r1		
Brown	Altematt	08005400		
Brown	Rice Lake	08003500		
Carlton	Bang	09004600	58	1

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Carlton	Bob	09002600	78	1
Carlton	Cedar	09003100	62	10
Carlton	Cross	09006200	110	6
Carlton	Dead Fish	09005100	153	115
Carlton	Flower	09006400	14	10
Carlton	Hardwood	09003000	100	25
Carlton	Hay	09001000	103	1
Carlton	Island	09006000	456	46
Carlton	Jaskari	09005000	74	74
Carlton	Kettle	09004900	611	415
Carlton	Long	09006600	17	4
Carlton	Miller	09005300	156	156
Carlton	Moose	09004300		
Carlton	Moosehead	09004100		
Carlton	Perch	09003600	796	597
Carlton	Rice Portage	09003700	832	120
Carlton	Sterle Pool	W0854002	29	2
Carlton	Tamarack	09006700	228	11
Carlton	Tamarack River	09r1		
Carlton	Wild Rice	09002300	54	36
Carlton	Woodbury	09006300	59	10
Cass	Baby	11028300	736	7
Cass	Bergkeller	11044700	120	5
Cass	Beuber	11035300	135	15
Cass	Big Birch	11001700	255	45
Cass	Big Portage	11030800	956	30
Cass	Big Rice (Remer)	11007300	2,717	1,411
Cass	Big Sand	11007700	752	10
Cass	Birch	11041200	1,262	1
Cass	Bluebill	11039700	51	1
Cass	Bowen	11035000	182	
Cass	Boy (& Boy River)	11014300	5,544	340
Cass	Brockway	11036600	182	55
Cass	Bullhead	11018400	88	
Cass	Cat	11050900	108	5
Cass	Cedar	11048100	34	3
Cass	Cedar	11044400	17	4
Cass	Child	11026300	295	12
Cass	Chub	11051700	57	51
Cass	Ding Pot	11056500	29	29
Cass	Donkey	11028000	54	
Cass	Drumbeater	11014500	376	5

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Cass	East Twin	11012300	297	50
Cass	Esterday	11051100	43	3
Cass	Farnham	11051300	142	71
Cass	Five Point	11035100	265	13
Cass	George	11010100	720	262
Cass	Gijik	11018500	118	1
Cass	Goose	11009600	844	844
Cass	Grass	11031500	113	
Cass	Grass	11009000		
Cass	Gull	11030500	9,541	15
Cass	Gull River	11r1	219	110
Cass	Hand (Lower)	11025100	122	50
Cass	Hand (Upper)	11024200	316	20
Cass	Hardy	11033200	89	2
Cass	Hattie	11023200	592	40
Cass	Hay	11019900	364	36
Cass	Hole-In-Bog	11019700	76	
Cass	Hunter	11017000	189	2
Cass	Inguadona	11012000	935	19
Cass	Island	11010200	390	10
Cass	Island	11036000	117	30
Cass	Kelly	11042800	50	10
Cass	Kerr	11026800	81	1
Cass	Kid	11026200	167	3
Cass	Laura	11010400	1,424	854
Cass	Leech	11020300	109,415	4,000
Cass	Lind	11036700	462	95
Cass	Little Birch	11001800	25	25
Cass	Little Boy	11036900	71	1
Cass	Little Boy	11016700	1,396	10
Cass	Little Swift	11013100	62	16
Cass	Little Vermillion	11003000	138	15
Cass	Little Woman	11026500	50	8
Cass	Lizotte	11023100	75	50
Cass	Lomish	11013600	282	197
Cass	Lower Milton	11008000	80	5
Cass	Lower Trelipe	11012900	618	20
Cass	Mad Dog	11019300	27	
Cass	Margaret	11022200	230	3
Cass	McCarthey	11016800	194	78
Cass	McKeown	11026100	171	3
Cass	Moon	11007800	58	5

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Cass	Moose	11042400	92	1
Cass	Mud	11030900	18	18
Cass	Mud	11010000	1,440	1,300
Cass	Norway	11030700	498	10
Cass	Nushka	11013700	78	
Cass	Ododikossi	11007400	20	10
Cass	Oxbow	11007500	172	4
Cass	Peterson	11015400	139	3
Cass	Pick	11026700	36	1
Cass	Pickerel	11035200	66	
Cass	Pillager	11032000	213	10
Cass	Pine Mountain	11041100	1,657	40
Cass	Portage	11047600	277	
Cass	Potshot	11014900	28	14
Cass	Rat	11028500	104	
Cass	Ray	11022000	183	37
Cass	Rice	11040200	188	5
Cass	Rice	11016200	342	137
Cass	Rice	11013800	55	1
Cass	Rice (Carrol's)	11022700	46	46
Cass	Rice (Pillager)	11032100	232	100
Cass	Rice Pad	11072000	14	4
Cass	Rock	11032400	249	10
Cass	Sailor	11001900	42	10
Cass	Schafer	11000400	44	2
Cass	Scribner	11044100	93	5
Cass	Six Mile	11014600	1,288	70
Cass	Skunk	11002700	145	30
Cass	Spring	11002200	86	12
Cass	Stephens	11021300	104	1
Cass	Swift	11013300	359	51
Cass	Tamarack	11034700	46	4
Cass	Tamarack	11018900	63	6
Cass	Thiebault	11002000	37	5
Cass	Third Guide	11000100	44	14
Cass	Thirty-Six	11017300	49	1
Cass	Thunder	11006200	1,316	2
Cass	Twin	11048400	168	
Cass	Unnamed	11077700	40	
Cass	Unnamed	11078000	10	4
Cass	Unnamed (Pistol Lake Rice Bed)	11073800	22	20
Cass	Unnamed (Rice Swamp)	11069800	11	

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Cass	Unnamed (Rice)	11061500	11	
Cass	Upper Gull	11021800	345	2
Cass	Upper Loon	11022500	114	
Cass	Wabedo	11017100	1,272	5
Cass	Wabegon	11040300	42	4
Cass	Washburn	11005900	1,768	60
Cass	Wax	11012400	95	10
Cass	West Twin	11012500	200	11
Cass	White Oak	11001600	68	1
Cass	Widow	11027300	197	
Cass	Winnibigoshish	11014700	69,821	1,000
Cass	Woman	11020100	5,360	54
Chippewa	Chippewa River	12r1		
Chisago	Goose	13008300	710	
Chisago	Rush	13006900	3,170	
Clay	Cromwell	14010300	27	
Clearwater	Anderson	15007400	53	3
Clearwater	Bagley	15004000	106	
Clearwater	Berg	15002500	50	
Clearwater	Clearwater River	15r1		
Clearwater	Duncan	15002400	18	
Clearwater	Elk	15001000	305	
Clearwater	First	15013900	60	3
Clearwater	Gill	15001900	380	38
Clearwater	Itasca	15001600	1,065	
Clearwater	Lomond	15008100	108	5
Clearwater	Lower Red	15020200		
Clearwater	Lower Rice	15013000	2,375	1,568
Clearwater	Mallard	15001800	123	25
Clearwater	Minerva	15007900	239	36
Clearwater	Mississippi	15r3		
Clearwater	Mud	15006100	294	103
Clearwater	Pine	15014900	1,465	220
Clearwater	Second	15014000	68	7
Clearwater	Sucker	15002000	90	14
Clearwater	Tamarack	15005600	21	
Clearwater	Tamarack	15013600	115	
Clearwater	Third	15014100	38	2
Clearwater	Unnamed (Rice Bed)	15002100	150	45
Clearwater	Upper Rice	15005900	1,860	1,116
Clearwater	Wild Rice River	15r2		
Cook	Bigsby	16034400	89	1

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Cook	Caribou	16036000	714	7
Cook	Christine	16037300	192	19
Cook	Elbow	16009600	415	124
Cook	Fente	16074100	35	
Cook	Four Mile	16063900	593	42
Cook	Grassy	16039000	22	
Cook	Gust	16038000	159	1
Cook	Iron	16032800	125	
Cook	Jack	16052100	127	12
Cook	Kelly	16047600	188	56
Cook	Luffs	16000600		
Cook	Mark	16025000	126	
Cook	Marsh	16048800	62	31
Cook	Moore	16048900	64	48
Cook	Mt. Maud	16wtld2		
Cook	North Fowl	16003600	297	
Cook	Northern Light	16008900	443	133
Cook	Peterson	16047800	104	1
Cook	Phoebe	16080800	758	1
Cook	Prout	16001300	18	
Cook	Rib	16054400	89	
Cook	Rice	16045300	230	92
Cook	Richey	16064300	114	
Cook	Royal River	16r1		
Cook	South Fowl	16003400	508	
Cook	Swamp	16000900		
Cook	Swamp River	16r2		
Cook	Swamp River Reservoir	16090100	165	153
Cook	Teal	16000300	73	1
Cook	Temperance River	16r3		
Cook	Toohey	16064500	369	
Cook	Turtle	16025100	61	
Cook	Unnamed	16wtld1		
Cook	Unnamed	16041600	14	14
Cook	White Pine	16036900	374	
Crow Wing	Arrowhead	18036600	285	40
Crow Wing	Bass	18001100	65	13
Crow Wing	Bass	18022900	114	1
Crow Wing	Bay	18003400	2,435	1
Crow Wing	Big Bird	18028500	205	10
Crow Wing	Birchdale	18017500	80	40
Crow Wing	Borden	18002000	1,038	31

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Crow Wing	Buffalo	18015200	36	18
Crow Wing	Bulldog	18001400	151	5
Crow Wing	Butterfield	18023100	225	1
Crow Wing	Camp	18001800	537	22
Crow Wing	Caraway	18017900	40	32
Crow Wing	Carlson	18039500	45	1
Crow Wing	Clark	18037400	309	3
Crow Wing	Cole	18012700	114	1
Crow Wing	Crow Wing	18015500	378	
Crow Wing	Dahler	18020400	277	28
Crow Wing	Deadman's	18018800	28	5
Crow Wing	Deer	18018200	78	30
Crow Wing	Dog	18010700	71	71
Crow Wing	Duck	18017800	310	175
Crow Wing	Duck	18031400	160	3
Crow Wing	Eagle	18029600	356	1
Crow Wing	Emily	18020300	675	2
Crow Wing	Erskine	18000900	186	7
Crow Wing	Faupel	18023700	42	25
Crow Wing	Flanders	18024700	181	20
Crow Wing	Garden	18032900	262	100
Crow Wing	Gilbert	18032000	391	7
Crow Wing	Goggle	18022300	107	11
Crow Wing	Goodrich	18022600	382	5
Crow Wing	Grass	18036200	45	1
Crow Wing	Grass	18023000	78	4
Crow Wing	Green	18023300	14	1
Crow Wing	Greer	18028700	384	20
Crow Wing	Half Moon	18023800	70	14
Crow Wing	Happy	18010100	51	36
Crow Wing	Hay	18044400	46	29
Crow Wing	Hole-in-the-Day	18040100	217	90
Crow Wing	Holt	18002900	164	10
Crow Wing	Horseshoe	18031700	33	13
Crow Wing	Island	18005200	37	18
Crow Wing	Island	18038300	85	2
Crow Wing	Jail	18041500	190	2
Crow Wing	Johnson	18032800	129	25
Crow Wing	Lily Pad	18027500	47	30
Crow Wing	Little Pine	18026600	384	20
Crow Wing	Little Pine	18017600	135	30
Crow Wing	Lizzie	18041600	384	100

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Crow Wing	Long	18003100	80	4
Crow Wing	Love	18038800	88	18
Crow Wing	Lower Dean	18018100	372	360
Crow Wing	Lower Mission	18024300	739	50
Crow Wing	Lows	18018000	320	45
Crow Wing	Mahnomen	18012600	238	1
Crow Wing	Mallard	18033400	73	4
Crow Wing	Maple	18004500	68	20
Crow Wing	Middle Cullen	18037700	405	2
Crow Wing	Mississippi River	18r1		1
Crow Wing	Mitchell	18029400	460	3
Crow Wing	Mollie	18033500	421	17
Crow Wing	Mud	18009400	78	6
Crow Wing	Mud	18013700	132	40
Crow Wing	Mud	18032600	82	60
Crow Wing	Mud	18019800	103	10
Crow Wing	Nelson	18016400	323	100
Crow Wing	Nisswa	18039900	213	25
Crow Wing	North Long	18037200	6,178	10
Crow Wing	Olson	18017100	28	3
Crow Wing	Ossawinnamakee	18035200	739	1
Crow Wing	Perch	18030400	181	8
Crow Wing	Pine	18026100	391	60
Crow Wing	Platte	18008800	1,768	350
Crow Wing	Pointon	18010500	193	14
Crow Wing	Rat	18041000	100	2
Crow Wing	Red Sand	18038600	569	28
Crow Wing	Rice (Blomberg's)	18012100	78	60
Crow Wing	Rice (Clark Lake rice bed)	18032700	181	124
Crow Wing	Rice (Deerwood)	18006800	185	170
Crow Wing	Rice (Hesitation State WMA)	18005300	168	138
Crow Wing	Rice (Lowell State WMA)	18040500	85	33
Crow Wing	Rice (Pratt's)	18031600	100	90
Crow Wing	Rice Bed	18018700	50	47
Crow Wing	Rock	18001600	210	10
Crow Wing	Rogers	18018400	249	4
Crow Wing	Round	18014700	144	5
Crow Wing	Round (Round-Rice Bed State WMA)	18003200	82	5
Crow Wing	Roy	18039800	310	5
Crow Wing	Sebie	18016100	180	2
Crow Wing	Sewells Pond	18044600	20	16
Crow Wing	Sibley	18040400	412	10

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Crow Wing	Smith	18002800	486	49
Crow Wing	South Long	18013600	1,380	4
Crow Wing	Stewart	18036700	254	5
Crow Wing	Tamarack	18031800	34	30
Crow Wing	Terry	18016200	102	55
Crow Wing	Twenty Two	18000800	169	42
Crow Wing	Twin Island	18010600	85	42
Crow Wing	Unnamed	18020100	16	1
Crow Wing	Unnamed	18041300	103	27
Crow Wing	Unnamed	18055000	30	30
Crow Wing	Unnamed	18005500	70	1
Crow Wing	Unnamed (Blackies Slough)	18054400	33	20
Crow Wing	Unnamed (Lost Rice)	18022800	157	80
Crow Wing	Unnamed (Nokasippi R. Rice Bed)	18048500	166	40
Crow Wing	Unnamed (Total's Pothole)	18054300	28	16
Crow Wing	Upper Cullen	18037600	459	23
Crow Wing	Upper Dean	18017000	263	10
Crow Wing	Upper Hay	18041200	640	2
Crow Wing	Upper Mission	18024200	895	5
Crow Wing	Upper Whitefish	18031000	7,969	50
Crow Wing	Velvet	18028400	167	2
Crow Wing	Whipple	18038700	345	40
Crow Wing	Whitefish	18000100	709	30
Crow Wing	Williams	18002400	47	3
Crow Wing	Wilson	18004900	63	4
Crow Wing	Wolf	18011200	218	25
Dakota	Blackhawk	19005900		
Dakota	Chub	19002000	301	1
Douglas	Mud	21023600	50	
Faribault	Minnesota	22003300	1,915	
Faribault	Rice	22000700		
Faribault	Rice	22007500		
Fillmore	Rice Creek	23r1		
Freeborn	Bear	24002800	1,560	
Freeborn	Geneva	24001500	1,875	18
Freeborn	Spicer	24004500	125	100
Freeborn	Trenton	24004900	184	18
Goodhue	Cannon River	25r2		
Goodhue	Rice Bottoms	25r1		
Goodhue	Sturgeon	25001701		
Hennepin	Grass	27008000	326	
Hennepin	Rice	27013200	294	

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Hennepin	Rice	27011600		
Houston	Blue	28000503	362	
Houston	Lawrence	28000501	142	
Houston	Target	28000502	424	
Hubbard	Alice	29028600	150	15
Hubbard	Birch Creek	29r1		
Hubbard	Clausens	29009700	222	
Hubbard	Crow Wing	29011600		
Hubbard	Crow Wing River	29river		
Hubbard	Deer	29009000	193	
Hubbard	Eagle	29025600	440	4
Hubbard	Eighth Crow Wing	29007200	493	1
Hubbard	Eleventh Crow Wing	29003600	752	1
Hubbard	Fifth Crow Wing	29009200	406	10
Hubbard	First Crow Wing	29008600	564	50
Hubbard	Fishhook River	29r4		
Hubbard	Fourth Crow Wing	29007800	523	130
Hubbard	Garfield	29006100	984	90
Hubbard	George	29021600	882	18
Hubbard	Hart	29006300	236	118
Hubbard	Hattie	29030000	359	
Hubbard	Holland-Lucy	29009500	44	
Hubbard	Horseshoe	29005900	264	
Hubbard	Island	29025400	522	60
Hubbard	Kabekona River	29r6		
Hubbard	Kabekona River	290075T2		
Hubbard	Kabenkona	29007500		
Hubbard	Little Rice	29018300	27	1
Hubbard	Little Stony	29008000	55	
Hubbard	Loon	29002000	112	
Hubbard	Lower Bottle	29018000	712	10
Hubbard	Lower Mud	29026700	30	30
Hubbard	Mantrap	29015100	1,770	200
Hubbard	Mud	29011900	146	30
Hubbard	Mud Creek	29r3		
Hubbard	Necktie River	29r2		
Hubbard	Ninth Crow Wing	29002500	235	
Hubbard	Oak	29006000	58	1
Hubbard	Oelschlager Slough	29000600	328	
Hubbard	Paine	29021700	258	
Hubbard	Plantagenet	29015600	2,620	
Hubbard	Portage	29025000	429	

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Hubbard	Potato	29024300	2,239	30
Hubbard	Rice	29017700	230	58
Hubbard	Schoolcraft	29021500	176	35
Hubbard	Second Crow Wing	29008500	228	5
Hubbard	Seventh Crow Wing	29009100	251	10
Hubbard	Shallow	29008900	295	9
Hubbard	Shell River	29r5		
Hubbard	Sixth Crow Wing	29009300	358	5
Hubbard	Spider	29011700	593	
Hubbard	Spring	29005400	43	
Hubbard	Sunday	29014400	62	
Hubbard	Tamarack	29009400	36	
Hubbard	Tenth Crow Wing	29004500	185	9
Hubbard	Third Crow Wing	29007700	636	40
Hubbard	Tripp	29000500	155	1
Hubbard	Twin	29029300		
Hubbard	Unnamed	29011500	16	
Hubbard	Unnamed	29011800	21	
Hubbard	Unnamed	29011400	24	
Hubbard	Unnamed	29008400	87	
Hubbard	Unnamed	29007900	38	
Hubbard	Unnamed	29017900	16	
Hubbard	Unnamed	29009900	26	
Hubbard	Unnamed	29015800	60	
Hubbard	Unnamed	29002100		
Hubbard	Unnamed	29026300	20	
Hubbard	Unnamed	29001900	15	
Hubbard	Unnamed (Boudora)	29008200	48	1
Hubbard	Unnamed (Hay Creek)	29055400	38	20
Hubbard	Upper Bass	29003400	30	
Hubbard	Upper Bottle	29014800	505	30
Hubbard	Upper Mud	29028400	50	50
Hubbard	Upper Twin	29015700	212	1
Isanti	Elizabeth	30008300	323	
Isanti	German	30010000	340	
Isanti	Grass	30014200	33	
Isanti	Krone	30014000	142	
Isanti	Lindgren	30014400	75	
Isanti	Little Stanchfield	30004400	155	
Isanti	Mud	30006500	300	
Isanti	Mud	30010600	81	
Isanti	Mud	30011700		

