Attachment 13

Air Quality Modeling Report

West River Dairy Expansion

Air Quality Modeling Report

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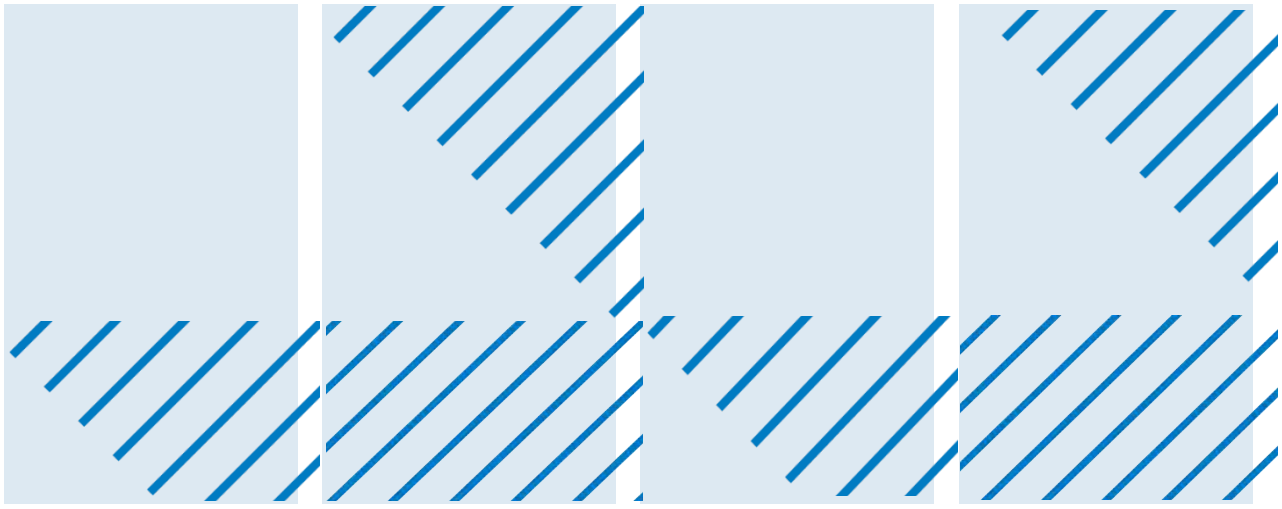


West River Dairy Expansion

May 2025

Contents

1 Introduction

Riverview, LLP proposes to increase the capacity of West River Dairy from its present 7,855 head of milking and dry cows up to 18,855. The dairy is in Section 1, Synnes Township, Stevens County, Minnesota.

Based on a protocol approved by the Minnesota Pollution Control Agency (MPCA) on April 11, 2025, air quality modeling calculated the hydrogen sulfide concentrations, ammonia concentrations, and odor concentrations at the property lines for West River Dairy and at the locations for 11 of the dairy's nearest neighbors. The locations of West River Dairy and the neighboring residences are provided in Figure 1.