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Isanti	North Stanchfield	30014300	153	
Isanti	Rice	30001800		
Isanti	Section	30006000	130	
Isanti	South Stanchfield	30013800	433	
Isanti	Typo	30000900	273	
Isanti	Upper Rice	30005700	208	208
Itasca	Ann	31030500	94	5
Itasca	Aspen	31069000	86	5
Itasca	Bass	31057600	2,844	427
Itasca	Big Fork River	31r3		
Itasca	Birdseye	31083400	73	11
Itasca	Blackberry	31021000	240	50
Itasca	Blackwater	31056100	674	300
Itasca	Bluebill	31026500	144	14
Itasca	Bosley	31040300	41	10
Itasca	Bowstring (& Bowstring River)	31081300	8,900	1,335
Itasca	Bowstring River	31r4		
Itasca	Buckman	31027200	222	33
Itasca	Clearwater	31040200	67	10
Itasca	Clubhouse	3105400		
Itasca	Coddington	31088300	70	18
Itasca	Cophenhagen	31053900		
Itasca	Cresent	31029400	42	2
Itasca	Crooked	31020300	80	12
Itasca	Cut Foot Sioux	31085700	3,222	322
Itasca	Damon	31094400	53	20
Itasca	Decker	31093400	292	58
Itasca	Deer	31034400	1,854	
Itasca	Dishpan	31099200	15	15
Itasca	Dixon	31092100	666	67
Itasca	Dora	31088200	477	89
Itasca	Egg	31081700	118	11
Itasca	Farley	31090200	33	5
Itasca	First River	31081800	228	160
Itasca	Grass	31072700		
Itasca	Grass	31052700		
Itasca	Gunny Sack	31026700	81	8
Itasca	Hamrey	31091100	61	15
Itasca	Harrigan	31017400	27	3
Itasca	Hay	31003700		
Itasca	Helen	31084000	109	76
Itasca	Hunters	31045000	162	16

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Itasca	Ima	31063400		
Itasca	Irene	31087800	10	1
Itasca	Island	31075400	291	10
Itasca	Kelly	31029100	31	19
Itasca	Lawrence	31023100	382	19
Itasca	Leighton	31003200	242	12
Itasca	Lillian	31075000	90	14
Itasca	Little Ball Club	31082200	181	10
Itasca	Little Cut Foot	31085200	1,357	136
Itasca	Little Drum	31074100	89	22
Itasca	Little Island	31017900	26	3
Itasca	Little Moose	31061000	234	12
Itasca	Little Rice	31071600		
Itasca	Little Spring	31079700	121	3
Itasca	Little White Oak	31074000	493	25
Itasca	Lost	31028900		
Itasca	Lost	31090000	26	5
Itasca	Lower Pigeon	31089300	53	20
Itasca	Marble	31027100	155	20
Itasca	Marie	31093700	45	10
Itasca	Middle Pigeon	31089200	182	15
Itasca	Mississippi River	31r6		
Itasca	Morph	31092900	67	3
Itasca	Mosomo	31086100	47	5
Itasca	Mud	31020600	271	203
Itasca	Munzer	31036000	108	3
Itasca	Nagel	31037700	90	50
Itasca	Natures	31087700	2,885	2,499
Itasca	O'Donnell	31030300	47	10
Itasca	Otter	31030100		
Itasca	Pigeon Dam	31089400	511	500
Itasca	Pokegama	31053200	15,600	100
Itasca	Pothole	31099100		
Itasca	Prairie	31038400	1,167	45
Itasca	Prairie (& Prairie River)	31005300	29	1
Itasca	Rabbits	31092300	209	157
Itasca	Raven	31092500	97	70
Itasca	Rice	31031500	37	15
Itasca	Rice	31071700		
Itasca	Rice	31077700		
Itasca	Rice	31087600	911	729
Itasca	Rice	31020100	115	6

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Itasca	Rice	31070700		
Itasca	Rice	31094200	39	
Itasca	Rice Creek	31r5		
Itasca	Rice Creek	31r1		
Itasca	Rice River	31r2		
Itasca	Ruby	31042200	243	5
Itasca	Sand	31082600	3,391	50
Itasca	Shallow Pond	31091000	281	11
Itasca	Simpson	31086700	35	5
Itasca	Sioux	31090700	69	27
Itasca	Skimmerhorn	31093900	30	6
Itasca	Soneman	31027600	40	16
Itasca	Spruce	31034700	58	58
Itasca	Stevens	31071800	224	11
Itasca	Stone Axe	31082800	37	4
Itasca	Swan	31006700	2,472	50
Itasca	Tuttle	31082100	56	16
Itasca	Unnamed	31081500	109	5
Itasca	Unnamed	31096100	10	2
Itasca	Unnamed	31020400	28	3
Itasca	Unnamed	31032200	28	2
Itasca	Unnamed	31006600	23	3
Itasca	Unnamed	31086000	24	5
Itasca	Upper Pigeon	31090800	86	10
Itasca	Walters	31029800	120	18
Itasca	Wart	31085900	14	5
Itasca	White Fish	31014200	31	2
Itasca	White Oak	31077600	905	271
Itasca	Whitefish	31084300	493	10
Itasca	Wilderness	31090100	26	4
Kanabec	Ann	33004000	363	18
Kanabec	Grass	33001300		
Kanabec	Kent	33003500	34	
Kanabec	Knife	33002800		
Kanabec	Mud	33001500		
Kanabec	Pomroy	33000900	267	
Kanabec	Rice	33001100	172	
Kanabec	Rice	33003100		
Kanabec	Sells	33001800	64	
Kanabec	Twin or East	33001900	27	
Kanabec	Unnamed	33002900	21	
Kanabec	Unnamed	33011100	33	27

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Kanabec	Unnamed	33001400	30	
Kanabec	Unnamed	33007200	31	1
Kanabec	Unnamed	33001200	11	
Kandiyohi	Bear	34014800	128	
Kandiyohi	Blaamyhre	34034500	121	
Kandiyohi	Eight	34014600	89	
Kandiyohi	Glesne	34035200	205	
Kandiyohi	Monongalia	34IMP001	1,500	
Kandiyohi	Mud	34015800	2,516	
Kandiyohi	Ole	34034200	66	
Kandiyohi	Unnamed	34023600	117	
Koochiching	Nett	36000100	7,369	
Koochiching	Rainy Lake	36000100	7,301	2,000
Koochiching	Rat Root	36000600	734	
Koochiching	Tilson Creek	36r1		
Lake	Bald Eagle	38063700	1,243	
Lake	Basswood	38064500	14,610	485
Lake	Bluebill	38026100	44	11
Lake	Bonga	38076200	138	138
Lake	Cabin	38026000	71	55
Lake	Campers	38067900	56	56
Lake	Charity	38005500	26	
Lake	Christianson	38075000	158	
Lake	Clark	38067400		
Lake	Clark	38064700	49	
Lake	Cloquet	38053900	176	
Lake	Cloquet River	38r1		
Lake	Comfort	38029000	42	
Lake	Cougar	38076700	71	1
Lake	Cramer	38001400	69	55
Lake	Crooked	38002400		
Lake	Crooked	38081700		
Lake	Crown	38041900	69	
Lake	Driller	38065200	24	
Lake	Dumbbell	38039300	476	48
Lake	Ella Hall	38072700	372	1
Lake	Fall	38081100	2,322	23
Lake	Farm	38077900	1,292	
Lake	Flat Horn	38056800	52	
Lake	Fools	38076100	14	14
Lake	Gabbro	38070100	927	
Lake	Garden	38078200	4,236	212

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Lake	Gegoka	38057300	174	14
Lake	Greenwood	38065600	1,469	15
Lake	Harris	38073600	121	18
Lake	Hjalmer	38075800	109	2
Lake	Hoist	38025100	117	
Lake	Horse River	38r5		
Lake	Hula	38072800	121	121
Lake	Isabella	38039600	1,318	
Lake	Isabella River	38r4		
Lake	Island River	38084200	49	49
Lake	Kawishiwi	38008000	468	
Lake	Kawishiwi River	38r2		
Lake	Little Gabbro	38070300	151	
Lake	Little Wampus	38068400		
Lake	Lobo	38076600	132	99
Lake	Manomin	38061600	455	23
Lake	Middle McDougal	38065800	104	
Lake	Moose	38003600	201	
Lake	Mud	38074200	164	
Lake	Muskeg	38078800	178	71
Lake	Newton	38078400		
Lake	Nine A.M.	38044500	27	14
Lake	North McDougal	38068600	273	
Lake	Papoose	38081800	54	3
Lake	Phantom	38065300	70	
Lake	Railroad	38065500	11	1
Lake	Rice	38046500	206	206
Lake	Roe	38013900	76	
Lake	Round Island	38041700	58	58
Lake	Sand	38073500	506	51
Lake	Sand River	38r3		
Lake	Scott	38027100	52	
Lake	Silver Island	38021900	1,239	
Lake	Slate	38066600	293	
Lake	Snowbank	38052900	4,819	50
Lake	Source	38065400	35	1
Lake	Sourdough	38070800	17	17
Lake	South McDougal	38065900	277	3
Lake	Stony	38066000	409	245
Lake	Stony River	38r6		
Lake	Upland	38075600	74	1
Lake	Vera	38049100	262	

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Lake	Wampus	38068500	146	
Lake	Wind	38064200	952	10
Lake	Wood	38072900	587	125
Lake of the Woods	Baudette River	39r2		
Lake of the Woods	Bostick Creek	39r1		
Lake of the Woods	Lake of the Woods	39000200	950,400	225
Lake of the Woods	Rainy River	39r5		
Lake of the Woods	Roseau Flowage	39IMP001	200	100
Lake of the Woods	Silver Creek	39r3		
Lake of the Woods	Winter Road River	39r4		
Le Sueur	Rice	40wtld1		
Le Sueur	Rice	40011400		
Le Sueur	Rice	40003700		
Le Sueur	Rice	40001600		
Mahnomen	Grass	44004700	22	
Mahnomen	Long	44000200	117	
Mahnomen	Peabody	44-wetld		
Mahnomen	Rice	44002400	120	
Mahnomen	Roy	44000100	689	
Mahnomen	Sargent (Little Rice)	44010800	174	
McLeod	Grass	43001300		
McLeod	Rice	43004200		
McLeod	Schaefer Prairie	43r1		
Mille Lacs	Dewitt Marsh	48002000	110	131
Mille Lacs	Dewitt Pool	48IMP004	146	131
Mille Lacs	Ernst Pool	48003600	300	200
Mille Lacs	Korsness Pool 1	48003500	130	90
Mille Lacs	Mille Lacs WMA - Headquarters 2 Pool	W9004009	500	13
Mille Lacs	Mille Lacs WMA - Jones 1 Dk Pool	W9004008	520	3
Mille Lacs	Mille Lacs WMA - Korsness Pool 2	W9004002	33	30
Mille Lacs	Mille Lacs WMA - Korsness Pool 3	W9004003	18	5
Mille Lacs	Mille Lacs WMA - Olson Pool	W9004007	85	2
Mille Lacs	Mille Lacs WMA - Townhall Pool	W9004010	110	3
Mille Lacs	Ogechie	48001400	732	
Mille Lacs	Onamia	48000900	2,250	1,350
Mille Lacs	Rice	48001000	512	
Mille Lacs	Shakopee	48001200	771	
Mille Lacs	Unnamed	48004300	60	10
Mille Lacs	Unnamed	48004400	500	
Mille Lacs	Unnamed	48005400	32	25
Mille Lacs	W. brnch Groundhouse Riv	48IMP002	50	1
Morrison	Bernhart	49013500	39	

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Morrison	Coon	49002000	75	75
Morrison	Crookneck	49013300	200	
Morrison	Hannah	49001400	109	27
Morrison	Long	49001500	128	32
Morrison	Longs	49010400	60	
Morrison	Madaline	49010100	50	
Morrison	Miller	49005100	39	9
Morrison	Mud	49009500	105	
Morrison	Mud	49007200	83	5
Morrison	Mud	49002700	23	9
Morrison	Mud	49001800		
Morrison	Peavy	49000500	140	
Morrison	Pelkey	49003000	113	10
Morrison	Placid	49008000	537	
Morrison	Platte River	49r2		
Morrison	Popple	49003300	153	
Morrison	Rice	49002500	323	250
Morrison	Rice Creek	49r1		
Morrison	Round	49001900	134	14
Morrison	Skunk	49002600	320	256
Morrison	Skunk	49000700		
Morrison	Sullivan	49001600	1,199	20
Morrison	Twelve	49000600	159	80
Nicollet	Rice	52003300		
Otter Tail	Armor	56038100		
Otter Tail	Beauty Shore	56019500	233	
Otter Tail	Berger	56114900	190	
Otter Tail	Davies	56031100	69	
Otter Tail	Dead	56038300	7,827	
Otter Tail	Duck	56092500	41	
Otter Tail	East Red River	56057300	292	
Otter Tail	Emma	56019400	473	
Otter Tail	Gourd	56013900		
Otter Tail	Grass	56011500		
Otter Tail	Grass	56072300		
Otter Tail	Grass	56071700		
Otter Tail	Head	56021300	499	
Otter Tail	Little McDonald	56032800	1,506	
Otter Tail	Long	56021000		
Otter Tail	Mud	56021500	138	
Otter Tail	Mud	56022200	437	
Otter Tail	Mud	56013200	155	

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Otter Tail	Mud	56114800	134	
Otter Tail	North Maple	56001300	161	
Otter Tail	North Rice	56034900	103	
Otter Tail	Otter Tail River	56r1		
Otter Tail	Peterson	56047100	141	
Otter Tail	Rankle	56093500	57	
Otter Tail	Reed	56087600	155	
Otter Tail	Rice	56000600		
Otter Tail	Rice	56035200		
Otter Tail	Rice	56070200		
Otter Tail	Rice	56021100	263	
Otter Tail	Rice	56036300	350	
Otter Tail	Rush	56014100	5,340	
Otter Tail	Sharp	56048200	160	
Otter Tail	Sixteen	56010000	107	
Otter Tail	South Maple	56000400	160	
Otter Tail	Star	56038500	4,809	
Otter Tail	Tamarack	56019200	440	
Otter Tail	Tamarack	56043300	470	
Otter Tail	Unnamed	56127300	126	
Otter Tail	Unnamed	56151700	23	
Otter Tail	Unnamed	56155000	14	
Otter Tail	Unnamed	56157800	29	
Otter Tail	Unnamed	56019800	69	
Otter Tail	Unnamed	56028400	83	
Otter Tail	Unnamed	56108300	198	
Otter Tail	Unnamed	56092700	35	
Otter Tail	Unnamed	56125900	12	
Otter Tail	West Battle	56023900		
Otter Tail	West Lost	56048100	915	
Otter Tail	Wing River	56004300	138	
Pine	Big Pine	58013800		
Pine	Cedar	58008900	71	
Pine	Crooked	58002600	94	85
Pine	Fox	58010200		
Pine	Grass	58012500		
Pine	Hay Creek Flowage	58000500	66	40
Pine	Kettle River	58r2		
Pine	Little North Sturgeon	58006600	20	
Pine	McCormick	58005800		
Pine	Passenger	58007600	75	
Pine	Pokegama (& River)	58014200	1,621	16

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Pine	Rush	58007800	88	
Pine	Stanton	58011100	84	34
Pine	Willow River	58r1		
Polk	Unnamed (Round)	60072100	9	2
Pope	Rice	61006900		
Ramsey	Grass	62007400		
Redwood	Rice Creek	64r1		
Rice	Cedar	66005200	927	93
Rice	Dudley	66001400	83	
Rice	Hatch	66006300	102	10
Rice	Hunt	66004700	190	19
Rice	Kelly	66001500	62	
Rice	Mud	66005400	269	54
Rice	Pooles	66004600	182	
Rice	Rice	66004800		
Rice	Unnamed	66010300	26	
Rice	Weinberger	66004100	53	8
Rice	Willing	66005100	53	5
Roseau	Bednar Impoundment	68IMP002	240	40
Scott	Artic	70008500		
Scott	Blue	70008800	316	120
Scott	Fisher	70008700	396	190
Scott	Rice	70006000		
Scott	Rice	70002500	328	160
Scott	Rice	70000100		
Sherburne	Big Mud	71008500	263	100
Sherburne	Buck Lake	71IMP007	30	26
Sherburne	Clitty	71011600	56	
Sherburne	Fremont	71001600	466	
Sherburne	Jim	71011100	20	20
Sherburne	Johnson Slough	71IMP004	65	10
Sherburne	Johnson Slought	71008400		
Sherburne	Josephine	71006800	132	
Sherburne	Josephine Pool	71IMP008	143	72
Sherburne	Kliever Marsh	71000300	37	
Sherburne	Long Pond	71003600	82	
Sherburne	Lower Roadside	71IMP006	8	7
Sherburne	Lundberg Slough	71010900	50	
Sherburne	Muskrat Pool	71IMP003	299	15
Sherburne	Orrock Lake	71IMP010	215	162
Sherburne	Rice	71001500	11	
Sherburne	Rice	71007800	505	

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Sherburne	Rice	71014200	187	2
Sherburne	Schoolhouse Pool	71IMP009	225	90
Sherburne	Sherburne NWR - Pool 1	71IMP001	2	2
Sherburne	Sherburne NWR - Pool 2	71IMP002	30	15
Sherburne	Sherburne NWR - Pool 31	71IMP011		
Sherburne	Unnamed	71002500	31	
Sherburne	Upper Roadside	71IMP005		
Sibley	Titlow	72004200	924	
St. Louis	???	69IMP002		15
St. Louis	Alden	69013100	190	
St. Louis	Anchor	69064100	316	32
St. Louis	Angell Pool	W0889001	500	80
St. Louis	Artichoke	69062300	306	
St. Louis	Balkan	69086000	36	2
St. Louis	Bear	69011200	125	125
St. Louis	Bear Island River	69r8		
St. Louis	Bear Trap	69008900	131	
St. Louis	Big	69019000	2,049	20
St. Louis	Big Rice	69017800	416	416
St. Louis	Big Rice	69066900	2,072	1,700
St. Louis	Birch	69000300	7,628	381
St. Louis	Black	69074000	118	
St. Louis	Blueberry	69005400	130	13
St. Louis	Bootleg	69045200	352	
St. Louis	Breda	69003700	137	135
St. Louis	Burntside	69011800	7,314	
St. Louis	Canary	69005500	22	1
St. Louis	Caribou	69048900	569	3
St. Louis	Cloquet River	69r5		
St. Louis	Comet	69026700	28	
St. Louis	Cranberry	69014700	69	
St. Louis	Crane	69061600	3,396	600
St. Louis	Deadmans	69IMP001	5	
St. Louis	Dollar	69053400	51	51
St. Louis	Duck	69019100	126	
St. Louis	Eagles Nest #3	69028500	1,028	
St. Louis	East Stone	69063800	92	24
St. Louis	East Twin	69016300		
St. Louis	Echo	69061500		
St. Louis	Ed Shave	69019900	90	
St. Louis	Elliot	69064200	393	20
St. Louis	Embarrass River	69r3		

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
St. Louis	Five Mile	69028800	106	10
St. Louis	Four Mile	69028100	86	1
St. Louis	Gafvert	69028000	33	1
St. Louis	George	69004000	42	
St. Louis	Gill	69066700	18	
St. Louis	Grand	69051100	1,742	10
St. Louis	Grass	69077600	49	1
St. Louis	Grassey	69091300		
St. Louis	Grassy	69008200		
St. Louis	Grassy	69021600		
St. Louis	Gull	69009200	196	20
St. Louis	Hay	69044100	47	
St. Louis	Hay	69043500	78	78
St. Louis	Hay	69015000	32	1
St. Louis	Hay	69057900	114	114
St. Louis	Hay	69043900	42	1
St. Louis	Hay	69041700	82	45
St. Louis	Hockey	69084900	139	70
St. Louis	Hoodoo	69080200	252	252
St. Louis	Horseshoe	69025500	39	10
St. Louis	Indian	69002300	57	
St. Louis	Jeanette	69045600		
St. Louis	Johnson	69011700	473	24
St. Louis	Joker	69001500	46	5
St. Louis	King	69000800	320	39
St. Louis	Kylen	69003400	16	2
St. Louis	La Pond	69017700	176	176
St. Louis	Leeman	69087500	284	90
St. Louis	Lieung	69012300	476	10
St. Louis	Little Birch	69027100	58	
St. Louis	Little Cloquet River	69r6		
St. Louis	Little Indian Sioux River	69r7		
St. Louis	Little Mesaba	69043600		
St. Louis	Little Rice	69061200	266	266
St. Louis	Little Sandy	69072900	89	89
St. Louis	Little Stone	69002800	163	
St. Louis	Little Vermillion	69060800	558	
St. Louis	Long (Butterball)	69004400	442	400
St. Louis	Low	69007000	353	71
St. Louis	Lower Pauness	69046400	162	1
St. Louis	Martin	69076800	71	
St. Louis	Moose	69079800	82	62

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
St. Louis	Mud	69015100	51	
St. Louis	Mud	69080000	71	18
St. Louis	Mud	69004700		
St. Louis	Mud Hen	69049400	165	
St. Louis	Myrtle	69074900	876	
St. Louis	Nels	69008000	200	2
St. Louis	Nichols	69062700	444	22
St. Louis	One Pine	69006100	369	37
St. Louis	Oriniack	69058700	748	
St. Louis	Papoose	69002400	16	16
St. Louis	Pelican (& River)	69084100	11,944	119
St. Louis	Perch	69068800	79	32
St. Louis	Petrel Creek	69r4		
St. Louis	Picket	69007900	78	7
St. Louis	Pike River	69r1		
St. Louis	Prairie	69084800	807	16
St. Louis	Rainy	69069400	220,800	
St. Louis	Rainy (Grassy Narrows)	69064000		
St. Louis	Rat	69092200		
St. Louis	Rat	69073700		
St. Louis	Rice	69057800	41	41
St. Louis	Rice	69080300		
St. Louis	Round	69004800	336	
St. Louis	Ruth	69001400	47	9
St. Louis	Sandpoint	69061700		
St. Louis	Sandy	69073000	121	121
St. Louis	Seven Beaver	69000200	1,508	1,282
St. Louis	Shannon (& River)	69092500	135	108
St. Louis	Side	69069900	25	15
St. Louis	Simian Lake	69061900	81	5
St. Louis	Sioux River	69r9		
St. Louis	Six Mile	69028300	103	1
St. Louis	St. Louis River	69r2		
St. Louis	Stone	69004600	230	173
St. Louis	Stone	69068600	160	24
St. Louis	Sturgeon	69093900	2,050	243
St. Louis	Sunset	69076400	309	6
St. Louis	Susan	69074100	305	
St. Louis	Tommila	69003500	87	85
St. Louis	Trettel Pool	W0889002	30	3
St. Louis	Turpela	69042700	76	61
St. Louis	Twin	69050400	18	1

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
St. Louis	Twin	69069500		
St. Louis	Unnamed	69063400	101	20
St. Louis	Unnamed (Camp 97)	69059400	25	
St. Louis	Upper Bug	69040600	23	
St. Louis	Upper Pauness	69046500	215	1
St. Louis	Vang	69087600	126	3
St. Louis	Vermilion	69037800	49,110	250
St. Louis	Vermilion River	69061300	1,125	562
St. Louis	Wabuse	69040800	64	51
St. Louis	Washusk #1	69040900	51	40
St. Louis	Watercress	69079700	43	43
St. Louis	Watercress (Mud)	69079700	30	
St. Louis	Wheel	69073500	11	6
St. Louis	Whitchel	69053100	71	53
St. Louis	White Iron	69000400		
St. Louis	Wild Rice	69037100	2,133	1
St. Louis	Wolf	69014300	456	
Stearns	Anna	73012600	133	
Stearns	Big Rice	73016800	282	
Stearns	Cedar	73022600	152	
Stearns	Crow	73027900	461	
Stearns	Fifth	73018000	76	
Stearns	Fish	73028100	204	
Stearns	Grass	73029400	157	
Stearns	Gravel	73020400	55	
Stearns	Henry	73016000	62	
Stearns	Henry	73023700	191	
Stearns	Linneman	73012700	108	
Stearns	Little Rice	73016700	56	
Stearns	Lower Spunk	73012300	269	
Stearns	McCormic	73027300	211	
Stearns	Middle Spunk	73012800	242	
Stearns	Mud	73016100	55	
Stearns	Raymond	73028500	126	
Stearns	Rice	73019600	1,568	
Stearns	Sagatagan	73009200	170	
Stearns	Schultz Slough	73020100	29	
Stearns	Tamarack	73027800	470	235
Steele	Oak Glen	74000400	350	4
Steele	Rice	74000100	697	467
Todd	Beck	77005600	57	25
Todd	Cass County	77000400	25	18

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Todd	Hayden	77008000	253	1
Todd	Jacobson	77014300	40	
Todd	Jaeger	77007500	46	28
Todd	Lawrence	77008300	172	
Todd	Little Fishtrap	77007400		
Todd	Little Pine	77013400		
Todd	Long	77006900	356	338
Todd	Mud	77008700	398	318
Todd	Pine Island	77007700	156	
Todd	Rice	77006100	675	60
Todd	Robbinson Pond	77IMP001	60	30
Todd	Rogers	77007300	185	130
Todd	Sheets	77012200	100	
Todd	Stones	77008100	63	
Todd	Thunder	77006600		
Todd	Tucker	77013900	43	
Todd	Twin	77002100	317	159
Todd	Unnamed	77020200	70	
Todd	Unnamed	77017600	40	2
Todd	Unnamed	77019700	53	
Todd	Unnamed	77017800	42	23
Todd	Unnamed	77014000	61	
Todd	West Nelson	77000500	84	70
Wabasha	Pool 5	79IMP001	600	35
Wabasha	Unnamed	W0580001	160	25
Wadena	Blueberry	80003400	555	30
Wadena	Burgen	80001800	92	86
Wadena	Finn	80002800	148	30
Wadena	Granning	80001200	50	50
Wadena	Jim Cook	80002700	238	
Wadena	Lower Twin	80003000	267	5
Wadena	Rice	80002400	8	1
Wadena	Round	80001900	58	58
Wadena	Strike	80001300	76	76
Wadena	Unnamed	80000700	16	16
Wadena	Yaeger	80002200	384	346
Wright	Albion	86021200	238	
Wright	Beaver Dam	86029600	253	
Wright	Butler	86019800	131	
Wright	Butternut	86025300	203	
Wright	Carrigan	86009700	162	
Wright	Cedar	86003400	191	

County name	Location Name (i.e. Lake or River)	MN Lake ID	Location size (acres)	Estimated wild rice coverage (acres)
Wright	Gilchrist	86006400	388	
Wright	Gonz	86001900	152	
Wright	Henshaw	86021300	277	
Wright	Long	86019400	255	
Wright	Louisa	86028200	183	
Wright	Malardi	86011200	149	
Wright	Mallard Pass	86018500	51	
Wright	Maple	86019700	82	
Wright	Maple Unit	86015700	177	
Wright	Mary	86004900	331	
Wright	Millstone	86015200	221	
Wright	Mink	86022900	304	
Wright	Mud	86002600	128	
Wright	Mud	86021900	66	
Wright	Pelican	86003100	2,793	
Wright	Pooles	86010200	166	
Wright	Rice	86003200	246	
Wright	Rice	86000200	57	
Wright	Sandy	86022400	118	150
Wright	School	86002500	76	
Wright	School Section	86018000	266	
Wright	Shakopee	86025500	206	
Wright	Smith	86025000	330	
Wright	Spring	86020000	63	
Wright	Taylor	86020400	78	
Wright	White	86021400	145	
Wright	Willima	86020900	246	
	1,286 total locations			
	For the 777 locations that have coverage data		1,569,889	64,328

Appendix C

Wild Rice Harvest Survey

The full report will be posted on the MNDNR website www.dnr.state.mn.us prior to March 1, 2008

Executive Summary

Introduction

The following objectives guided the study design, survey instrument and final report for this effort.

- To determine the characteristics of wild rice harvesters in Minnesota.
- To assess current harvest levels and harvester satisfaction.
- To assess current natural wild rice harvest use of Minnesota lakes and rivers.
- To obtain wild rice harvester opinions of current state regulations and proposed revisions.
- To determine factors that limit wild rice harvesting.
- Identify information needs of wild rice harvesters, and the best means to deliver information to harvesters.
- To determine support for natural wild rice management priorities.

In November of 2006 the Minnesota Department of Natural Resources initiated a self-administered, mail questionnaire of all 2006 wild rice license holders (n=1,625) to gather information on the objectives listed above, and all 2004 and 2005 license holders who did not purchase a license in 2006 (n=945) to gather information on why they did not harvest wild rice in 2006. Completed questionnaires were returned by 53 percent (n=1,365) of the 2,574-license holder sample.

Characteristics

The 2004 to 2006 wild rice license holder respondents were predominately male (82%), Minnesota residents (98%), and averaged 51 years of age. A large majority (81%) are 40 years of age or older. A majority harvested wild rice under only a state license (86%). The average age that harvesters began gathering wild rice was 31. Friends and parents were the primary means of introduction to the activity, and 69 percent of harvesters reported introducing others to gathering wild rice. The average harvester has 13 seasons of experience.

Harvest Levels

Based on responses, an estimated average of 430 pounds of unprocessed natural wild rice was gathered per harvester in 2006. Based on state issued license sales of 1,625 in 2006, this creates a total harvest estimate of approximately 700,000 pounds of natural wild rice. Approximately two percent of 2006 respondents harvested more than 2,000 pounds of rice, while 79 percent harvested less than 500 pounds. When comparing these groups (those harvesting > 500 lbs and those harvesting < 500 lbs) there is a difference in both the average age they began harvesting (20 and 33 years old, respectively) and the average number of seasons participated (25 and 12 years, respectively). A large majority (85%) of harvesters harvest for personal use.

Harvester Satisfaction

A large majority (82%) of 2006 harvesters were satisfied with their overall wild rice harvesting experience, with only one in ten expressing dissatisfaction. Harvesters were neutral on the existing wild rice season opening date (July 15th) and slightly in favor of the current wild rice season hours (9 a.m. to 3 p.m.). Other comment topics included: high licensing fees, less than ideal water levels, lack of processor information, lack of enforcement, weather, shoreline degradation, motor boats in wild rice stands, beaver control, and a need for more regulation of genetically modified wild rice.

Use of Minnesota Lake and Rivers to Harvest Wild Rice

A total of 3,151 trips were reported by 845 harvesters, resulting in an average of 4 trips per person to gather wild rice. Sixty percent (60%) of 2006 harvesters took three or fewer trips, while 12 harvesters (1%) managed 20 or more trips. One half (50%) of the respondents reported harvesting on only one lake, indicating that multiple trips were made to the same lakes. An additional 28 percent reported harvesting on two lakes. The average number of lakes visited for harvesting wild rice was 1.8 across all harvesters. The maximum number of lakes visited was six.

During 2006, over two-thirds (70%) of all wild rice harvesting trips were in Aitkin, St. Louis, Itasca, Crow Wing or Cass counties. The next five counties with the highest number of trips were Becker, Clearwater, Beltrami, Lake and Hubbard counties. The above ten counties had 91 percent of all wild rice harvesting trips. A total of 28 counties were identified as being visited for wild rice gathering.

While 407 locations were identified from the survey results to at least the county level, only 313 noted a specific name (i.e. lake name or river segment). Of these 313 locations, the top ten harvest locations based on harvest pressure (number of trips) account for 27.4 percent of the statewide total. Further review notes that 50 percent of total trips are represented by the top 32 locations and that the top 68 locations represent 66.6 percent of total trips.

State Regulations

About half (53%) of the respondents supported a change in harvesting hours from 9 a.m. - 3 p.m. to 10 a.m. - sunset, and three-fourths (77%) supported changing the wild rice season opening from July 15 to August 14. More than half (62% and 66% respectively) of the respondents opposed use of watercraft up to 38 inches wide or establishing a 7-day nonresident license.

Participation, Information Needs

The most important factors identified by respondents that limit participation in harvesting were personal time, and knowing when and where to harvest wild rice. For respondents that did not harvest is 2006, finding a rice processor ranked highest after personal time. Where and when to harvest are again ranked high for information helpful to 2006 ricers. In order of preference, the preferred method for delivery of information is through web sites, pamphlets or as a section of the DNR Hunting Regulation Handbook. Other limiting factors identified in comments include the cost of the license, fuel and transportation costs, and access (to private and reservation lakes).

Management Priorities

A large majority of respondents ranked water level management as the highest management priority, followed by availability of information. Seeding ranked third, while enforcement of regulations, access site improvement, and wild rice research were ranked fourth, fifth and sixth,

respectively. Other comments included protection from genetically modified rice, increased habitat protection, and excessive license fees. Specific habitat protection comments included more restrictions on shoreline development, protection from motorized watercraft, prevention of the removal of wild rice through aquatic plant management permits, and more management of specific lakes that are historical wild rice lakes.

Appendix D

The Life History of Natural Wild Rice

Growth and Development

The following description of the growth of wild rice plants is adapted primarily from the work of Dr. Ervin Oelke and others at the University of Minnesota unless noted otherwise (Oelke et al. 2000, Oelke 2007).

As an annual plant, wild rice develops each spring from seeds that fell into the water and settled into sediment the previous fall or before. Germination requires three to four months of cold, nearly freezing water (35° F or colder). Seeds exposed to drying die. Seed dormancy is regulated through hormonal growth promoters and inhibitors and by an impermeable, tough, wax-covered pericarp. Low oxygen levels can also inhibit germination.

Seed germination typically occurs when the substrate and surrounding water temperatures reach about 40° F. Depending on water depth, latitude, and the progression of spring weather, wild rice germinates in Minnesota sometime in April, well ahead of most but not all perennial plants. Within three weeks, rooted wild rice seedlings develop three submerged leaves. These leaves usually remain submerged and decay as the plant matures. Adventitious roots arise at the first leaf node and occasionally at the second and third nodes. Most, but not all, roots are shallow, often rust-tinged due to iron deposits, and may spread 8 to 12 inches. Natural mortality can be relatively high during the submerged leaf stage (Meeker 2000).

The emergent stage begins with the development of one or two floating leaves and continues with the development of several aerial leaves two to three weeks later. The floating leaves are apparent in late May to mid June in Minnesota, again dependent on water depth, latitude, and weather. It is at this stage of growth that wild rice is most susceptible to uprooting by rapidly changing water levels due to the natural buoyancy of the plant. Rising water levels can significantly stress the plant even if it remains rooted.

The upper portion of the wild rice stem is hollow, with thin evenly spaced partitions. The number of tillers, or additional flowering stems, can vary with plant density and water depth. In deep water there may only be one stem per plant while in shallow water the number can exceed 30. Tillers typically mature 7 to 14 days later than the main stem (Meeker 2000).

Wild rice begins to flower in mid to late July in Minnesota. Flowering times are dependent on both day length and temperature. Short day lengths trigger earlier flowering but a reduction in kernel number. Longer day lengths delay flowering while increasing kernel number. Warmer temperatures will accelerate development, and cooler temperatures will slow growth. Wild rice flowers are produced in a branching panicle with female flowers (pistillate or seed-producing) at the top of the panicle on appressed branches. Female florets typically number about 130 per plant. Male flowers (staminate or pollen-producing) are produced on nearly horizontal branches on the lower portion of the panicle. Natural wild rice is primarily pollinated by wind. High temperatures and low humidity can negatively affect fertilization rates.

There are several variations of the typical wild rice panicle. One is the bottlebrush variant, often associated with male sterility, in which the male flowering branches remain appressed and give the panicle a compact bottlebrush appearance. Another variant is the crowsfoot panicle, in which the female flowering branches spread in the same manner as the male branches. In another variant, the male florets are replaced by female florets, resulting in a gynoecious or entirely female panicle.

Cross-pollination is typical for natural wild rice because the female flowers develop, become receptive, and are pollinated before the male flowers on the same plant shed pollen. The female florets are receptive over a period of about ten days (Moyle 1944b). Cross-pollination is enhanced by plant-to-plant variation for flowering within the same stand due to the effects of water depth, non-synchronous tillering, and genetic differences among plants (Moyle 1944b, Meeker 2000).

Cross-pollination within and among wild rice populations helps maintain genetic variability and the biologic potential for wild rice to adapt to changing conditions. Some changes may be seasonal or annual in nature; others, such as changing climate in the Great Lakes region, will likely be long term. The variability in natural wild rice genetics that exists today may be a critical determinant of whether natural wild rice can adapt to changes in regional weather. Studies in northern Wisconsin found sufficient genetic diversity among geographically distinct stands of natural wild rice to identify four regional populations. The degree of diversity within stands varied widely, however, with larger and denser stands having higher levels (Waller et al. 2000).

When viable pollen grains land on the female stigma, they germinate within one hour and reach the embryo sac within two. Seeds are visible two weeks after fertilization, and they mature in four to five weeks. Immature seeds have a green outer layer that turns purplish black as the seed reaches physiologic maturity.