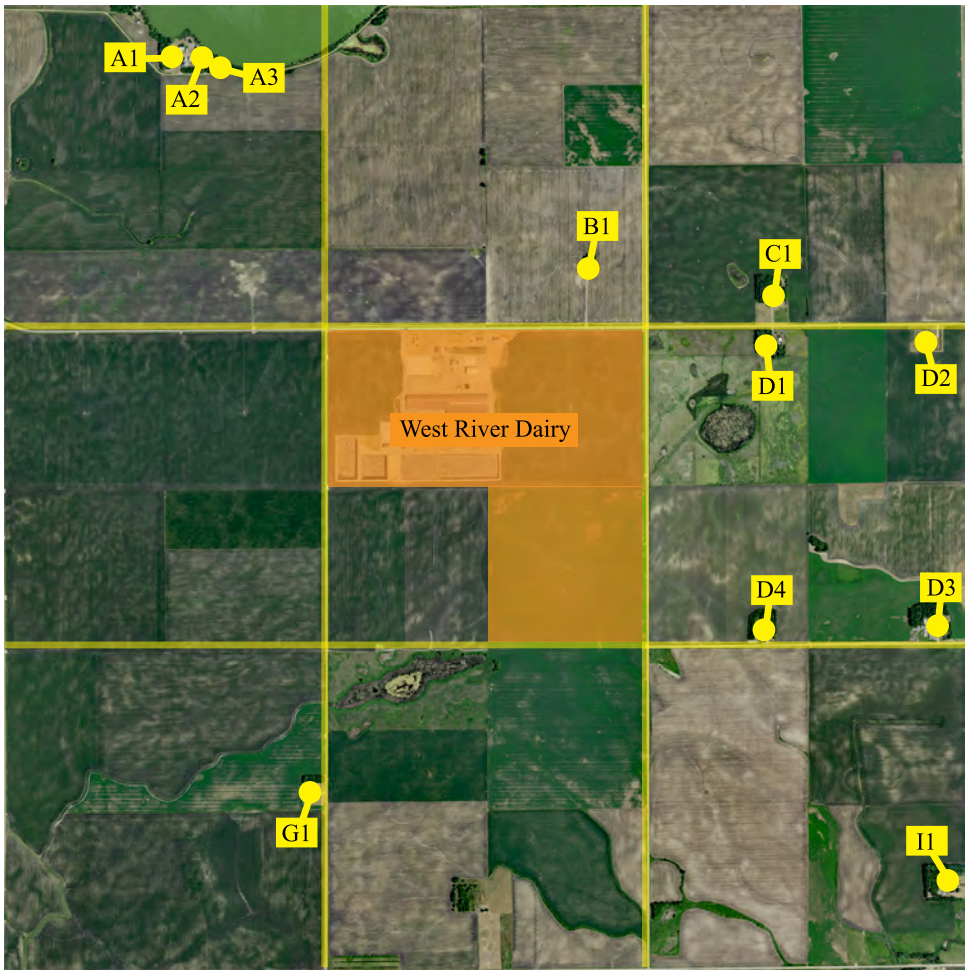


Figure 1 **Modeled locations of the expanded West River Dairy (Section 1, Synnes Township) and the 11 neighboring residences.**

The modeled emission sources for the expanded West River Dairy consisted of six freestall barns, two holding barns, two separator buildings, one straw-covered primary manure storage basin, seven HDPE-covered secondary manure storage basins, and two bedding stacking pads.

The following atmospheric concentrations were calculated:

1. the hourly hydrogen sulfide concentrations at the property lines for West River Dairy to assess the potential to comply with Minnesota's ambient air quality standard for hydrogen sulfide of 30 parts per billion by volume (ppb);

2. the monthly hydrogen sulfide concentrations at 11 of the dairy's nearest neighbors to assess the potential to exceed Minnesota's subchronic (13-week) inhalation Health Risk Value (iHRV) for hydrogen sulfide of 10 micrograms per cubic meter ($\mu g/m^3$);

3. the hourly ammonia concentrations at the property lines for West River Dairy to assess the potential to exceed Minnesota's acute iHRV for ammonia of 3,200 $\mu g/m^3$;

4. the annual ammonia concentrations at 11 of the dairy's nearest neighbors to assess the potential to exceed Minnesota's chronic iHRV for ammonia of 80 $\mu g/m^3$; and

5. the hourly odor concentrations at the property lines for West River Dairy and at 11 of the dairy's nearest neighbors to assess the potential for off-site odor episodes.

The above concentrations were calculated using the AERMOD air quality model, based on 5 years of historical weather data.

The air quality modeling results suggest that the proposed West River Dairy expansion will comply with the Minnesota ambient air quality standard for hydrogen sulfide. The standard regards the third exceedance of 30 ppb within any 5-day period as a violation. Compliance is demonstrated when the high-third-high (H3H) concentration (with background) for any 5-day period at each property-line receptor is less than 30 ppb. AERMOD calculated a maximum H3H hydrogen sulfide concentration of 12.44 ppb at the dairy's property lines. When a background concentration of 17 ppb is added to the AERMOD-calculated concentration, the H3H hydrogen sulfide concentration is 29.44 ppb, which is below the ambient standard of 30 ppb. Thus, no violation of the 30-ppb ambient hydrogen sulfide standard was modeled for the proposed West River Dairy expansion.

The AERMOD results indicate that the expanded West River Dairy will not generate hydrogen sulfide concentrations at the neighboring residences that exceed the subchronic (13-week) hydrogen sulfide iHRV. The calculated maximum monthly hydrogen sulfide concentration for the neighboring residences is 0.21 $\mu g/m^3$. When a background concentration of 1.00 $\mu g/m^3$ is added to the AERMOD-calculated concentration, the maximum monthly neighbor hydrogen sulfide concentration is 1.21 $\mu g/m^3$, which is below the subchronic hydrogen sulfide iHRV of 10 $\mu g/m^3$.

The modeling results suggest that the proposed West River Dairy expansion will not create ammonia concentrations at its property lines that exceed the acute ammonia iHRV. AERMOD calculated a maximum hourly property-line ammonia concentration of 1,861 $\mu g/m^3$. When a background concentration of 148 $\mu g/m^3$ is added to the AERMOD-calculated concentration, the maximum property-line ammonia concentration is 2,009 $\mu g/m^3$, which is below the acute ammonia iHRV of 3,200 $\mu g/m^3$. Thus, no exceedance of the acute ammonia iHRV was modeled at the property lines for the expanded dairy.