Seeds ripen over several days on an individual stem, starting at the top. Primary stems ripen earlier than secondary tillers, plants in rivers ripen earlier than those in lakes, plants in shallow water earlier than those in deeper water, and plants in northern Minnesota earlier than those in more southerly stands.

This staggered maturation process means that ripe seeds may be available within individual stands for several weeks, and across the entire range of natural wild rice in Minnesota for a month or longer. This extended period of “shattering”, or dropping of ripened seed, is an important mechanism that insures at least some seeds will survive to perpetuate the natural wild rice stand. The entire process, from germination of a new plant to the dropping of mature seeds, takes about 110 to 130 days (or about 2600 growing-degree days) depending on temperature and other environmental factors.

Not all wild rice seed germinates the following year. Under some conditions, natural wild rice seeds can remain dormant in the bottom sediment for many years to several decades if conditions are not suitable for germination. This allows wild rice to survive years when high water levels or

storms reduce or eliminate productivity. Wild rice can germinate and colonize habitats after other plants have been removed by environmental disturbance if a seed bank is present (Meeker, 1999).

Even under ideal growing conditions, wild rice populations follow approximately three to five year cycles (Jenks 1900, Moyle 1944b, Pastor and Durkee Walker 2006, Walker et al. 2006). Highly productive years are followed by unproductive ones followed by a gradual recovery (Moyle 1944b, Grava and Raisanen 1978, Atkins 1986, Lee 1986, Archibold et al. 1989). Recent study suggests that oscillations in wild rice may be caused by delays in nutrient recycling to plant uptake. Wild rice litter accumulation may inhibit plant growth and production (Pastor and Durkee Walker 2006, Walker et al. 2006). In particular, the amount of wild rice straw, stage of decay, and tissue chemistry (root litter) may affect available nutrients, influence production, and result in population cycling (Walker, Ph.D. thesis 2008).

Habitat Requirements

While the historical range of wild rice illustrates its broad distribution, its specific occurrence and abundance is in large part dependent on local environmental conditions. The following descriptions are a capsulation of the historical and current literature (Moyle 1944a, Rogosin 1951, Lee 2000, Meeker 2000, Oelke 2007). For more detailed information be sure to check the original sources.

Hydrology

Wild rice generally requires some moving water, with rivers, flowages, and lakes with inlets and outlets being optimal areas. Water basins with intermittent or seasonal flow may sustain beds, but annual production will fluctuate more widely. Seasonal water depth is critical. Wild rice grows well in about 0.5 - 3 feet of water, although plants may be found deeper. Shallower sites support strong competition from perennial emergent plants and deeper water stresses the plant to the point that seed production is limited or nonexistent. At Rice Lake National Wildlife Refuge from 2002 to 2005, production and growth parameters were highest at water depths of 1- 30 inches (McDowell, personal communication).

Water levels that are relatively stable or decline gradually during the growing season are preferred. Abrupt water level increases during the growing season can uproot plants. Wild rice is particularly sensitive to this disturbance during the floating leaf stage. However, some observers feel that water levels kept stable over the long term (multiple years) tend to favor perennial aquatic vegetation over wild rice (David and Vogt, personal communication).

Water characteristics

Clear to moderately stained water is preferred, as darkly stained water may limit sunlight penetration and hinder early plant development.

Wild rice grows over a wide range of alkalinity, pH, iron, and salinity. It does best in water that has a pH range of 6.0 - 8.0 and alkalinity greater than 40 ppm. Some of the measured chemistry

parameters are alkalinity (5-250 ppm), pH (6.4-10.1 SU), Iron (0.1-3.0 ppm) and True Color (50-300 Pt-Co) (Andryk 1986, Persell and Swan 1986).

The state of Minnesota instituted a water quality criterion for sulfate in wild rice waters of 10 mg/liter. The level was established based on observations by Moyle (1944a), however, other field observations and research show that wild rice can grow in waters with significantly higher sulfate concentrations (Grava 1981, Lee and Stewart 1983, Peden 1982). This research also indicates that factors such as oxygen levels and potential sediment anoxia are involved in the wild rice-sulfate connection.

While researchers have observed that natural wild rice ecosystems are relatively nutrient rich, excess levels of nutrients, especially phosphorus, can have significant adverse effects on natural wild rice productivity (Persell and Swan 1986).

Sediment

Although wild rice may be found growing in a variety of bottom types, the most consistently productive are lakes with soft, organic sediments (Lee 1986). The high organic matter content with a rather low carbon/nitrogen ratio is necessary to meet the rather high nitrogen needs of wild rice (Carson 2002). Nitrogen and phosphorus are major limiting nutrients for wild rice (Carson 2002). Flocculent sediments with nitrogen and phosphorus concentrations less than one gram per square meter are typically incapable of supporting sustained production (Lee 1986).

Competing Vegetation

As an annual plant sprouting each year from seed, wild rice can have difficulty competing with aggressive perennial vegetation, particularly where natural hydrologic variation has been reduced. Cattail (*Typha* spp.), particularly hybrid cattail (*Typha x glauca*), yellow water lily (*Nuphar variegata*), and pickerelweed (*Pontederia cordata*) are examples of plants that have been cited as competing with wild rice (Norrgard, David, and Vogt, personal communication).

Appendix E
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Appendix F
Stakeholder Comments

UNIVERSITY OF MINNESOTA

North Central Research and Outreach Center
College of Food, Agricultural and Natural Resource Sciences

1861 East Highway 169
Grand Rapids, MN 55744
218-327-4490
Fax: 218-327-4126
http://ncroc.cfans.umn.edu

Date: February 10, 2008
To: Legislators of the State of Minnesota
From: Dr. Raymie Porter, University of Minnesota
Re: The report "Natural Wild Rice in Minnesota" submitted by the DNR

In this statement I do not speak on behalf of the University of Minnesota, but rather as a scientist who has been engaged in research on cultivated wildrice breeding at the University of Minnesota for almost 20 years.

I would like to commend the Technical Team convened by the DNR to pull together the information that contributed to this report. Although the participants represent diverse interests when it comes to wildrice, our meetings have been characterized by a vigorous interchange of ideas with mutual respect, while focusing on what is actually known about wildrice. I hope that future efforts to deal with the issues identified by this report will be as positive and fruitful as what I have experienced in the meetings of the Technical Team. I would like to add the following comments to the report for emphasis.

The loss of genetic diversity should be viewed *not* as a primary *cause*, but rather as an *effect* resulting from other causes. Granted, addressing the loss of genetic diversity is crucial for the species to flourish in state waters. Loss of genetic diversity means loss of the alleles (or variant forms) of genes across the many natural populations of wildrice, which also means that there are fewer genotypes (genetic types) for a given trait within a given population. Having fewer genotypes may limit a population's ability to respond to seasonal, yearly, or long-term changes in the local environment of that population. This is especially true if the genotypes lost are ones needed for adaptation to conditions that prevail at that site. But, since loss of genetic diversity is usually caused by factors that reduce the number of individuals in populations to low numbers, alleviating the problems that reduce wildrice stands will help maintain the genetic diversity of wildrice. The report does a good job of characterizing the primary threats that limit wildrice stands and that could therefore reduce genetic diversity.

But how will we know whether or how genetic diversity is being affected? Only through knowledge about the genetics of wildrice. Sound scientific knowledge about the genetic make-up of natural stands, coupled with knowledge about how different genes respond to various environmental factors, should prove useful in guiding restoration efforts. If seeds need to be brought in from other natural stands in order to restore a site, knowing the genetics of the potential donor stands could help identify those that might be most similar to the population that remains at, or that once existed at, the site.

What about cultivated wildrice? Is the breeding of wildrice really a threat to natural stands from a genetic perspective? The consensus of the Technical Team is that it is not. I agree with this perspective. In fact, I believe that cultivated wildrice should not be made a scapegoat for problems in natural stands. I have heard speculations that cultivated wildrice causes this or that problem observed in a natural stand– speculations without evidence. What I know about population genetics leads me to the conclusion that such speculations will never find evidence to support them. Some basic facts about population genetics and wildrice should shed light on this.

Cultivated varieties (cultivars) of wildrice in Minnesota are not genetically uniform—they are heterogeneous, or made up of many different genotypes. The wildrice breeding project at the University of Minnesota has endeavored to maintain as much genetic diversity as possible in the cultivars released. Also, since all the genes in cultivars ultimately originated in the natural wildrice gene pool, they are a subset of the total genetic variability of wildrice. No new alleles or genes have been artificially added (i.e., no genetic engineering has been done, nor is it being pursued). Therefore, it seems reasonable to assume that cultivated wildrice has less total genetic diversity than natural wildrice. But this is the norm for any cultivated crop species, since breeders would tend to select only those alleles (variant forms) of genes that make the crop better adapted under the narrower range of cultivated conditions. Conversely, breeding a crop for adaptation to cultivated conditions tends to make it less fit for survival in the wild.

But even if a wildrice cultivar were genetically uniform, that uniformity should not impact the vast diversity of natural wildrice. There are many more acres of natural stands than cultivated stands, and they are rarely in close proximity to each other. That wildrice pollen travels over long distances has *not* been established. But even if pollen should travel between cultivars and natural stands, it could just as easily travel from one natural stand to another. And pollen moving from one natural stand to another natural stand nearby would likely be so few in number compared to the pollen produced locally that it would be diluted to insignificant amounts. Also, the viability of that pollen once it arrives is in doubt, given the short life of wildrice pollen.

"Migration" is the term used by population geneticists to describe gene movement between populations. But what would happen in those cases of successful migration of alleles of genes into a population? If the allele of that gene is *already* present in the population, the migration doesn't add anything new. If the allele is *not* already present, it would *add* to the genetic diversity of the population where it has found its home. This new allele, along with all the other alleles already present in the population, are then subjected to the forces of natural selection. If the allele increases the fitness of the plant to survive under the conditions of that population, natural selection favors it, and it will increase in its frequency in the population according to how much fitness it adds. If it decreases the fitness of the plant, natural selection will not favor it, and other plants with more favorable alleles will out-compete it. In this manner, natural selection will determine the genetic make-up of the population.

The heterogeneous nature of wild populations is the response of those populations to ever-changing local conditions. Any given year, some genotypes will do well, others will do poorly. In a different season, other different genotypes may prevail. In short, those plants with alleles that enable the plant to grow well and produce more seed under the local environmental conditions will contribute those genes to the next generation. Natural selection will enable the best plants to survive. This will be the case as long as there is enough genetic variability to allow adaptation to that environment.

Therefore, those factors that are known to adversely impact natural stands should be the focus of efforts to protect and enhance natural wildrice. This would accomplish the most to prevent loss of genetic diversity. It has been stated in the report that the threat of transgenic wildrice doesn't exist—no one knows of anyone who is pursuing it, and it seems unlikely that they would. Traditional (or conventional) breeding of wildrice is not a threat, by consensus of the Technical Team, for the reasons that I have just given. Other threats have been identified as important. Those threats should be addressed.

MINNESOTA CULTIVATED Wild Rice COUNCIL

4630 Churchill Street, #1, St. Paul, MN 55126 • Phone: 651.638.1955 • Fax: 651.638.0756 • mnwildrice@comcast.net

February 11, 2008

Ray Norrgard
Wetland Wildlife Program Leader
MN DNR
500 Lafayette Rd.
St. Paul, MN 55155-4020

Dear Mr. Norrgard:

As President of the Minnesota Cultivated Wild Rice Council (MCWRC), I appreciate the opportunity to comment on the Natural Wild Rice in Minnesota Study you were required to complete and are submitting to the Minnesota Legislature. The protection of natural stands of wild rice is an extremely important issue and is supported strongly by the MCWRC.

As I'm sure you know, cultivated wild rice plays an important role in Minnesota's rural economy. It is grown on marginal crop lands, providing income to some of the poorest counties in Minnesota. As forestry, mining, and other industries have lost jobs in the region, alternative opportunities for employment have become more important to the region. The cultivated wild rice industry has provided much-needed economic activity in these northern Minnesota counties. More than 500 people derive full or part-time employment directly from the cultivated wild rice industry in Minnesota, many of them on farms that have been in the family for four generations. On a full-time equivalent basis, these jobs equal more than 200 positions.

Additionally, the wild rice industry generates about $3.1 million in employee compensation annually. It also contributes a total of $8.7 million in total employee payroll and over $21 million in revenues to Minnesota's economy. Other industries share in about $20 million in revenues directly related to the wild rice industry. So you can see how important the cultivated wild rice industry is to northern Minnesota. *(The economic information cited herein is taken from a 1992 study of the economic impact of wild rice in Minnesota. Therefore, these figures understate the contributions of wild rice to Minnesota's economy in today's dollars.)*

With regard to the legislation passed in 2007 which requires an environmental impact statement for any proposed release of genetically modified wild rice and a study of potential threats to natural stands of wild rice, the MCWRC remained neutral. However, we feel it is very important to address a couple of specific issues as they relate to cultivated wild rice in Minnesota.

First, we would like to bring attention to the fact that, as noted in the wild rice study, traditional wild rice breeding programs do not pose a threat to natural stands. Wild rice grown in paddies is the same genus and species as that found in natural stands. Evidence to support this fact can be found by analyzing the 2007 harvest.

In 2007, hand harvesters enjoyed their most productive harvest in more than 40 years - at the same time cultivated wild rice producers recorded their highest production ever, a virtual impossibility if cultivated wild rice truly had a negative impact on natural stands. An article by Rod Ustipak, coordinator of a wild rice management program in Minnesota for Ducks Unlimited (DU) and the Minnesota Department of Natural Resources (DNR), which appeared in the September 16, 2007 edition of the St. Paul Pioneer Press (an article still available online at http://www.ducks.org/news/1359/DroughtimprovesMinne.html), explains how drought conditions over the past few years have actually conspired to create an environment in which natural stands thrived and produced a bumper harvest, conditions completely unrelated to cultivated wild rice production.

Secondly, although it is mentioned in the Natural Wild Rice In Minnesota Study as a concern, we feel it is extremely important to explicitly state the following: ***genetically engineered wild rice does not exist.***

There is a widely held belief, though completely inaccurate, that wild rice is somehow, somewhere being genetically modified or engineered. It is not. The MCWRC is neither developing, nor does it have plans to develop genetically engineered wild rice. We are not aware of any entity that is developing GE wild rice. The federal and state regulatory processes currently in place, coupled with the enormous investment (in the millions of dollars) necessary to develop GE wild rice, renders any effort to do so cost prohibitive. These facts, coupled with the recently passed legislation which requires an environmental impact study prior to the release of any genetically modified varieties of wild rice provide ample safeguards to the environment to ensure food safety and environmental integrity.

Since natural wild rice stands gave birth to the cultivated wild rice industry in Minnesota growers are keenly aware of the importance of protecting them. In fact, the MCWRC board of directors went on record with its support of protecting natural stands when it passed the following resolution at its July 27, 2005, board meeting, *"The MCWRC fully supports the protection of native stands of wild rice in Minnesota. There is no genetic engineering of wild rice occurring. The biosafety requirements in place through the coordinated framework of the USDA, EPA, FDA, the State of Minnesota, and the University of Minnesota are working well to assure a safe environment and food supply."*

Many threats may exist to natural stands of wild rice – shoreline development, climate change, wildlife activity, and recreational water use just to name a few. If we are to be successful in maintaining the vigor and existence of natural stands it is imperative that we analyze and focus our efforts on current threats - those that exist now - rather than perceived threats which are likely never to exist.

Sincerely,

Beth Nelson,
President

Tribal Statement Regarding MNDNR Wild Rice Study
Submitted To the State Legislature February 15, 2008

We appreciate the opportunity to provide input into the development of this *Natural Wild Rice in Minnesota* report. Manoomin (wild rice) is a remarkable and valuable component of the Minnesota landscape, and it is commendable that the State is concerned with its future. We concur with most of the wild rice history, ecology and proposed management recommendations contained therein and offer our statements below as points for emphasis and clarity to the Legislature and State DNR.

Manoomin is an inherent part of being Ojibwe. Our lifestyles and cultural identity are intimately bound to manoomin, spiritually, physically and economically. The importance of manoomin to the Ojibwe people cannot be overstated as it holds a central position in the lives and rich history of the Ojibwe people. It is more than just another grain or crop; it is a cultural resource of indescribable importance. It is a sacred gift from the creator to our people and is used for sustenance, ceremonial and commercial purposes.

The right of the Ojibwe to harvest and use manoomin was reserved and guaranteed in treaties signed between the Chippewa Bands of the region and the federal government that predate Minnesota statehood. Recent Supreme Court rulings have upheld the existence of these treaty reserved rights along with the federal trust responsibility to uphold these rights, and resources they are built upon.[1] Today, Tribal members continue to harvest manoomin, as they have for many years, in numbers greater than the rest of the state population. The very existence of the Ojibwe people depends on the vitality of their environment, their resource use and their culture which is intricately connected to natural wild rice.

Science and technology in the world is rapidly changing and challenging the environment of our daily lives. Threats to the existence and integrity of natural stands of wild rice are of immense concern to the Ojibwe. Today, the thought of genetic modification of wild rice poses an alarming threat into the possibility of irreversible genetic contamination of our natural stands of wild rice. This would have a profound negative impact on the Ojibwe people. The connection between Ojibwe culture and wild rice is not a static concept and should not be viewed as such. Rather, our relationship to wild rice should be acknowledged as a respectful, living force that guides the growth and development of our Ojibwe communities, as it has for centuries.

We feel strongly that manoomin must be protected from genetic engineering. From the beginning of the genetic engineering debate in Minnesota, the tribes have wanted GE wild rice banned. For the Ojibwe, no level of contamination is acceptable. Once genetic contamination occurs, there is likely no way to reverse it. There are published documents and reports demonstrating that genetically engineered plants can escape test plots and intermingle with native populations at distances greater than was previously thought. These same studies have shown that the range of impacts on native populations is significantly greater than currently recognized.[2] Thus, if GE wild rice were to be grown in Minnesota, it is not a question of whether contamination will occur rather, it is a question of how quickly and to what extent contamination will occur.

We recognize and appreciate that the current statute requiring an Environmental Impact Statement prior to any proposed release of GE wild rice represents progress. However, we desire complete and permanent protection for manoomin. There are currently no proven safe guards that could effectively isolate GE strains of wild rice from natural stands. The only way to prevent genetic contamination is to ensure that no GE wild rice is released into the environment. A ban on genetically engineered rice in Minnesota would be the best way to achieve this.

We recommend that the State Legislature require the Environmental Quality Board to specifically include Tribal cultural impacts as part of any GE wild rice Environmental Impact Statement process. Statements should include effects on the cultural practices of the Tribal community and State and address effects on Ojibwe culture, and traditional and customary rights.

We can not afford to hesitate when it comes to protecting natural stands of wild rice. We must conserve the biodiversity of natural wild rice stands. The rapid development of new technology and science combined with corporate exploitation of resources adds to the urgency. We must not allow Minnesota manoomin to be genetically contaminated by genetically engineered varieties that may be developed. This resource is far too precious, far too significant ecologically, economically and culturally, and far too sacred to allow this to occur. The protection and preservation of natural bed wild rice needs to be the concern of all Minnesotans. We desire to work with the State of Minnesota to ensure that wild rice is protected fully and permanently.

Bois Forte Band of Chippewa
Fond du Lac Band of Lake Superior Chippewa
Grand Portage Band of Chippewa
Leech Lake Band of Ojibwe
Mille Lacs Band of Ojibwe
White Earth Band of Ojibwe
The Minnesota Chippewa Tribe
1854 Treaty Authority
Great Lakes Indian Fish and Wildlife Commission
White Earth Land Recovery Project

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[1] None of the material in this report can be construed to abrogate, abridge, affect, modify, supersede or alter any treaty-reserved right or other sovereign rights of the regions Chippewa Bands' as recognized by any means, including but not limited to, agreements with the United States, Executive Orders, statutes, judicial decrees, or Federal law.

[2] The following references represent a small sample of the research on the uncertainty of the impact and fate of genetically engineered organisms on natural ecosystems: Schoen, DJ, Reichman JR, and Ellstrand, NC 2008. Transgene Escape Monitoring, Population Genetics, and the Law. Bioscience Vol. 58 No. 1: 71-77; Ponti, Luigi, 2005. Transgenic Crops and Sustainable Agriculture in the European Context, Bulletin of Science Technology & Society Vol. 25, No. 4: 289-305; Lundmark, C, 2007, Genetically Modified Maize, Bioscience Vol. 57, No. 11: 996.

DUCKS UNLIMITED

Ryan P. Heiniger
Director of Conservation Programs – MN/IA

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February 12, 2008

Commissioner Mark Holsten
Department of Natural Resources
500 Lafayette Road
Saint Paul, Minnesota 55155

RE: Wild Rice Study Report

Dear Commissioner Holsten:

I am writing to express Ducks Unlimited's support for the recently completed wild rice report. Thanks to you and your staff for developing such a thorough document and set of recommendations. In particular, we are especially pleased with recommendations in the report that call for increased management, inventory, and stewardship of Minnesota's wild rice lakes and wetlands. Ducks Unlimited looks forward to helping your staff and other partners implement those recommendations in the coming years through our Living Lakes Initiative.

As with many of Minnesota's natural resources, wild rice habitat for waterfowl and other wildlife has been impacted and degraded due to changes to our land and waters. Due to the biological, cultural and economical values of wild rice, it is incumbent upon the state of Minnesota in collaboration with local stakeholders to invest new financial resources to protect and enhance the precious wild rice habitat that remains. Wild rice is one of the most important aquatic plants to migratory waterfowl and it is also critically important to other game and non-game wildlife species.

Since 2001, Ducks Unlimited has worked in partnership with the Minnesota Department of Natural Resources to assess, enhance, manage, and protect over 100 wild rice lakes annually throughout northern Minnesota. Grants from the Minnesota Environment & Natural Resource Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources have also provided important funding to both improve wild rice lakes and protect their shoreline through conservation easements.

DU was pleased provide input during the development of the wild rice study and we support the final report the DNR developed for the legislature. Please advise us of any opportunities to provide further support regarding this important wetland and shallow lake conservation issue.

Sincerely,

Ryan Heiniger
Director of Conservation Programs – MN/IA

Cc: Dave Schad, Dennis Simon, Ray Norrgard, & Nicole Hansel-Welch
Jon Schneider & Rod Ustipak

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Tamarac National Wildlife Refuge
35704 County Highway 26
Rochert, Minnesota 56578-9638
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TMC-08-003

February 15, 2008

Ray Norrgard
Wetland Wildlife Program Leader
Minnesota Department of Natural Resources
500 Lafayette Rd.
St. Paul, MN 55155-4020

Subject: **Wild Rice Study document "Natural Wild Rice in Minnesota."**

Dear Mr Norrgard:

This is a letter of endorsement for the above mentioned document and for the document development process. The U.S. Fish and Wildlife Service (Service) has long recognized the ecological importance of natural wild rice stands and associated wetlands. The establishment of National Wildlife Refuges, such as Tamarac and Rice Lake, for the purpose of managing these wetland habitats for the benefit of migrating and resident wildlife is evidence of this appreciation. This study, which provides exceptional background information on the importance of natural wild rice as well as identifies potential threats and management challenges, will be extremely useful in the continued management of this critical resource. Additionally, the process fostered a close working relationship between State, Tribal and Federal governments, university researchers, non-government organizations and well as interested citizens. This collaborative effort is essential to insuring the abundance of natural wild rice for future generations.

Thank you for the opportunity to participate in this process and provide comments.

Sincerely,

Barbara Boyle

Barbara Boyle
Refuge Manager

EXHIBIT 17

AGU PUBLICATIONS

JGR

Journal of Geophysical Research: Biogeosciences

RESEARCH ARTICLE
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Key Points:
- Sulfate loading to freshwater ecosystems may alter aquatic plant communities when sulfate is reduced to sulfide in the anoxic rooting zone
- The occurrence of self-sustaining wild rice populations is mainly controlled by pore water sulfide concentrations
- Even if pore water sulfide is low, wild rice is less likely to be found if the surface water is turbid or warm

Supporting Information:
- Table S1
- Table S2
- Table S3
- Data Set S1
- Figure S1

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Sulfide Generated by Sulfate Reduction is a Primary Controller of the Occurrence of Wild Rice (*Zizania palustris*) in Shallow Aquatic Ecosystems

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Abstract Field observations suggest that surface water sulfate concentrations control the distribution of wild rice, an aquatic grass (*Zizania palustris*). However, hydroponic studies show that sulfate is not toxic to wild rice at even unrealistically high concentrations. To determine how sulfate might directly or indirectly affect wild rice, potential wild rice habitat was characterized for 64 chemical and physical variables in over 100 sites spanning a relatively steep climatic and geological gradient in Minnesota. Habitat suitability was assessed by comparing the occurrence of wild rice with the field variables, through binary logistic regression. This analysis demonstrated that sulfide in sediment pore water, generated by the microbial reduction of sulfate that diffuses or advects into the sediment, is the primary control of wild rice occurrence. Water temperature and water transparency independently control the suitability of habitat for wild rice. In addition to generating phytotoxic sulfide, sulfate reduction also supports anaerobic decomposition of organic matter, releasing nutrients that can compound the harm of direct sulfide toxicity. These results are important because they show that increases in sulfate loading to surface water can have multiple negative consequences for ecosystems, even though sulfate itself is relatively benign.

Plain Language Summary Research in the 1940s and 1950s found that wild rice grew best in low-sulfate Minnesota lakes, but it was not known why. The correlation was a puzzle, since sulfate is not very toxic to plants or animals. This study found that the problem is sulfide, not sulfate. Sulfate can be converted into toxic levels of sulfide in the soil in which wild rice germinates and roots. Wild rice is an annual plant that must sprout each spring from seed that was dropped the previous fall into wet soil. Anaerobic microbes in the soil make sulfide from sulfate in the overlying water. Lakes, streams, and wetlands that have high concentrations of dissolved sulfide in the sediment therefore have a low probability of hosting wild rice. The study also found that wild rice prefers high-transparency water and cold winters.

1. Introduction

Minnesota is unique among U.S. states and Canadian provinces in having a water quality standard that regulates sulfate (SO_4) to protect wild rice, *Zizania palustris* and *Zizania aquatica*. The more common wild rice species in Minnesota, *Z. palustris* (northern wild rice), is an annual emergent aquatic grass that forms monocultures in shallow freshwaters (wetlands, lakes, and rivers) in the area of the Laurentian Great Lakes (Minnesota, Wisconsin, Michigan, Ontario, and Manitoba). Wild rice is culturally important to multiple groups in Minnesota, especially Ojibwe, Dakota, and other Native Americans, and also provides habitat and food for waterfowl and other wildlife (Vennum, 1988). In 1977, the Minnesota legislature voted to make wild rice the Minnesota state grain. Minnesota Rule 7050.0224, promulgated in 1973, seeks to limit the exposure of wild rice to SO_4 concentrations exceeding 10 mg L^{-1} (0.1 mmol L^{-1}). This value was based on empirical research that correlated water chemistry to aquatic plant assemblages and included the observations that no large populations of *Z. palustris* occur in waters exceeding 10 mg L^{-1} SO_4 and that stands are uncommon where SO_4 concentrations exceed 50 mg L^{-1} (Moyle, 1944, 1945). In addition, Moyle (1956) noted that plantings of wild rice seed in high-SO_4 regions generally failed. A larger unpublished Minnesota Department of Natural Resources data set also shows that sites with reported wild rice

presence (DNR, 2008) are generally correlated with surface water SO_4 below 10 mg L^{-1} (Figure S1 in the supporting information).

We report here on a multiyear field survey that was part of a larger study (Myrbo et al., 2017; Pastor et al., 2017; Pollman et al., 2017) designed to reevaluate the 10 mg L^{-1} SO_4 standard by testing potential mechanisms by which SO_4 might be harmful to wild rice. SO_4 is a relatively nontoxic and unreactive compound under aerobic conditions. Pastor et al. (2017) and Fort et al. (2014) have shown that SO_4 is not directly toxic to wild rice at concentrations up to 1,600 mg L^{-1}, which exceeds concentrations in virtually all natural surface waters of the upper Midwest (Gorham, Dean, & Sanger, 1983). The U.S. Environmental Protection Agency's nonmandatory drinking water standard of 250 mg L^{-1} SO_4 (2.6 mmol L^{-1}) is based on taste rather than toxicity (EPA, 2010).

1.1. Potential Effects of Elevated Sulfate and Sulfide in Freshwater Systems

SO_4 concentrations in most freshwaters are less than a few percent of the mean concentration in seawater (2,800 mg L^{-1} (29.1 mmol L^{-1})). We surveyed 108 different lakes, streams, and wetlands across Minnesota, where the median SO_4 concentration in lakes is 10 mg L^{-1} (10th and 90th percentiles of 0.2 and 285 mg L^{-1} (MPCA, 2016)). In the much higher SO_4 concentrations of marine waters, it is well established that SO_4 can diffuse into sediment and be converted by microbial sulfate reduction (MSR) to potentially toxic sulfide that influences the presence and absence of rooted macrophytes, such as seagrasses (Borum et al., 2005; Ingold & Havill, 1984; Koch & Erskine, 2001; Lamers et al., 2013).

Despite a long-standing assumption that SO_4 is benign (Pester et al., 2012; Schindler, 1986; Urban et al., 1994) and plays a negligible role in freshwater biogeochemistry (e.g., Capone & Kiene, 1988), there is evidence that SO_4 availability in freshwaters can control the concentration and therefore the toxicity of hydrogen sulfide (H_2S) in sediment pore water to plants and animals (Bagarinao, 1992; Kinsman-Costello, O'Brien, & Hamilton, 2015; Lamers et al., 2013; Wang & Chapman, 1999). The chemical species of H_2S varies with pH; below pH 7, H_2S dominates, and above pH 7, the bisulfide ion (HS^-) dominates. For simplicity in this discussion we refer to the sum of the two species as sulfide.

1.1.1. Sulfide Toxicity to Freshwater Plants

Remarkably little attention has been given to the potential toxicity of sulfide in sediment pore water, even after Bagarinao (1992) concluded in a major review that sulfide had been "largely overlooked as an environmental factor for aquatic organisms." In a discussion of sediment toxicity testing, Wang and Chapman (1999) also observed that the biological implications of sulfide in sediments are poorly understood and "all too often ignored." They suggested that sulfide may be more important than ammonia in determining sediment toxicity to organisms and made a suite of recommendations to fill the knowledge gap, including the measurement of sulfide in undisturbed sediments. Kinsman-Costello et al. (2015) measured sulfide in undisturbed sediments and concluded that the potential toxicity of pore water sulfide is likely shaping the plant and animal communities of freshwater ecosystems. Lamers et al. (2013), in a review of sulfide toxicity to aquatic plants, pointed out that traditional toxicity testing generally neglects the chemistry of the rooting zone. Simkin, Bedford, and Weathers (2013) showed that pore water sulfide in a wetland controlled the distribution of plants more than did nutrients.

The toxicity of elevated sulfide to freshwater plants was first recognized in paddy-grown white rice (*Oryza sativa*) in the 1950s (Lamers et al., 2013; Pearsall, 1950). Rice paddies and other water-saturated soils present a profound challenge for rooted plants because of the chemical changes caused by the absence of oxygen and resulting potential toxicity of the pore water (Ponnamperuma, 1972). Anaerobic decomposition of organic matter results in elevated pore water concentrations of ammonia, organic acids, and variable concentrations of sulfide and ferrous Fe, depending on the availability of SO_4 and Fe. The interaction of Fe and the S cycle is complicated (Hansel et al., 2015), but because under anoxic conditions sulfide forms an insoluble precipitate with Fe, elevated pore water sulfide concentrations occur when Fe availability is relatively low (Ponnamperuma, 1972; van der Welle et al., 2006). It is thought that the iron sulfide precipitates are relatively inert and that only sulfide dissolved in pore water is potentially toxic. The concentration of sulfide in pore water is the balance between production and competing fates of sulfide, including precipitation with metals such as Fe, oxidation by oxygen introduced by bioturbation or by release from the roots of macrophytes (Armstrong & Armstrong, 2005), and by downward advection of surface water due to groundwater movement or transpiration by dense macrophyte stands (Bachand et al., 2014).

1.1.2. Geochemical Consequences of Enhanced Microbial Sulfate Reduction

Increased SO_4 availability can allow increased anaerobic decomposition of organic matter, releasing the inorganic nutrients that generally limit growth of higher plants (N, P, and K) (Lamers, Tomassen, & Roelofs, 1998; Myrbo et al., 2017; Weston et al., 2006, 2011). Enhanced decomposition breaks down particulate and dissolved organic carbon (DOC) in the sediment, which can increase DOC and dissolved inorganic carbon (DIC) in the overlying water (Myrbo et al., 2017).

In addition to supporting organic matter mineralization, MSR production of sulfide causes a cascade of reactions that can alter ecosystem functioning independent of any toxicity to plants and animals. First, sulfide can participate in redox reactions, chemically reducing Fe, which converts Fe from solid phase Fe(III) oxyhydroxides to water-soluble Fe(II) (Hansel et al., 2015). The dissolution of the Fe oxyhydroxides releases sorbed ions into solution, including phosphate and trace metals (Caraco, Cole, & Likens, 1993; Davranche & Bollinger, 2000; Søndergaard, Jensen, & Jeppesen, 2003). Second, sulfide can precipitate dissolved metals, including essential plant nutrients Fe, Cu, and Zn, decreasing their bioavailability and leading to nutrient deficiency (Kirk, 2004; Lamers et al., 1998; Neue & Bloom, 1989; Neue & Lantin, 1994). In systems unpolluted with heavy metals, the sulfide precipitate is overwhelmingly dominated by iron sulfide compounds, consisting of a range of stoichiometries and minerals (Schoonen, 2004), which we here term "FeS compounds." Third, the conversion of SO_4 to sulfide entails the production of DIC, or alkalinity, an effect not fully appreciated in freshwater systems until the mechanistic consequences of acid rain were investigated in the 1980s (Baker, Brezonik, & Pollman, 1986; Cook et al., 1986; Schindler, 1986). Alkalinity is thought to be a major factor influencing the distribution of aquatic species, including macrophyte species (Moyle, 1945; Vestergaard & Sand-Jensen, 2000). In addition, elevated alkalinity may further enhance decomposition, producing a positive feedback to the effects of SO_4-driven mineralization (Geurts et al., 2009; Roelofs, 1991).

1.2. Multiple Plausible Negative Effects of Elevated Sulfate and Sulfide Production on Wild Rice

The purpose of this study was to examine the multiple ways that increases in SO_4 concentration and sulfide production can change the biogeochemical functioning of freshwater ecosystems and potentially negatively affect the growth and reproduction of wild rice populations. Before any field data were collected for this study, alternative hypotheses regarding the most likely negative effects were identified (MPCA, 2011), so that appropriate data would be available to test them. The primary hypotheses of how increases in surface water concentrations of SO_4 could harm wild rice populations include direct toxicity by elevated pore water sulfide; reduced bioavailability of Fe, Cu, or Zn; and increased P bioavailability promoting the growth of phytoplankton and macrophytes that compete for light and space. Additional variables were quantified so that exploratory data analysis could be pursued in addition to evaluation of the primary hypotheses. Surface water, pore water, and sediment physical and chemical properties were collected from 108 different sites, both with and without wild rice present, to inform evaluation of these multiple interrelated hypotheses.