The AERMOD results indicate that the expanded dairy will not create ammonia concentrations at the neighboring residences that exceed the chronic ammonia iHRV. The calculated maximum one-year time-averaged ammonia concentration for the neighbors is 9.39 $\mu g/m^3$. When a background ammonia concentration of 5.72 $\mu g/m^3$ is added to the AERMOD concentration, the maximum annual ammonia

concentration for a neighboring residence is 15.11 µg/m^3, which is below the chronic ammonia iHRV of 80 µg/m^3.

Thus, the AERMOD modeling results for the proposed West River Dairy expansion suggest compliance with the hydrogen sulfide air quality standard, no exceedances of the subchronic hydrogen sulfide iHRV, no exceedances of the acute ammonia iHRV, and no exceedances of chronic ammonia iHRV.

2 General Modeling Approach

The modeling approach assumed that the expanded West River Dairy is the only significant and quantifiable emission source within a 3-section by 3-section grid (Figure 1). The air quality impacts associated with the dairy were explicitly modeled. The air quality impacts associated with any other sources in the modeled 3-section by 3-section grid were considered implicitly as contributors to the background concentrations that are added to the modeling results. Hence, the background concentrations of hydrogen sulfide and ammonia include the impacts associated with sources such as small feedlots, septic tank vents, fertilizer and manure application to cropland, and wetlands.

The AERMOD (version 24142) air quality model[1, 2] was used to calculate the property-line and nearest-neighbor odorous gas concentrations. The calculated concentrations were based on historical wind speeds, wind directions, atmospheric stabilities, and rural mixing heights. The historical weather data consisted of five years (2018-2022) of surface meteorological data for the National Weather Service (NWS) station in Alexandria, MN and of upper air weather data for the NWS station in Chanhassen, MN. The Alexandria surface weather data represents a location surrounded by flat terrain and some row crops. Similar conditions surround West River Dairy. The surface and upper air weather data files were combined into an AERMET (version 21112) meteorological file by the MPCA using the surface friction velocity adjustment option for low-wind stable conditions.[3, 4, 5]

Hourly, monthly, and annual average concentrations were calculated. The modeling assumed no decay of any modeled gas due to chemical reactions. A complex terrain was considered. Source and receptor elevations were determined by AERMAP (version 24142)[6] using ⅓ arc second Digital Elevation Model (DEM) files obtained from a U.S. Geological Survey website.[7] All modeled property-line and nearest-neighbor receptors were defined as discrete receptors. The modeled receptor height was 0 meters, *i.e.*, ground level. Property-line receptors were less than or equal to 25 meters apart. An arbitrary Cartesian coordinate system (*x, y*) was used with the southwest corner of Section 1, Synnes Township, Stevens

[1] U.S. EPA. 2024. *Guideline for Air Quality Models.* 40 *CFR* Ch. 1, Part 51, Appendix W (November 29, 2024).

[2] U.S. EPA. 2024. *User's Guide for the AMS/EPA Regulatory Model (AERMOD).* U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA-454/B-24-007.

[3] U.S. EPA. 2021. *User's Guide for the AERMOD Meteorological Preprocessor (AERMET).* U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-454/B-21-004.

[4] Qian W. and Venkatram A. 2011. Performance of steady-state dispersion models under low wind-speed conditions. *Boundary-Layer Meteorology* 138(3): 475-491.

[5] U.S. EPA. 2024. *Guideline for Air Quality Models.* 40 *CFR* Ch. 1, Part 51, Appendix W (November 29, 2024).

[6] U.S. EPA. 2024. *User's Guide for the AERMOD Terrain Preprocessor (AERMAP).* U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA-454/B-24-008.

[7] https://www.usgs.gov/the-national-map-data-delivery/gis-data-download

County as the origin (0, 0). Positive values of *x* represent distance east of the origin. Positive values of *y* represent distance north of the origin.

2.1 Impact Thresholds and Background Values

To assess the potential for environmental impacts, the concentrations of hydrogen sulfide and ammonia calculated by the air quality modeling were compared to air quality standards and inhalation Health Risk Values (iHRVs). The AERMOD-calculated odor concentrations were compared to an odor classification system based on detection-threshold odor units.

The direct comparison of model-generated concentrations to these environmental threshold concentrations does not consider the impact of different averaging times. EPA guidelines do not allow concentrations to be time averaged for time periods less than an hour.[8] This is important because the Minnesota ambient air quality standards for hydrogen sulfide are based on average concentrations over a 30-minute period and because the published odor intensity correlations are often based on instantaneous measurements. For example, an hourly model-generated hydrogen sulfide concentration of 29 ppb may contain a half-hour average concentration that exceeds the 30-ppb standard. Also, an odor intensity that an odor panelist may find to be merely detectable in a short-term field measurement could be annoying if present for an hour or longer.

The background concentrations of hydrogen sulfide and ammonia provided in Table 1 were added to the AERMOD-calculated concentrations as described in EPA guidelines.[9] The listed background concentrations are for rural Minnesota. The listed 17-ppb background hydrogen sulfide concentration is appropriate when assessing a feedlot's potential to comply with the 5-day 30-ppb standard. A background concentration of 18 ppb should be used when assessing the potential to comply with the half-year 50-ppb hydrogen sulfide standard.

Table 1 Background concentrations for rural Minnesota

Pollutant	Hourly Background Conentration	13-Week Background Concentration	Annual Background Concentration
Hydrogen Sulfide	17 ppb (24.3 µg/m^3)	0.70 ppb (1.00 µg/m^3)	Not Required
Ammona	208 ppb (148 µg/m^3)	Not Required	8.07 ppb (5.72 µg/m^3)

The background concentrations listed in Table 1 are not the time-averaged concentrations obtained from monitoring. Instead, the listed concentrations reflect the monitored data expressed in the terms of the "exceedance or violation condition" for the corresponding iHRV guideline or ambient standard. For example, the background 208-ppb ammonia concentration for the acute ammonia iHRV represents the maximum hourly concentration that occurred within the entire length of monitoring. This is the appropriate interpretation of background for the acute ammonia iHRV, because the guidance is concerned with any potential exceedance of the iHRV. Also, the 17-ppb hydrogen sulfide background represents the third highest 30-minute concentration that occurred within any 5-day period (*i.e.*, the high-third-high or H3H).

[8] U.S. EPA. 2024. *Guideline for Air Quality Models.* 40 *CFR* Ch. 1, Part 51, Appendix W (November 29, 2024).

[9] *Ibid.*

This is appropriate, because the ambient hydrogen sulfide standard defines a violation as the third exceedance of 30-ppb within any 5-day period.

To assess the potential for off-site odor impacts, the AERMOD-calculated odor concentrations (expressed as detection-threshold odor units) were compared to the reference odor intensities provided in Table 2. An odor concentration of 83 detection-threshold odor units (OU) is defined as a faint odor and corresponds to an odor intensity that "an average person might detect if attention is called to the odor, but the odor would not otherwise be noticed."[10]

Table 2 Odor intensity classification[11]

Odor Intensity Number	Odor Strength	n-Butanol Reference Solution (ppm)	Detection-Threshold Odor Units (OU, D/|T)
0	No odor	0	0
1	Very faint	250	28
2	Faint	750	83
3	Moderate	2,250	244
4	Strong	6,750	723
5	Very Strong	20,250	2,140

2.2 Source Characterizations

The dairy barns and associated buildings at the expanded West River Dairy were characterized as either line sources or single volume sources using the approaches described in EPA air quality modeling documentation.[12, 13]

A building with a length greater than or equal to twice its width (aspect ratio greater than or equal to 2) was represented as a line source, *i.e.*, a line of separated or adjacent square volume subsources, respectively. Each subsource was defined in terms of its location, size, gas emission rate, initial lateral dimension of the volume source, release height, and the initial vertical dimension of the volume source. The sides of each square volume subsource were equal the width of the modeled barn. The distance between the centers of the neighboring square volume subsources was calculated by the following:

$$D = W + \frac{L - nW}{n - 1} \quad (1)$$

[10] Jacobson L. D. and Guo H. 2000. Odor from feedlots setback estimation tool (OFFSET). In: *Livestock and Poultry Odor Workshop II*, Dept. of Biosystems & Agricultural Engineering, University of Minnesota, St. Paul, MN, 39 pp.

[11] Jacobson L. D. *et al*. 2000. Development of an odor rating system to estimate setback distances from animal feedlots: odor for feedlots setback estimation tool (OFFSET). Final Report. Prepared by the Department of Biosystems and Agricultural Engineering, University of Minnesota, St. Paul, MN. 26 pp.

[12] U.S. EPA. 1995. *User's Guide for the Industrial Source Complex (ISC3) Dispersion Models. Volume II–Description of Model Algorithms*. U.S. Environmental Protection Agency, Office of Air Quality, Research Triangle Park, NC, EPA-454/B-95-003b.

[13] U.S. EPA. 2024. *User's Guide for the AMS/EPA Regulatory Model (AERMOD).* U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA-454/B-24-007.

in which *D* is the distance between volume subsource centers (m), *W* is the barn width (m), *L* is the barn length (m), and *n* is the number of square volume subsources used to characterize the barn. The emission rate for each square volume subsource was equal to the total emission rate for the barn divided by the number of square volume subsources used to represent the barn. The initial lateral dimension was obtained from:

$$\sigma_{yo} = \frac{D}{2.15} \quad (2)$$

in which σ_{yo} is the initial lateral dimension of the volume subsource (m). The source height of the emitted gas was equal to one-half the height of the barn. The initial vertical dimension σ_{zo} (m) was obtained from the following equation:

$$\sigma_{zo} = \frac{H}{2.15} \quad (3)$$

in which *H* is the barn height (m).