2. Methods

2.1. Study Area

2.1.1. Physical Environment

SO_4 concentrations in surface water vary with geology and climate (Gorham et al., 1983) in a northeast-southwest gradient across Minnesota. Bedrock and bedrock-derived glacial deposits of northeastern Minnesota (the "arrowhead") comprise slowly weathered crystalline materials, generally low in S, and surface waters are dilute (specific conductance of $<$140 and often $<$30 μmho cm^{-1}; Gorham et al., 1983). Within this area of naturally low SO_4, iron-mining activities in the "Iron Range" district of northeastern Minnesota have created an "island" of lakes and streams elevated in SO_4 (Figure 1), a result of the weathering of sulfide minerals in waste rock piles and tailing basins. The surficial geology of southwestern Minnesota, in contrast, is derived from marine shales and carbonates that are relatively S-rich and readily weathered: surface waters often exceed 500 μmho cm^{-1} and may exceed 7,000 μmho cm^{-1} (Gorham et al., 1983). SO_4 concentration is positively correlated with conductivity above about 200 μmho cm^{-1} and 10 mg L^{-1} or 0.1 mmol L^{-1} SO_4 (Figure 7B in Gorham et al., 1983). Overprinting this geological pattern is a strong climatic gradient with warmer, drier conditions toward the southwest (toward the northern Great Plains) and colder, more humid conditions to the northeast (toward the Laurentian Great Lakes), which enhances the conductivity gradient: more evaporative conditions in the southwest serve to concentrate surface waters and further increase ionic

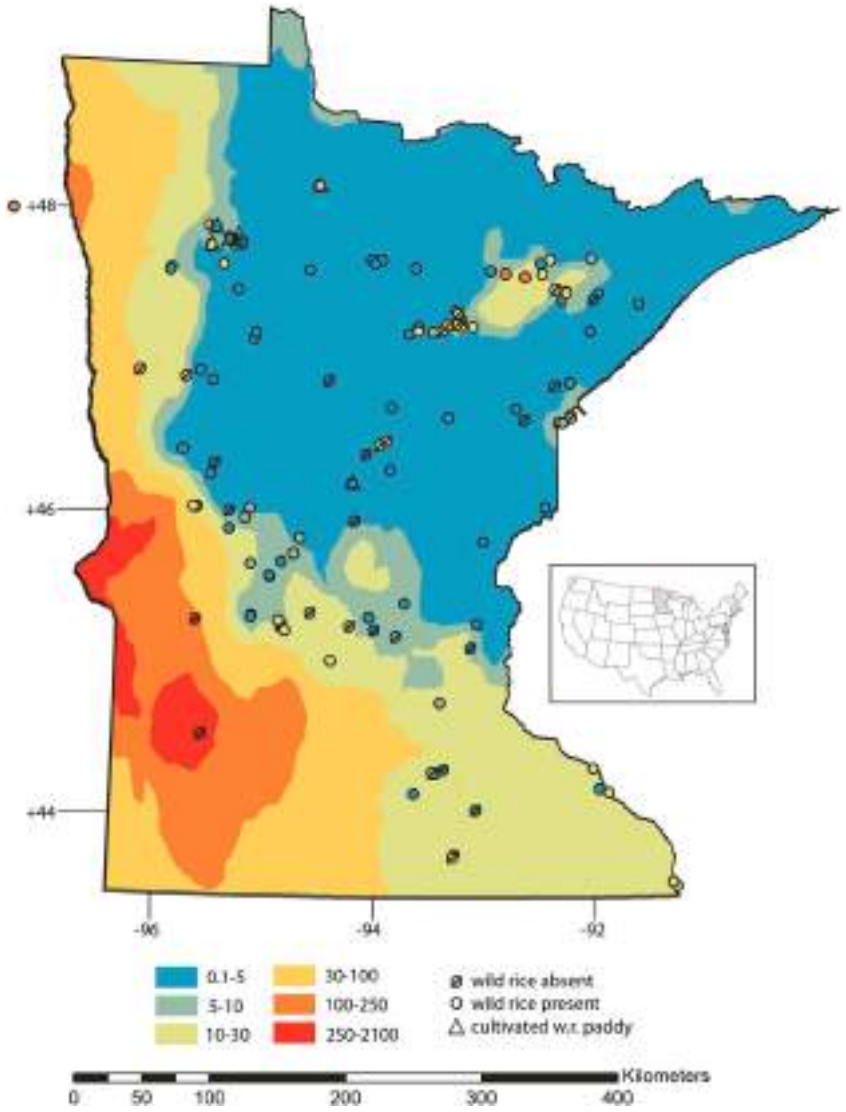


Figure 1. Map of Minnesota showing field sites overlain on kriged contours of average surface water SO_4 concentrations from 4,998 waterbodies (data from MPCA and DNR databases). The symbols are filled with the color corresponding to the site's surface water sulfate concentration. Site to the northwest of the Minnesota map is within the state of North Dakota, 40 km west of the border with Minnesota (see text). Sites where wild rice was not found have a diagonal line through the symbol.

strength, while moister conditions in the northeast maintain low ionic strength in surface waters (Gorham et al., 1983).

2.1.2. Habitat Preferences of Wild Rice

Although the scientific literature contains many assertions concerning the environmental preferences of wild rice regarding water and sediment quality (e.g., DNR, 2008, 2016; Lee, 2002; Moyle, 1944; Moyle & Krueger, 1964; Pillsbury & McGuire, 2009), sometimes little evidence was presented to support the putative preferences. The shallow freshwaters in which wild rice is found are usually relatively transparent because wild rice and other rooted macrophytes do best if they can photosynthesize as they grow each spring from the sediment to the water surface (Scheffer, 1998). Otherwise, any particular habitat preference of wild rice, such as specific chemical ranges of the sediment or surface water, is challenging to identify. Since wild rice is an opportunistic annual plant, a primary habitat requirement is periodic environmental disturbance (Grime, 1977) that keeps perennial plants such as water lilies from controlling the space and light of the shallow waters in which these species cooccur (Pillsbury & McGuire, 2009). Wild rice does not seem to have specific sediment requirements, as it has been observed growing in a variety of substrates (Aiken et al., 1988; Lee,

1986) within its range. Annual plants are adapted to exploit environments intermittently favorable for rapid plant growth and to maximize seed production (Grime, 1977). Wild rice produces between 25 and 150 relatively large seeds per stem (Eule-Nashoba, Biesboer, & Newman, 2012). Seeds buried in the sediment can survive for up to several decades until conditions are again favorable for germination and growth (DNR, 2008). *Zizania palustris* seeds germinate at low rates unless they have been exposed to near-freezing temperatures for at least 3 months (Kovach & Bradford, 1992), although the environmental cues for subsequent germination are poorly understood, aside from elevated temperature.

Because *Z. palustris* does not normally self-pollinate and is wind-pollinated (which implies that the pollen source must be relatively nearby; Friedman & Barrett, 2009), does not reproduce asexually, and has an annual life cycle (Aiken et al., 1988), in this analysis the presence of wild rice plants is taken to mean that the waterbody hosts a successfully reproducing and self-sustaining population. A few of the sites in this study may have experienced recent watershed changes such that steady state has not yet been reached among environmental variables and wild rice reproduction, but the balance of the 108 sites should have been in steady state at the time of sampling. The population of wild rice in a given lake can exhibit large fluctuations from year to year, which has been attributed to disturbances such as abrupt increases in water level (DNR, 2008) and to cyclical changes in N availability (Walker et al., 2010). Wild rice fills a unique ecological niche, in that there are virtually no other annual aquatic macrophytes across the Great Lakes region (Eggers & Reed, 2011).

2.1.3. Site Selection

The goal of the field survey was to identify and sample potential wild rice habitat across a gradient of SO_4 concentrations. Potential wild rice habitat was defined simply as shallow water (30–120 cm deep, though some sampled sites had water as shallow as 5 cm) that was sufficiently transparent to support rooted aquatic macrophytes. Turbidity from dense phytoplankton blooms or suspended solids may effectively exclude rooted macrophytes due to light limitation (Scheffer, 1998).

Most Minnesota lakes that host wild rice populations have low SO_4 concentrations; the median concentration of wild rice lakes is 1.8 mg L^{-1}, and the 75th percentile is 3.6 mg L^{-1} (MPCA, 2014). If only those waters hosting abundant wild rice were sampled, most of those would be low in SO_4, and little would be learned about how elevated SO_4 concentrations (or other important variables) might affect wild rice. Conservation biologists commonly identify important habitat variables through binary (i.e., is the species present or absent at a given site?) logistic regression, which requires the sampling of sites that do not support the species of interest (e.g., Carroll, Zielinski, & Noss, 1999; Peeters & Gardeniers, 1998; van der Heide et al., 2009). Consequently, potential wild rice habitats with a range in SO_4 concentrations were sampled without regard to whether the waterbody hosted or was known to host wild rice. An effort was made to sample waterbodies that covered the range of SO_4 concentrations across Minnesota and especially to sample sites in high-SO_4 regions that had reports of recent or historical presence of wild rice. This strategy also resulted in the sampling of a high-SO_4 wild rice site in the North Branch of the Turtle River (198 mg SO_4 L^{-1}), 40 km into North Dakota from northwestern Minnesota (Figure 1). A gradient of SO_4 concentrations was sampled by identifying potential wild rice habitat in two areas of elevated SO_4, the "island" of elevated SO_4 in the Iron Range region of northeastern Minnesota and waters naturally elevated in SO_4 to the west and south of the known range of wild rice (Figures 1 and S1). Nutrient (N and P) availability (reflecting natural soil fertility as well as agricultural runoff) also increases to the west and south, potentially supporting phytoplankton growth sufficient to exclude macrophytes, including wild rice. Consequently, in western and southern Minnesota, DNR lake databases were screened for the presence of water lilies (*Nuphar variegata* or *Nymphaea odorata*), the occurrence of which indicates transparency sufficient to support rooted macrophytes that also often cooccur with wild rice. In an analysis of DNR aquatic plant surveys from 1,753 shallow lakes, we found that the odds of finding wild rice where there are water lilies are 26 times the odds of finding wild rice where there are no water lilies, with a 95% confidence interval of 20–36 times (neither wild rice nor water lilies = 968; wild rice but not water lilies = 60; no wild rice but water lilies = 272; both wild rice and water lilies = 453).

With these considerations, water bodies were selected for sampling based on preliminary data including average water depth, presence of water lilies, conductivity or SO_4 concentration, and geographic distribution (i.e., to sample widely across the state). Both rivers and lakes were sampled, as were seven different cultivated wild rice paddies. Within a given water body, the field team chose a location for sampling based on a decision tree (Table S1 in the supporting information).

2.2. Field Methods

Sampling occurred in August–September 2011 and June–September 2012 and 2013. Sampling efforts were focused in late summer to capture physical and chemical conditions when wild rice plants were maturing and when identification of wild rice is most certain; voucher specimens of wild rice were always taken. Samples were collected from an anchored canoe or small boat, except in the cultivated wild rice paddies when the water was too shallow to float a canoe, and samples were collected on foot. A Hach model HQ40d or Hydrolab Quanta sonde, calibrated daily, was used to measure temperature, specific conductance, dissolved oxygen, and pH in the surface water. Water transparency was determined with a 1 m long Secchi-tube (Water Monitoring Equipment & Supply, USA), and apparent color was measured using a Hach model CO-1 color test kit. Surface water samples (later split into separate subsamples; see below) were collected by a technician wearing long nitrile gloves in two 2 L amber Nalgene bottles that had been previously triple rinsed with deionized water and rinsed 3 times with water from the site before filling. Water samples were stored on ice.

Short (~50 cm) sediment cores with ~10–20 cm of overlying water were collected at eight undisturbed locations at least 1 m apart around the boat using an HTH corer (Pylonex, Sweden) with a 7 cm diameter polycarbonate barrel. A piston was inserted in the bottom end of each core as it was retrieved. Cores were kept upright and shaded prior to sample processing.

Aquatic macrophytes were identified and percent cover estimated within a plastic hoop 1 m in diameter placed at 4 locations around the boat. In 2012 and 2013, the number of stems of wild rice inside each hoop was also quantified.

Pore water samples were obtained from cores processed on shore using 10 cm Rhizon™ filters (pore size 0.12–0.18 μm) (Rhizosphere.com, Netherlands; Shotbolt, 2010) inserted vertically into the core tops, following extrusion of overlying water, and connected to evacuated serum bottles with PVC/polyethylene tubing and a stainless steel needle. Three separate cores were sampled, one for nutrients (nitrate + nitrite, TP, and TN) and DOC (70 mL), a second for metals (50 mL), and a third for dissolved silica, Cl, and SO_4 (30 mL). A fourth core was sampled for pore water sulfide, but in this case, the serum bottle was preloaded with 0.2 mL of 2.0 N zinc acetate, 0.5 mL of 15 M sodium hydroxide, and a stir bar, flushed with a nitrogen atmosphere, evacuated, and preweighed. Air was flushed from the Rhizon-tubing assembly with sample pore water using a second evacuated bottle before the needle was inserted into the sulfide sample bottle. In 2011 only pore water samples for sulfide and metals were collected. Pore water pH was measured on a fifth core by inserting the probe of a Hach model HQ40d pH meter into the sediment to a depth of 5 cm and allowing the reading to stabilize.

A composite sediment sample was collected from the uppermost 10 cm of the sixth, seventh, and eighth cores, placed into a stainless steel bowl, and stirred under nitrogen atmosphere to homogenize. A 50-mL subsample was placed in a polypropylene sample bottle along with 1.0 mL of 1.0 N zinc acetate for analysis of acid-volatile sulfide (AVS). The headspace of the AVS sample bottle was flushed with N_2 and the bottle capped; that bottle was placed in a larger glass jar and that jar flushed with N_2 and tightly sealed. The sample was immediately placed in a cooler with dry ice to freeze. The remaining composited sediment was placed into a polycarbonate container and stored on ice for later analysis.

Water subsamples were taken from the large amber Nalgene bottles by a technician wearing nitrile gloves. Sulfuric acid (5 mL of 10%) was immediately added to subsamples for the analysis of P, TKN (total Kjeldahl nitrogen), ammonia, and nitrate + nitrite in 250 mL polyethylene bottles. Nitric acid (2.5 mL of 20%, to acidify to pH < 2) was immediately added to subsamples for the analysis of total metals in 250 mL polyethylene bottles. Samples for dissolved metals were subsampled in 250 polyethylene bottles and subsequently filtered using a 0.45 μm filter and preserved with nitric acid in the laboratory. Samples were stored on ice.

2.3. Laboratory Methods

Surface water, pore water, and most sediment analyses were conducted by the Minnesota Department of Health Environmental Laboratory (MDHEL) in 2012 and 2013, following standard methods. In 2011 other laboratories conducted the analyses (University of Minnesota Soils Laboratory (UMNSL), St. Croix Watershed Research Station (SCWRS), and Gustavus Adolphus College (GAC)); methodological differences are noted, and the laboratory is identified where relevant.

Surface and pore water samples were analyzed for anions (Cl and SO_4) by ion chromatography on a Dionex ICS-3000 (MDHEL), Fe, Ca, Na, Mg, and K by inductively coupled optical emission spectrometry on a Varian 715-ES (MDHEL), Mn, Cu, Zn, Co, Ni, Al, As, and Se by inductively coupled mass spectrometry on a Perkin Elmer Elan DRCE (MDHEL), and DOC by UV-persulfate oxidation on a Tekmar-Dohrmann Phoenix 8000 (SCWRS and MDHEL). N and P were measured by colorimetric methods (on a Lachat Quikchem Flow-Injection Autoanalyzer) at SCWRS and MDHEL following cadmium-reduction (nitrate and ammonia) or dual alkaline-persulfate digestions (TP and TN). Silica was measured colorimetrically at SCWRS on the Lachat Autoanalyzer and at MDHEL on a Beckman Coulter DU 800 UV/VIS spectrophotometer. Pore water sulfide was analyzed colorimetrically on each lab's Lachat Autoanalyzer following in-line acid distillation and NaOH trapping (SM 4500-S2). Alkalinity was measured by potentiometric acid titration (MDHEL) or as DIC by acid digestion and IR detection (SCWRS). DIC was converted to alkalinity using pH, temperature, and specific conductance of the surface water.

Sediment samples from 2011 were analyzed by combustion for total carbon (TC), total nitrogen (TN), and total sulfur (TS) using, respectively, a Tekmar Phoenix 8000 CO_2 analyzer, an Elementar Vario Max N analyzer, and a LECO sulfur analyzer (UMNSL). Samples from 2012 and 2013 were analyzed for CHN on a Costech 4010 Elemental Analyzer (UMN Stable Isotope Laboratory). Total inorganic carbon (carbonate) was analyzed by coulometric titration on a UIC CM5015 CO_2 coulometer, while water and organic matter content were determined by loss-on-ignition methods (Heiri, Lotter, & Lemcke, 2001) in the UMN LacCore facilities. Sediment AVS was analyzed colorimetrically, as above for pore water sulfide, following acid-distillation and in-line alkaline trapping (SM 4500-S2; Hsieh & Shieh, 1997).

Sediment phosphorus was extracted from freeze-dried sediments following methods of Engstrom and Wright (1984) for total-P and Hieltjes and Lijklema (1980) for P fractions (NH_4Cl-extractable, NaOH-extractable, HCl-extractable, and residual (organic)-P). The P extracts were measured colorimetrically by flow-injection autoanalyzer (SCWRS). Extractable iron and trace metals were quantified from a 0.25 g homogenized freeze-dried sediment subsample incubated in 0.5 M HCl for 30 min at 80°C. The samples were centrifuged, decanted, and analyzed by ICP-MS at GAC. This extraction releases metal oxyhydroxides, sulfides, and loosely bound phases from the sediment without appreciably attacking the silicate matrix (Balogh et al., 2009).

2.4. Data Subsets and Statistical Analysis

From 2011 to 2013, 260 site visits were conducted in 108 different natural waterbodies, including lakes, small streams, backwaters of the Mississippi River, and wetlands, plus 7 different cultivated wild rice paddies. For a variety of logistical reasons, the full suite of samples could not be collected on some site visits. Three subsets of the field data were identified for the analyses reported here. A subset that consists of all of the samples from natural waterbodies (excluding the cultivated paddies) with virtually complete analyses (surface water, pore water, and bulk sediment; $n = 194$) was termed for internal purposes Class D. Pollman et al. (2017) used Class D to develop a structural equation model to elucidate key variables that govern the concentration of sulfide in sediment pore water. A second subset, Class S, of 51 samples from 7 stream and 8 lake sites was each sampled 3 to 5 times from 27 May to 19 September 2013, to provide a data set to assess seasonality in variables. A third subset, Class B, was used for conducting probabilistic analyses to identify the most likely parameters controlling the presence and absence of wild rice and to examine Spearman nonparametric correlations among field variables. Class B consists of one sample from each site ($n = 108$) and excludes samples collected in 2011, which were analyzed with slightly different lab methods. Although Class B was not created as a random sample of Minnesota waterbodies, the frequency distribution of SO_4 concentrations is intermediate between a probability-based survey conducted by USEPA (MPCA, 2016) and a list of known wild rice water bodies, which are overwhelmingly low-SO_4 lakes (MPCA, 2014). Therefore, the Class B data set is reasonably representative of potential wild rice habitat, and binary logistic regressions can be used to approximate the probability of wild rice occurrence as a function of field variables such as pore water sulfide. The Class B data set is used in all analyses presented here, with two exceptions: (1) Figures 3a–3c present the full Class D data set, plus for comparison, data from the cultivated wild rice paddies; (2) Statistical analysis was performed with the software package R version 3.2.3.