A barn with an aspect ratio less than 2 was modeled as a square volume source. The side length was calculated from the following:

$$S = \sqrt{LW} \quad (4)$$

in which *S* is the side length (m). The emission rate for the single square volume source was equal to the total emission rate for the barn. The initial lateral dimension was obtained from:

$$\sigma_{yo} = \frac{S}{4.3} \quad (5)$$

in which σ_{yo} is the initial lateral dimension of the single volume source (m). The source height of the emitted gas was equal to one-half the barn height. The initial vertical dimension was obtained from equation (3).

Seven of the expanded dairy's manure storage basins will be covered with non-porous high-density polyethylene (HDPE) covers. The hydrogen sulfide and ammonia emission rates from the seven HDPE-covered storage basins were based on the permeability of the cover material to water vapor and on the chemistry of the stored liquid. Odor emission rates were based on literature values.

The one straw-covered primary manure storage basin was characterized as a non-buoyant area source with varying emission rates. The BasinOdor algorithms estimated hourly emission rates based on the water-phase concentration of the modeled gas, the estimated water temperature, and the recorded wind speed. BasinOdor uses EPA-recommended mass-transfer algorithms to estimate emission rates.[14] The

[14] U.S. EPA. 1994. *Air Emissions Models for Waste and Wastewater*. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA-453/R-94-080A.

liquid-phase mass transfer coefficient in the BasinOdor algorithms was defined by modified Mackay-Yeun correlations.[15, 16, 17, 18]

The overall mass transfer coefficients for the one straw-covered manure basin included the added mass transfer resistance provided by the straw. The dry straw layer was assumed to be 1-inch thick and to prevent the wind-induced mixing of the liquid surface. No chemical or biological reactions were assumed to occur within the straw cover. The modeled effectiveness of a 1-inch straw cover in reducing emissions is provided in Figure 2.

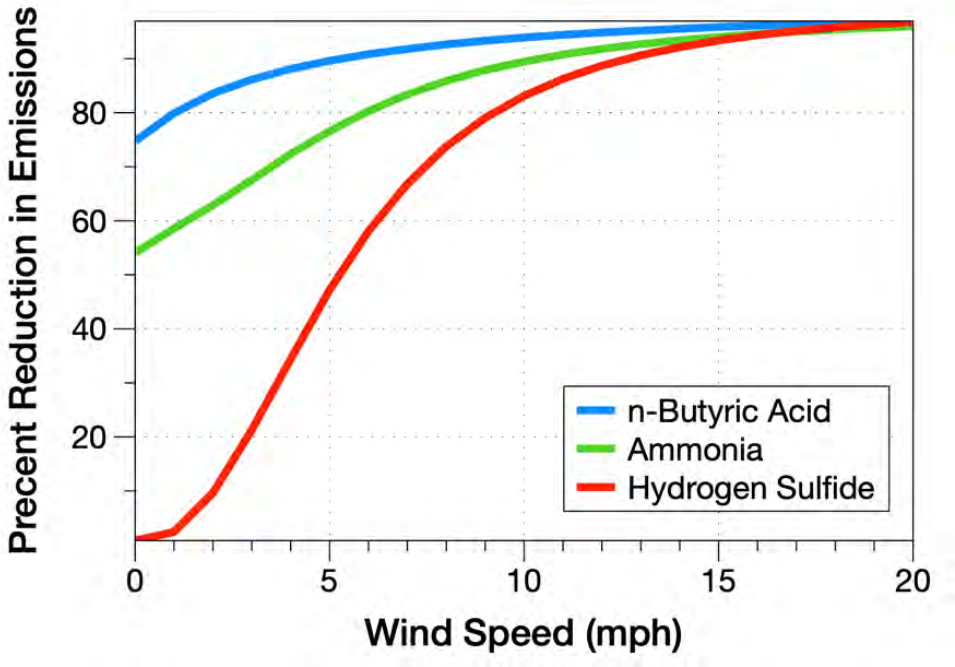


Figure 2 **Modeled percent reduction in emission rates from a straw-covered basin compared to an uncovered basin. The gas-specific responses to wind speed are due to differences in the Henry's Law coefficients and diffusion coefficients for the three gases. A uniform temperature of 20°C (68°F) is assumed.**

Hourly water temperatures within the storage basins were calculated by the heat balance approach described in Thomann and Mueller (1987).[19] The approach assumes that the basin is completely-mixed

[15] Mackay D. and Yeun A.T.K. 1983. Mass transfer coefficient correlations for volatilization of organic solutes from water. *Environ. Sci. Technol*. 17(4): 211-217.

[16] Hedden T. 1982. *Volatile Organic Chemical Emissions from Wastewater Impoundments Under No-Wind Conditions*. Master's thesis, University of Arkansas, Fayetteville, AR.

[17] Lunney P. D. 1983. *Characterization of Wind and Depth Effects upon Liquid Phase Mass Transfer Coefficients: Simulation Studies*. Master's thesis, University of Arkansas, Fayetteville, AR.

[18] Blunden J., Anega V. P. and Overton J. H. 2008. Modeling hydrogen sulfide emissions across the gas-liquid interface of an anaerobic swine waste treatment storage system. *Atmospheric Environment* 42: 5602-5611.

[19] Thomann R. V. and Mueller J. A. 1987. *Principles of Surface Water Quality Modeling and Control*. Harper & Row, Publishers, Inc., New York, NY, 644 pp.

vertically and that the sky is free of clouds. The EPA's PCRAMMET algorithms[20] were used to estimate the hourly variation in solar radiation based on day of the year, hour of the day, site latitude, and site longitude. Basin depth was assumed constant and equal to maximum design capacity depth. When the water temperature algorithms predict water temperatures less than or equal to 0°C (32°F), the emission algorithms assume that the basin is ice covered and that no gases are emitted into the atmosphere.

The two proposed bedding stacking pads were modeled as a non-buoyant area sources with variable emission fluxes. The OpenLotFlux algorithms estimated the hourly hydrogen sulfide, ammonia, and odor emission flux rates based on the wind speed, cloud cover, solar radiation, air temperature, and surface soil temperature. OpenLotFlux uses mass transfer algorithms obtained from the agricultural and micro-meteorological literature[21, 22] and the average effective hydrogen sulfide and ammonia concentrations at the surface of the manure pack obtained from cattle feedlot monitoring data.[23, 24] An average effective odor surface concentration was obtained from the flux chamber measurements of Duysen *et al*. (2003).[25] The impact of manure pack temperature on hydrogen sulfide and ammonia flux rates was calculated using the correlations of Koziel *et al*. (2005).[26] Manure pack temperatures were calculated from the historical soil temperatures at 4-inch below the surface near Lamberton, MN.[27] Monthly scalars were used to address temperature impacts on odor emission flux rates.[28]

2.3 Neighboring Residences

Air quality modeling calculated the odorous gas concentrations at the 11 neighboring residences shown in Figure 1.

[20] U.S. EPA. 1999. *PCRAMMET User's Guide*. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-454-B-96-001 (Revised June 1999).

[21] Sommer S. G. and Olesen J. E. 2000. Modeling ammonia volatilization from animal slurry applied with trail hoses to cereals. *Atmospheric Environment* 34(15): 2361-2372.

[22] Arya S. P. 2001. *Introduction to Micrometeorology. Second Edition*. Academic Press, San Diego, CA.

[23] Todd R. W. *et al*. 2005. Ammonia and gaseous nitrogen emissions from a commercial cattle feedyard estimated using the flux-gradient method and the N:P ratio analysis. In: State of the Science, Animal Manure and Waste Management, January 4-7, 2005, San Antonio, TX.

[24] Baek B. H. *et al*. 2006. Ammonia and hydrogen sulfide flux and dry deposition velocity estimates using vertical gradient method at a commercial beef cattle feedlot. *International Journal of Global Environmental Issues* 6(2-3): 189-203.

[25] Duysen R. D. *et al*. 2003. Ammonia, hydrogen sulfide and odor emissions from a beef cattle feedlot. ASAE Meeting Paper No. 034109. St. Joseph, MI.

[26] Koziel, J. *et al*. 2005. Ammonia and hydrogen sulfide emissions from beef cattle feedlots. Livestock Emissions Research Symposium, California Air Resources Board, Fresno, CA.

[27] www.swroc.coafes.umn.edu/weather/Reports/soil_hist_ave.PDF

[28] Duysen R. D. *et al*. 2003. Ammonia, hydrogen sulfide and odor emissions from a beef cattle feedlot. ASAE Meeting Paper No. 034109. St. Joseph, MI.

3 Site Description

The modeled emission sources for the expanded West River Dairy consisted of the following:

- six freestall barns;
- two holding barns;
- two separator buildings;
- one straw-covered primary manure storage basin;
- seven HDPE-covered secondary manure storage basins; and
- two bedding stacking pads.

The modeled locations of the buildings, basins, and stacking pads are provided in Figure 3. The setback distances to the property lines range from 150 to 2,239 feet.