To identify variables associated with the presence and absence of wild rice, we relied on binary logistic regressions (BLR), using the glm function in R. BLR does not require normally distributed data, but

Table 1
Field Variable Correlation With the Presence-Absence of Wild Rice, Assessed Through Binary Logistic Regression (BLR), Plus Spearman Correlations Between Variables[a]

	Binary logistic regression (BLR) correlation with field variable			Spearman correlation with field variable (rho)				
Field variable	Log transformed?	*p* value	Correlation direction	Wild rice density (only wild rice sites) *n* = 67	Pore water sulfide	Sediment AVS	Water transparency	Water temperature
pw K	Y	0.0008***	Negative	−0.27*	0.46***	0.11	−0.10	0.33***
pw sulfide	Y	0.0012***	Negative	−0.31**	1.00	0.29**	−0.07	0.17
Water depth (m)	N	0.0028***	Negative	0.07	0.11	0.08	0.22*	0.19*
Transparency (cm)	N	0.0031***	Positive	0.11	−0.07	−0.13	1.00	−0.08
sw TN	Y	0.0054**	Negative	−0.12	0.22*	0.08	−0.61***	0.23*
sed Se % dry	N	0.0059**	Negative	0.12	0.08	0.27**	−0.21*	0.13
sw Temp	N	0.0077**	Negative	0.08	0.17	0.11	−0.08	1.00
pw Fe	Y	0.0109*	Positive	0.20	−0.58***	0.00	0.04	0.09
sw pH	N	0.0200*	Negative	−0.14	0.28**	0.08	−0.05	0.35***
sw TP	Y	0.0353*	Negative	0.15	0.05	0.29**	−0.58***	0.27**
Latitude	N	0.0376*	Positive	−0.04	−0.06	−0.09	0.13	−0.51***
sed TS % dry	Y	0.0483*	Negative	0.20	0.40***	0.42***	0.03	−0.08
sw K	Y	0.0922		−0.03	0.29**	0.21*	−0.18	−0.08
sed AVS % dry	Y	0.1317		0.02	0.29**	1.00	−0.13	0.11
sw sulfate	Y	0.1475		−0.10	0.44***	0.45***	−0.07	0.04
sed TP % dry	N	0.2697		−010	0.07	0.30**	−0.14	0.14
sw alkalinity	Y	0.2786		0.25*	0.22*	0.26**	0.11	0.17
pw TN	Y	0.2963		−0.30	0.31***	0.14	−0.20*	0.34***
pw NH4	Y	0.4505		−0.33**	0.33***	0.22*	−0.17	0.26**
sed Fe % dry	Y	0.4795		0.16	−0.35***	0.38***	−0.10	−0.06
pw DOC	Y	0.4865		0.08	−0.05	−0.1	−0.21*	0.09
pw Si	N	0.5548		0.03	0.33***	0.18	0.07	0.29**
pw TP	Y	0.6341		0.02	0.12	0.30**	−0.26**	0.26**
sed TN % dry	N	0.6807		−0.06	0.14	0.04	0.06	−0.06
sed water content	N	0.7274		−0.07	0.15	0.10	0.10	0.02
sed TOC % dry	N	0.7854		−0.10	0.10	0.02	0.10	−0.06

[a]Note. The variables are ordered by the significance of the BLR. The first 12 variables have BLR significance of $p < 0.05$. The additional 14 variables are listed because of their correlation with pore water sulfide, sediment AVS, or surface water transparency or temperature—or their notable lack of correlation with wild rice presence-absence (pw = pore water; sw = surface water; sed = sediment).
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

nevertheless, we transformed some variables (Table 1) to achieve approximately normal distributions. BLR also yields the probability of occurrence at a given value of the variable. Spearman nonparametric correlations (rho) between field variables in Class B were examined as part of the effort to identify the major biogeochemical interactions in these shallow-water systems. Seasonality in a variable was assessed using linear mixed effects models, with time (fraction of a year) as a fixed variable and site as a random factor (to account for multiple samples per site). In the model developed for each field variable, we accounted for the seasonal cycle using the following equation (Crawley, 2007), where *A*, *B*, and *C* are fitted model coefficients:

$$y = A + B\ \sin\ (2\pi\ \text{time}) + C\ \cos\ (2\pi\ \text{time}) \quad (1)$$

3. Results and Discussion

3.1. Field Variables Associated With Wild Rice Presence and Absence

Of the 64 field quantified variables, BLR identified 12 that are associated with the presence/absence of wild rice at the 0.05 probability level or better (Table 1): pore water sulfide, K, and Fe (Figures 2a, 2b, and 2f); surface water temperature, TP, TN, and pH (Figures 2d, 2m, 2n, and 2o); sediment Se and TS (Figures 2c and 2p); water depth and transparency (not shown; Figure 2e); and latitude of the site (Figure 2g). These variables may be important in controlling the presence or absence of wild rice or may merely be correlated with one or more actual causative factors. Because we are primarily interested in factors that control presence or absence of wild rice, in contrast to the density of wild rice, we place primacy on the BLR results and use the Spearman

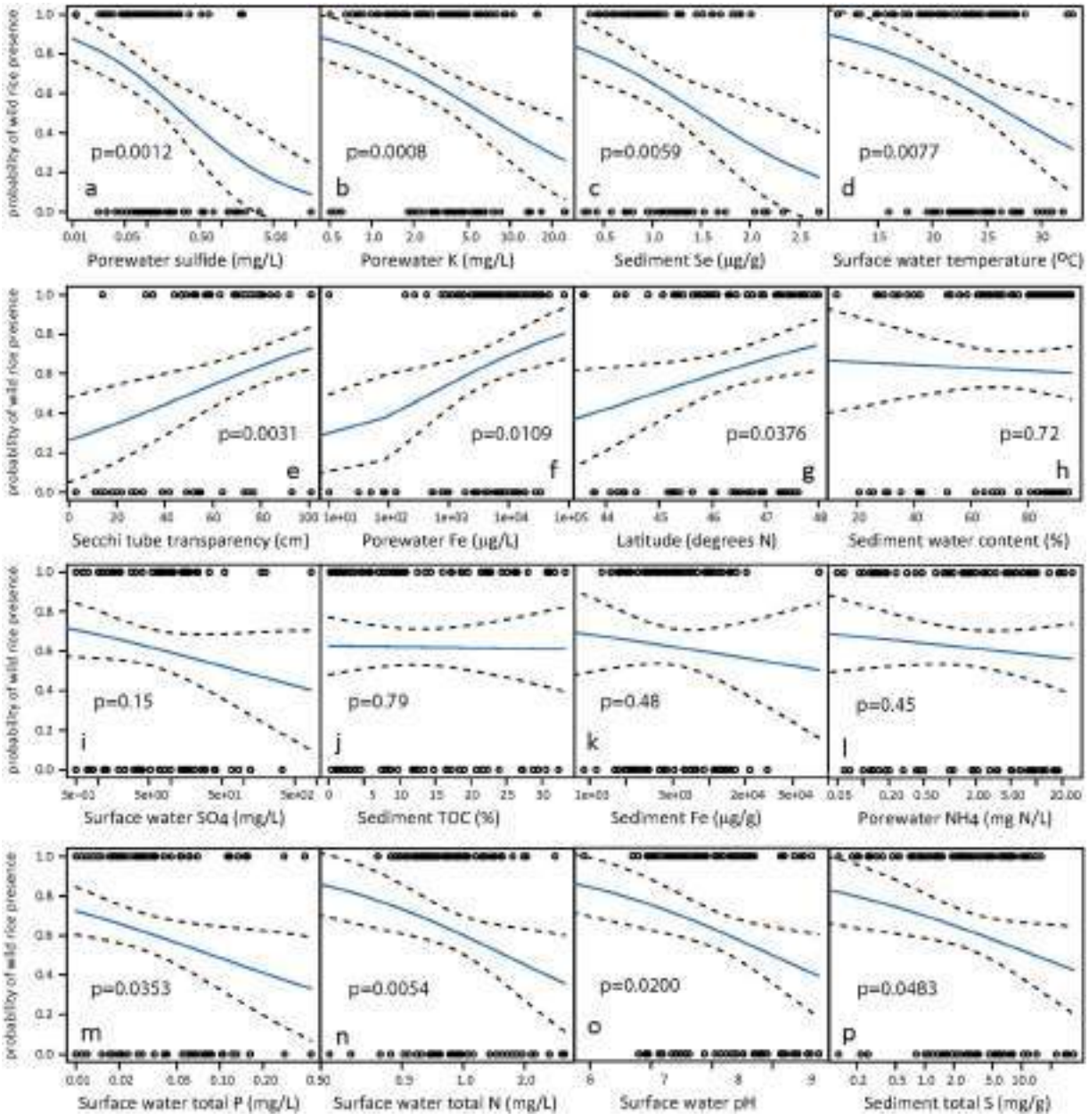


Figure 2. Binary logistic regressions for 16 variables found to be statistically significant in this study or indicated in the literature as important for wild rice habitat. The open circles indicate the value for a given parameter of each site used in the analysis; the circles at the top of a plot indicate sites with wild rice present; the circles at the bottom of a plot indicate sites with wild rice absent. The span of the dashed lines around the solid line indicates the 95% confidence interval.

correlations to help understand the relationships between environmental factors of interest. Wild rice density is negatively correlated with pore water sulfide, potassium (K), and NH_4 and positively correlated with surface water alkalinity (Table 1). There are likely factors controlling the density of wild rice at any particular location in addition to the variables measured, such as herbivory and hydrological disturbances.

One should be cautious in the interpretation of statistically significant associations between wild rice and field variables, in that true cause and effect are not necessarily obvious. For instance, is the toxic quality of pore water sulfide sufficient explanation for its negative associations with both the presence and density of wild rice? Do sites with greater density of wild rice have lower pore water sulfide because low sulfide allows wild rice to grow, or because plants release oxygen from their roots, oxidizing sulfide? The true explanation is likely a combination of the two mechanisms: elevated pore water sulfide can eventually extirpate a wild rice

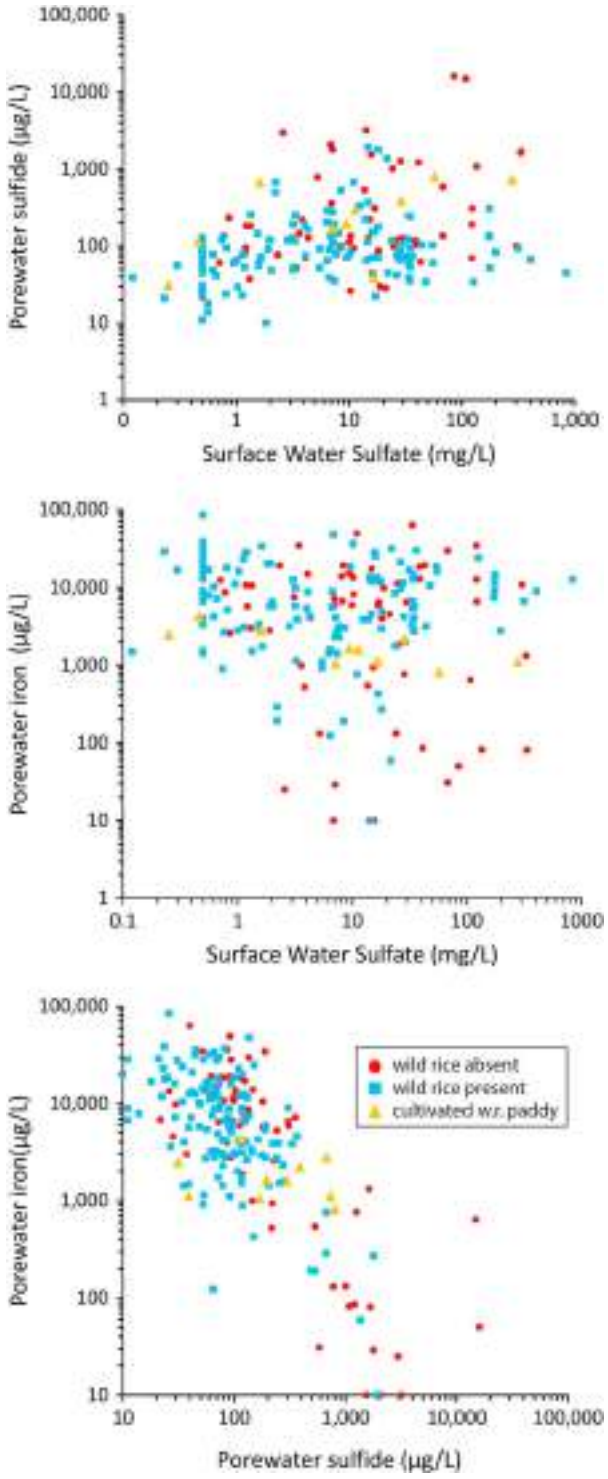


Figure 3. Class D data plus cultivated wild rice paddies (yellow triangles) showing sites with wild rice present (blue squares) and absent (red circles). Note that (a) pore water sulfide is not linearly related to surface water SO_4, indicating that additional factors besides SO_4 concentration contribute to the sulfide concentration in pore water; (b) wild rice can occur in sites over a wide range of surface water SO_4 values as long as pore water Fe is relatively high; and (c) pore water Fe and sulfide have a strong negative relationship, due to the energetically favorable formation of FeS compounds, and that wild rice mainly occurs where pore water sulfide is $<1{,}000\ \mu g\ L^{-1}$.

population by reducing seedling survival and seed production, weight, and viability (Pastor et al., 2017), but oxygen release from roots when sulfide concentrations are low enough to allow wild rice to successfully reproduce drives sulfide to even lower concentrations than would have occurred without the plants (Myrbo et al., 2017). Although the negative correlation between pore water sulfide and wild rice density (rho = -0.31, $p < 0.01$, Table 1) could be interpreted to mean that lower sulfide allows a larger population to grow, it is also possible the correlation is partly caused by oxygen release from the wild rice roots, decreasing sulfide concentrations. This hypothesis is supported by the observation from a controlled experiment that acid-volatile sulfide (AVS) sediment concentrations were 30% lower when wild rice was present (Myrbo et al., 2017).

Of the 12 variables significantly associated with the occurrence of wild rice, we propose that nine are noncausal and merely related to one or more of three truly causative factors: (1) pore water sulfide, (2) water transparency, and (3) water temperature. These three variables are not significantly correlated with one another (Table 1), and there are plausible mechanisms for each to independently exclude wild rice from otherwise suitable habitat: (1) elevated sulfide reduces the growth of wild rice (Pastor et al., 2017); (2) low water transparency plausibly constrains the ability of a germinated wild rice seed to reach sufficient light before it runs out of endosperm energy (Aiken et al., 1988; DNR, 2008); and (3) warmer winter water temperature at lower latitudes may limit seed germination, as the seeds of *Z. palustris* must experience at least 3 months in cold water to break seed dormancy (Kovach & Bradford, 1992) (although summer temperatures were measured in this study, winter and summer temperatures would be correlated).

3.2. Pore Water Sulfide as a Causal Variable and Associated Correlated Variables

Our primary a priori hypothesis was that elevated surface water SO_4 can produce elevated pore water sulfide concentrations which, in turn, negatively affect potential wild rice habitat. A plot of pore water sulfide against SO_4, with wild rice presence noted (Figure 3a), suggests that wild rice is generally not found at sites with elevated sulfide. Of the sites with pore water sulfide greater than 1,000 $\mu g\ L^{-1}$, wild rice was present in 23% (3 of 13, with only a few plants found at 2 of those 3 sites). In contrast, wild rice was present at 74% of the sites where sulfide was less than 1,000 $\mu g\ L^{-1}$. Despite historical reports of *Zizania aquatica* in Minnesota, inspection of voucher specimens, following the taxonomy of Terrell et al. (1997), found only *Z. palustris* at all sites sampled. *Zizania aquatica* (Southern wild rice) is rare in Minnesota, but its range extends east through Wisconsin and the southern part of the Great Lakes region to New England and occurs in freshwater tidal marshes south to Florida and west to Louisiana (Terrell et al., 1997). The findings of this study, especially those related to temperature, may not apply to *Z. aquatica*.

Despite a strong relationship between sulfide and wild rice, the relationship between SO_4 and pore water sulfide among the 108 field sites was not a simple linear function. High surface water SO_4 did not always result in high pore water sulfide (above 1,000 $\mu g\ L^{-1}$), and some samples with surface water SO_4 less than 10 $mg\ L^{-1}$ had pore water sulfide greater

than 1,000 μg L^{-1} (Figure 3a). The 33 samples with surface water SO_4 below 1.0 mg L^{-1} all had pore water sulfide less than 200 μg L^{-1}, suggesting that surface water SO_4 might limit maximum sulfide production.

Wild rice was present at high and low SO_4 concentrations as long as pore water Fe was high and sulfide was low (Figures 3b and 3c): pore water Fe and sulfide each exert antipathetic control over the concentration of the other (Figure 3c; Pollman et al., 2017), and wild rice mainly persists in sites where pore waters are low in sulfide and high in Fe. Pollman et al. (2017) developed a structural equation model showing that variations in three variables (SO_4, sediment TOC, and sediment extractable Fe) contribute nearly equally to the observed variations in pore water sulfide among the sites in this study. Sulfate-reducing bacteria are simultaneously limited in their production of pore water sulfide by surface water SO_4 and sediment TOC (which are roughly proportional to available SO_4 and labile organic matter, respectively). Concentrations of sulfide in pore water are then constrained by the availability of pore water Fe, which is in turn controlled by the overall supply of Fe in the sediment (Pollman et al., 2017).

If pore water sulfide concentration is a causative factor controlling the presence of wild rice, as hypothesized, then other variables may be statistically significant because they either vary with the process of SO_4 reduction or with the sulfide itself. Pastor et al. (2017) showed that wild rice growth declines in proportion to sulfide concentrations in both hydroponic and outdoor mesocosm experiments. In a study of the Pastor et al. mesocosms, Myrbo et al. (2017) showed that the enhanced mineralization of plant litter associated with SO_4 reduction produced increases in surface water P and N, and increases in pore water sulfide caused decreases in pore water Fe. These effects from the controlled mesocosm experiment are consistent with correlations observed among sites in the field data between pore water sulfide and surface water N and pore water Fe (Table 1). Surface water P is not significantly correlated with pore water sulfide in the field data, despite dual mechanisms of P mobilization from sediment, (1) the interaction between sulfide and Fe (Caraco et al., 1993; Maynard, Dahlgren, & O'Geen, 2011; Smolders & Roelofs, 1993) and (2) mineralization of organic matter. The lack of correlation of surface water P with pore water sulfide in this field study is not surprising because given the wide variety of landscapes sampled, there is no reason that pore water sulfide would be proportional to the mass of Fe that has reacted with sulfide and released sorbed P. In SO_4 addition experiments where the P and Fe content of the sediment is held constant, there is often a significant correlation between pore water sulfide and mobilized P (Myrbo et al., 2017). In contrast to the lack of correlation of pore water sulfide with surface water P in this field study, AVS is significantly correlated with surface water P (rho = 0.30, $p < 0.01$, Table 1), presumably because AVS is proportional to the iron that has reacted with sulfide.

Elevated pore water sulfide is a product of SO_4 reduction-driven mineralization of sediment organic matter, which also releases the constituents of the decaying plant material, N, P, K, silica, and C (either as DIC, which increases alkalinity, or DOC) into sediment pore water and the overlying surface water (Myrbo et al., 2017). Consequently, the occurrence of wild rice is negatively associated not only with pore water sulfide ($p = 0.001$) but also with elevated pore water K ($p = 0.0008$) and surface water TN ($p = 0.005$, Table 1). Median concentrations of these variables are lower in wild rice waters compared to waters with no observed wild rice (88 versus 126 μg L^{-1} sulfide, 2.4 versus 4.3 mg L^{-1} pore water K, and 0.74 versus 0.95 mg L^{-1} TN, Table S3). Pore water sulfide is itself positively correlated with pore water K, TN, NH_4, and silica, surface water K, alkalinity, and pH, and sediment TS and AVS (Tables 1 and S4).