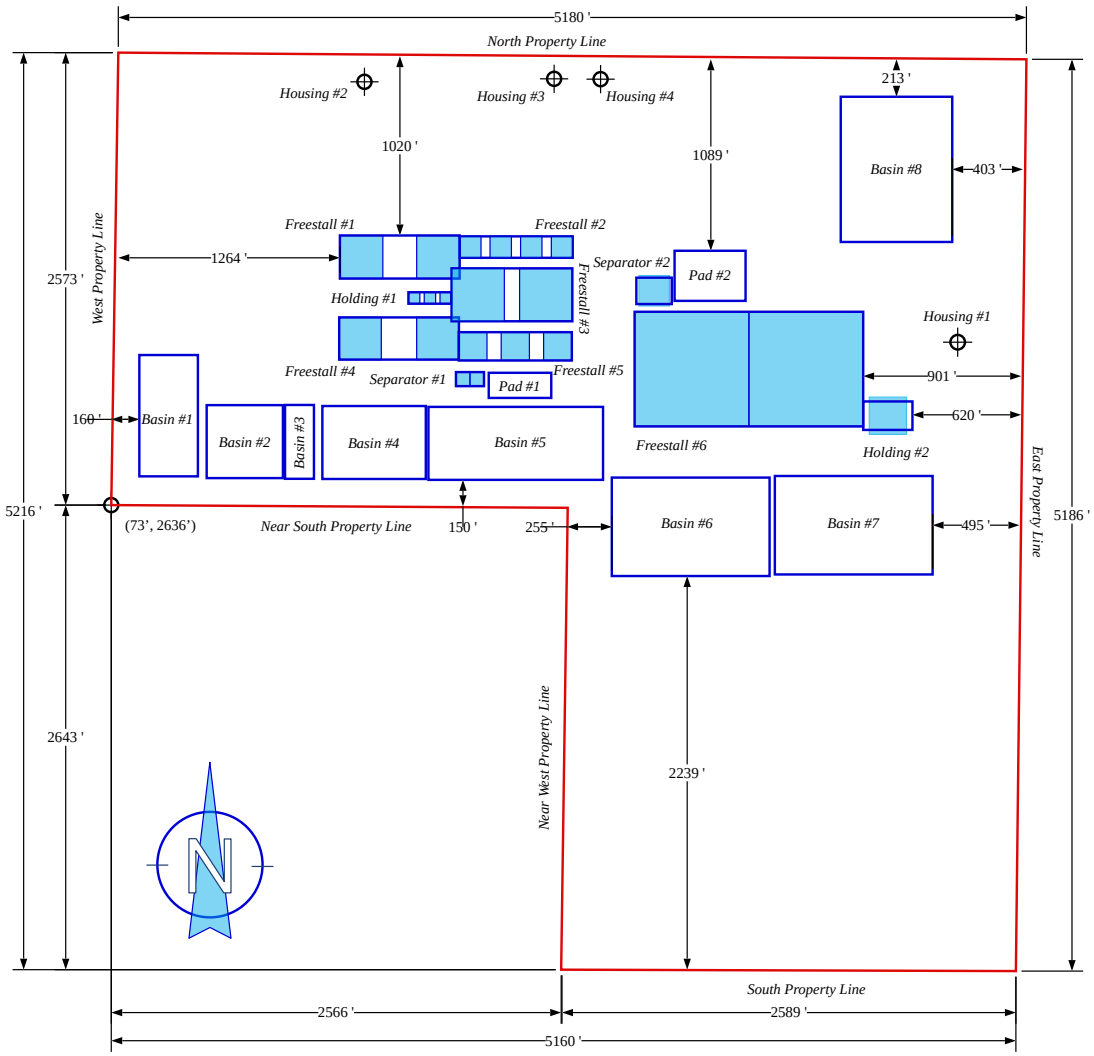


Figure 3 **Modeled locations of the buildings, basins, bedding stacking pad, and property lines for the expanded West River Dairy**

The physical characteristics of the freestall barns, holding barns, and separator buildings are provided in Table 3. The proposed 1304-ft by 692-ft Freestall #6 barn was modeled as a line source with two 652-ft by 652-ft subsources. The existing freestall barns were modeled as line sources. The existing holding barn and the existing separator building were modeled as line sources. The proposed holding barn and separator building were modeled as volume sources.

The dimensions of the manure storage basins are provided Table 4. The one straw-covered primary manure storage basin (Basin #3) was modeled as a non-buoyant area source with varying hydrogen sulfide, ammonia, and odor emission rates. The seven HDPE-covered basins were modeled as non-buoyant area sources with varying odor emission rates, and constant hydrogen sulfide and ammonia emission rates.

The existing 335 ft by 130 ft (Stacking Pad #1) and the proposed 405 ft by 285 ft (Stacking Pad #2) bedding stacking pads were modeled as non-buoyant area sources with varying emission rates.