The strong evidence for the association of elevated pore water K with the absence of wild rice (Table 1) is interesting, as K is an essential plant nutrient, and therefore, it is unlikely that the association is based on toxicity to wild rice. Rather, it is likely that the association is a result of the simultaneous mobilization of K with the production of sulfide as plant matter is mineralized. Potassium does not bond covalently with organic compounds and is readily leached out of dead organic matter (Troeh & Thompson, 2005). Silica phytoliths dissolve as plant matter is mineralized, allowing additional K that had been trapped within the phytoliths to be released into sediment pore water (Nguyen et al., 2015). Wild rice and other wetland macrophytes develop abundant phytoliths that release dissolved silica upon decomposition (Struyf & Conley, 2009). Additional dissolved silica is likely released to pore water as epiphytic diatoms are mineralized. Pore water silica, K, and sulfide are all significantly correlated with each other (Tables 1 and S5). The negative correlation of pore water K with wild rice may be magnified by its additional positive correlation with elevated water temperature (Table 1), which plausibly accelerates dissolution of silica in organic matter (Gudasz et al., 2010; Kamatani, 1982).

AVS largely consists of solid-phase sulfide, which is not available to plants and therefore is not significantly associated with wild rice presence/absence ($p > 0.10$, Table 1). AVS is a measure of cumulative sulfide production, which is proportional to past mineralization of organic matter, consistent with significant positive correlations between AVS and pore water TP and NH_4, and surface water TP and alkalinity ($p < 0.01$, 0.05, 0.01, and 0.01, respectively, Table 1).

The negative association of sediment total-S (TS) with wild rice presence (BLR $p = 0.048$, Table 1) is likely the result of both TS and wild rice being controlled by sulfide production; the median TS concentration at sites with wild rice is 2.6 mg g^{-1}, compared to 4.1 mg g^{-1} at sites without wild rice (Table S3). Sediment TS is correlated with both pore water sulfide and AVS. The negative association of sediment Se with wild rice (BLR $p = 0.006$) is surprising, given that median Se concentrations are very low (0.9 and 1.2 μg g^{-1} in sites with and without wild rice, respectively). The slightly higher Se at sites without wild rice may be caused by the coprecipitation of Se and S by SRB, as shown by Hockin and Gadd (2003). Selenium is correlated with sediment total S (rho = 0.35; $p < 0.001$).

3.3. Water Transparency as a Causal Variable and Associated Correlated Variables

Lower water transparency is associated with a lower probability of wild rice occurrence (BLR $p = 0.003$). Transparency is not related to wild rice density (rho = 0.11, $p > 0.20$, Table 1); however, low transparency can apparently exclude wild rice (11 of the 12 sites with transparency <30 cm had no wild rice), but above that threshold, other variables control wild rice density. Low water transparency decreases photosynthesis of wild rice seedlings while growing to the water surface, which (a) decreases oxygen production that could otherwise be used to detoxify sulfide internally (Krüssel et al., 2014), or externally if released into pore water from the roots (Colmer, 2003); and (b) decreases the energy available for root development, enhancing vulnerability to a sudden increase in water depth, which can uproot an entire year's cohort (DNR, 2008). Wild rice is unusual among grasses in that the stem develops before the root, probably because the seedling may have to grow over 50 cm before reaching the water surface, at which time floating leaves are developed that can supply energy for root development (Aiken, 1986). If transparency is too low, or the water too deep, the energy stored in the seed can be insufficient for the seedling to reach the water surface.

Water transparency can be controlled by the density of phytoplankton, which was not measured in this study. However, transparency is highly correlated with the nutrient concentrations that control phytoplankton growth, total phosphorus (rho = −0.58, $p < 0.001$), and total nitrogen (rho = −0.61, $p < 0.001$). Transparency can also be controlled by colored dissolved organic matter, consistent with the observed significant correlation between transparency and water color (rho = −0.68, $p < 0.001$, Table S4).

3.4. Temperature as a Causal Variable and Associated Correlated Variables

Wild rice germinates at higher rates following longer exposure at temperatures closer to freezing (Kovach & Bradford, 1992), consistent with the significant association of wild rice absence with lower latitudes (BLR $p = 0.04$) and warmer summer water temperature (BLR $p = 0.008$; medians of 21.9° and 23.7°C with and without wild rice, respectively). Sites with warmer summer water temperatures generally also have warmer winter temperatures. Warmer and shorter winters would cause lower germination rates, ultimately reducing the probability that a population could persist over the long term. For this reason, the Minnesota Department of Natural Resources hypothesizes that climate change may push the range of wild rice farther north (DNR, 2008, 2016). However, the temperature control of wild rice germination has not been adequately investigated to rigorously assess this hypothesis. The observed association of wild rice with lower pH surface waters (BLR $p = 0.04$; median pH values of 7.8 and 8.5 at sites with and without wild rice, respectively) may be due simply to the correlation of wild rice with cooler surface waters: the solubility of CO_2 is higher in colder water, leading to lower pH (Spearman correlation between temperature and pH = 0.35, $p < 0.0001$).

Lower latitude sites are negatively associated with wild rice presence and density (Table 1). Lower latitude sites are correlated with higher water temperature (rho = −0.51, $p < 0.001$). Geological and land use gradients also correlate with latitude, producing correlations with surface water N and P (rho = −0.25 and −0.31, $p < 0.01$). Despite these correlations with nutrients, latitude is not significantly correlated with water transparency (rho = 0.13), so the general unsuitability of lower latitudes for wild rice may be a combination of warmer winters and some reduced transparency as a result of nutrient enrichment. Latitude is not significantly correlated with pore water sulfide (rho = −0.06).

3.5. Synergy Among the Three Causal Variables of Sulfide, Temperature, and Transparency

While temperature may control wild rice presence/absence through winter temperatures too warm to achieve high rates of seed germination in the spring, higher summer temperatures may act synergistically on variables correlated with pore water sulfide. Elevated summer temperatures likely enhance microbial activity, no matter which electron acceptor is respired by the dominant microbes (Gudasz et al., 2010). Water temperature is indeed correlated with pore water concentrations of the plant nutrients N, P, and K released by decomposition, which are also significantly correlated with either pore water sulfide or AVS (Table 1). Although sulfide production may be enhanced by elevated temperature, the correlation between sulfide and temperature is weak (rho = 0.17; $p > 0.05$).

The production of sulfide plausibly contributes to the significant correlation of six of the nine variables with wild rice occurrence: P and N in surface water, Fe and K in pore water, and S and Se in sediment. Water temperature is significantly correlated with three of these variables (P, N, and K), and therefore, synergistically reinforces their associations with the absence of wild rice. Elevated surface water P and N are further synergistically associated with the absence of wild rice because their release via MSR-driven mineralization also enhances phytoplankton growth, reducing light available to wild rice seedlings; P and N are highly correlated with reduced transparency ($p < 0.001$, Table 1).

In this data set greater water depth is negatively associated with the occurrence of wild rice, not because wild rice grows better in shallower water, which it may, but because of where field crews took samples when wild rice was not present. Following a decision tree (Table S1), when wild rice was not present, field crews usually sampled among water lilies, which, on average, were observed in slightly deeper water than wild rice (67 cm compared to 52 cm).

Finally, *multiple* BLR was employed to investigate the question of whether any of the correlated variables provided additional explanatory power for the occurrence of wild rice beyond the models with sulfide, transparency, or temperature as base predictors. Surface water temperature is predictive of wild rice presence independent of sulfide ($p = 0.03$). Pore water K improves models based on sulfide ($p = 0.02$) or temperature ($p = 0.004$) alone but provides no significant additional explanatory power beyond a model built on both sulfide and temperature ($p = 0.07$). Overall, multiple BLR analysis confirms that other variables provide no additional explanatory power and that the three base predictors are independent of each other.

Multiple BLR was used to model the probability of wild rice occurrence (WR presence) as a function of pore water sulfide (pw sulfide, in mg L^{-1}), water transparency as measured by the Secchi tube (trans, in cm), and water temperature (Temp, in °C):

$$\text{Logit}\,(\text{WR presence}) = 0.532 + 0.0183\,(\text{trans}) - 1.169\,(\,\text{log10 pw sulfide}) - 0.107\,(\text{Temp}) \quad (2)$$

where odds = exp(logit) and probability = (odds/(1 + odds)).

Pore water sulfide and water transparency are significant variables in the multiple BLR ($p = 0.012$ and $p = 0.016$, respectively), whereas water temperature is only marginally significant ($p = 0.056$). To visualize the interaction of the variables, a 3-D plot was constructed that predicts the probability of wild rice occurrence as a function of sulfide and transparency, while holding constant the marginally significant variable, temperature, at the median value of the Class B data set (23.2 C; Figure 4). Within the range of variables in Class B, modeled probabilities of wild rice occurrence range from a high of 89.8% (trans = 100 cm, which was the maximum of the measurement device, and pw sulfide = 11 $\mu g\ L^{-1}$, which was the reporting limit) to a low of 9.6% (trans = 3 cm, which was the minimum observed, and pw sulfide = 2,000 $\mu g\ L^{-1}$). Modeling was cut off at a sulfide concentration of 2,000 $\mu g\ L^{-1}$ because only three Class B sites had pore water sulfide greater than 2,000 $\mu g\ L^{-1}$ and none of the three hosted wild rice.

3.6. Field Variables not Evidently Associated With Wild Rice Presence and Absence

Some variables included among the initial hypotheses, or in the past cited as important attributes of wild rice habitat, were not found to be significantly associated with wild rice presence and absence. These include sediment TOC ($p = 0.79$, Figure 2j; DNR, 2008; Lee, 1986; Moyle & Krueger, 1964), flocculent sediment (quantified here as the sediment water content; $p = 0.72$, Figure 2h; DNR, 2008; Lee, 1986; Moyle & Krueger, 1964), sediment N ($p = 0.68$, Table 1; Carson, 2002; Walker et al., 2010), sediment P ($p = 0.27$, Table 1; Carson, 2002; DNR, 2008), and surface water alkalinity ($p = 0.28$, Table 1; Moyle, 1944).

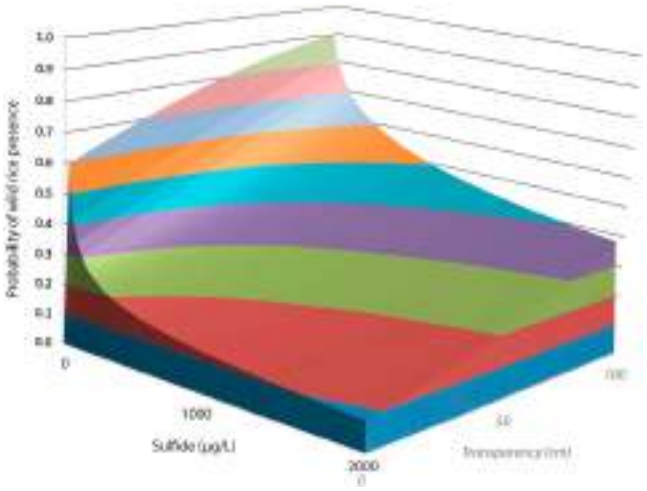


Figure 4. Visualization of the relationship, determined by multiple binary logistic regression, between water transparency and pore water sulfide in controlling the probability of wild rice occurrence at 23.2°C, the median temperature for all sites in the class B data set.

Reduced sediments are generally regarded as producing pore water constituents that are potentially toxic to rooted plants; potentially toxic agents, in addition to sulfide, include ammonia and Fe (Pezeshki & DeLaune, 2012). Analysis of the binary logistic regressions showed no evidence for ammonia toxicity (BLR $p = 0.45$, Figure 2l) or Fe toxicity (wild rice presence is positively correlated with pore water Fe, BLR $p = 0.01$, Figure 2f). As a product of decomposition, ammonia is correlated with pore water sulfide, K, and silica (Spearman correlations $p < 0.001$, Table S4).

The field data provide little evidence that elevated sulfide production excludes wild rice by producing Fe, Cu, or Zn deficiency (Table S3). The possibility that *low* pore water Fe limits wild rice growth is difficult to distinguish from sulfide toxicity because of the strong negative correlation between pore water Fe and pore water sulfide (rho = −0.58, $p < 0.0001$, Table 1). Hydroponic studies using chelated Fe in combination with elevated sulfide (Pastor et al., 2017) show reduced growth, implying that the mechanism is sulfide toxicity, rather than Fe limitation, assuming that the chelated Fe remains bioavailable in the presence of sulfide (Li et al., 2009). The median pore water Fe levels at sites with and without wild rice are similar, 5.7 and 5.9 mg L^{-1}, respectively; average levels are 11.0 and 7.0 mg L^{-1}, respectively, which produced the significant BLR positive correlation between pore water Fe and wild rice presence. On balance, there is little evidence to support the hypothesis that elevated sulfide reduces wild rice growth through Fe deficiency rather than by direct sulfide toxicity. Pore water Cu concentrations were often below the detection limit in the field sites sampled, precluding analysis of their correlation with wild rice presence and absence. The BLR for pore water Zn concentrations with wild rice presence and absence was not statistically significant (data not shown). Neither Cu nor Zn had a significant Spearman correlation with pore water sulfide (data not shown), unlike Fe.

3.7. Seasonality in Field Variables

Fifteen natural wild rice sites were sampled 3 to 5 times in 2013 to determine which field variables exhibit statistically significant seasonal trends that might be important to consider in the overall analysis, given that different sites were sampled in different months. Some variables conformed to expected seasonal trends, such as water temperature ($p = 0.001$), which increased in early summer, peaked about 1 August, and then declined. Some of the surface water variables exhibited monotonic increased concentrations over the summer (alkalinity, Na, Mg, and SO_4; $p = 0.0009$, 0.008, 0.021, and 0.05, respectively). One hypothesis that explains this observation is that waterbodies in Minnesota, after being diluted by spring snowmelt, in general become more concentrated as the summer progresses due to evaporation and, for waterbodies with shorter residence times, greater influence of groundwater flux. Cl and Ca had nonsignificant positive slopes ($p = 0.29$ and 0.37, respectively), whereas K exhibited no trend ($p = 0.48$). As expected, none of the solid-phase variables of the homogenized 10 cm long sediment cores showed any significant seasonal trends (e.g., sediment extractable Fe $p = 0.93$, sediment TOC $p = 0.96$). Among the pore water variables, only K and pH exhibited significant trends. Pore water K values decreased over the summer ($p = 0.006$), likely as a result of diffusion into surface water or uptake by growing rooted macrophytes. Pore water pH generally increased over the summer ($p = 0.003$), which may reflect loss of CO_2 as the sediment warmed over the summer, reducing the solubility of gases. The lack of seasonality in pore water sulfide ($p = 0.62$) indicates that sulfide concentrations were in steady state with the variables that exert primary control over its concentration, surface water SO_4, extractable Fe, and sediment TOC (Pollman et al., 2017). Of the variables controlling pore water sulfide, only SO_4 exhibited even marginally significant seasonal trends ($p = 0.05$, 0.93, and 0.97, for SO_4, extractable Fe, and sediment TOC, respectively). Despite the finding of seasonal variation in SO_4, Pollman et al. (2017) found that SO_4 is one of the primary variables that control pore water sulfide concentrations. Seasonal variation in SO_4 concentrations undoubtedly contributes to noise in the statistical relationship documented by Pollman et al. (2017). Myrbo et al. (2017) found that the microbial production of pore water sulfide in a wild rice sediment is proportional to the long-term average SO_4 surface water concentration.

3.8. Cultivated Wild Rice Paddies

Commercial wild rice paddies have been reported with healthy stands of wild rice growing under surface water SO_4 levels as high as 170 mg L^{-1} (Aiken et al., 1988). Our limited measurements in seven different paddies ranged from 0.3 mg L^{-1} to 279 mg L^{-1} SO_4, with a median of 8.3 mg L^{-1} (n = 7, Table S3). Natural wild rice waters in our study had a median SO_4 concentration of 4.1 mg L^{-1}. Surprisingly, median pore water sulfide in paddies was 182 μg L^{-1}, greater than the medians of natural wild rice waters (88 μg L^{-1}; n = 67) and waters without wild rice (126 μg L^{-1}; n = 41). The median sediment extractable Fe concentration of paddies (4.5 mg g^{-1}) is similar to that of natural wild rice waters (4.8 mg g^{-1}). In contrast, median sediment TOC is much higher in paddies (25.2%) than natural wild rice waters (9.1%). It thus appears that the greater TOC driving enhanced SO_4 reduction (Pollman et al., 2017) and driving median pore water Fe lower than in natural wild rice sediments (1.6 and 5.7 mg L^{-1}, respectively), despite the similar reservoirs of Fe in the sediment. Elevated production of sulfide coupled with the consumption of the available Fe may put some paddies on the brink of sulfide toxicity to wild rice.

However, the physical setting of cultivated wild rice paddies differs from that of natural lakes and streams in a number of important ways. Often paddies and their surface sediments are dewatered during the growing season through use of buried drainage tiles, allowing tillage after harvesting and enhanced aerobic decomposition of rice straw and roots, and possibly reoxidation of sulfide and reduced Fe. Prior to drainage tile installation in the 1980s, failure of wild rice crops was sometimes attributed to elevated sulfide (Grava & Rose, 1975; Gunvalson, personal communication, 2016). Water depth in paddies is also typically shallower (median of 30 cm) than wild rice habitat in natural lakes and rivers (median of 52 cm), allowing seedlings to emerge above water with less energy expended, photosynthesize sooner, and release oxygen from roots to oxidize sulfide. The use of nitrogen fertilizers may further enable seedlings to elongate more quickly through the water and into the air. Fertilized plants have been shown to be more resistant to sulfide toxicity than are control plants (Geurts et al., 2009). The production of sulfide would be inhibited if N fertilizers were applied as nitrate—but N fertilizers are applied as ammonia or urea (Oelke et al., 1997).

3.9. Conclusions and Implications

Analysis of an extensive suite of physical and chemical parameters from 108 different sites with potential wild rice habitat shows that pore water sulfide toxicity is a primary biogeochemical factor controlling the occurrence of wild rice populations in otherwise favorable habitat. High concentrations of pore water sulfide greatly decrease the probability that a wild rice population will be found in a waterbody. When pore water sulfide is low enough to support reproducing wild rice populations, however, it is likely that the relationship between sulfide and wild rice becomes more complicated and analysis of cause and effect more ambiguous. The variation in sulfide concentration is correlated to the density of wild rice, at least partially as a result of oxygen release from roots, and thus, not only does sulfide affect wild rice but wild rice affects sulfide.

Aside from low pore water sulfide, favorable wild rice habitat has long, cold winters and transparent surface water in the ice-free season. *Zizania palustris* seeds germinate at low rates if the winter is too warm or too short. The probability that wild rice seedlings successfully grow to maturity is reduced if photosynthesis is inhibited by low water clarity. Thus, pore water sulfide (itself a function of surface water SO_4, sediment Fe, and sediment organic matter (Pollman et al., 2017)), water temperature, and water transparency together largely determine wild rice presence and absence. These three factors are independent of one another but may act synergistically on other related processes.

In addition to generating sulfide, SO_4 reduction supports organic matter mineralization that releases nutrients and alkalinity to the surface water, which has the potential to change plant community structure even if Fe is high enough to keep pore water sulfide from reaching phytotoxic levels (Myrbo et al., 2017). Natural and anthropogenic SO_4 loading to freshwaters may thus strongly affect ecosystem composition and function, despite the low direct toxicity of SO_4 under oxic conditions.

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