Table 3 Dimensions and capacities of the barns and buildings at the expanded West River Dairy

Building	Status	Barn Length (feet)	Barn Width (feet)	Barn Height (feet)	Number of Housed Animals (head)
Freestall #1	existing	683	245	29	2,230
Freestall #2	existing	645	122	29	1,120
Freestall #3	existing	689	301	29	1,055
Freestall #4	existing	683	240	29	2,230
Freestall #5	existing	645	161	29	1,220
Freestall #6	proposed	1,304	692	30	11,000
Holding #1	existing	245	65	25	varies
Holding #2	proposed	281	162	25	varies
Separator #1	existing	160	80	37	—
Separator #2	proposed	202	150	37	—

Table 4 Dimensions of the manure storage basins at the expanded West River Dairy

Basin	Status	Cover	Length (feet)	Width (feet)
Basin #1	existing	HDPE	690	334
Basin #2	existing	HDPE	435	415
Basin #3	existing	straw	420	165
Basin #4	existing	HDPE	590	415
Basin #5	existing	HDPE	996	415
Basin #6	proposed	HDPE	900	560
Basin #7	proposed	HDPE	900	560
Basin #8	proposed	HDPE	636	826

HDPE = non-porous high-density polyethylene geosynthetic cover

4 Gas Emission Rates

4.1 Dairy Barns

The freestall barns, holding barns and separator buildings at the expanded West River Dairy were modeled as sources of hydrogen sulfide, ammonia, and odor. The average emission flux rates obtained from the National Air Emissions Monitoring Study (NAEMS) are as follows:

- 0.417 ± 0.228 µg $H_2S/(m^2 \bullet sec)$[29]
- 42.1 ± 15.7 µg $NH_3/(m^2 \bullet sec)$[30]
- 3.63 ± 2.80 OU/$(m^2 \bullet sec)$.[31]

The modeled daily hydrogen sulfide, ammonia, and odor emission rates varied seasonally using the sinusoidal least-squares curve fits of the NAEMS datasets provided in Figures 4, 5, and 6, respectively.

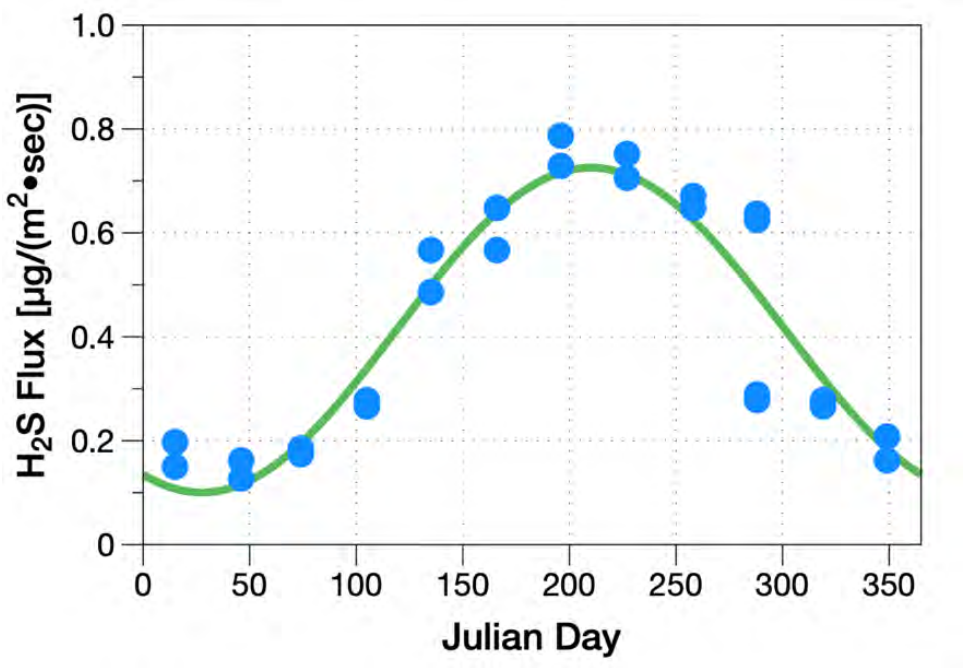


Figure 4 Seasonal variation in hydrogen sulfide flux for freestall dairy barns

[29] Cortus E.L. *et al*. 2010. National Air Emissions Monitoring Study: Emissions Data from Two Freestall Dairy Barns in Wisconsin - Site WI5B. Final Report. Purdue University, West Lafayette, IN.

[30] *Ibid*.

[31] Akdeniz N. *et al*. 2012. Odor and odorous chemical emissions from animal buildings: Part 2. Odor emissions. *Transactions of the American Society of Agricultural and Biological Engineers* 55(6): 2335–2345.

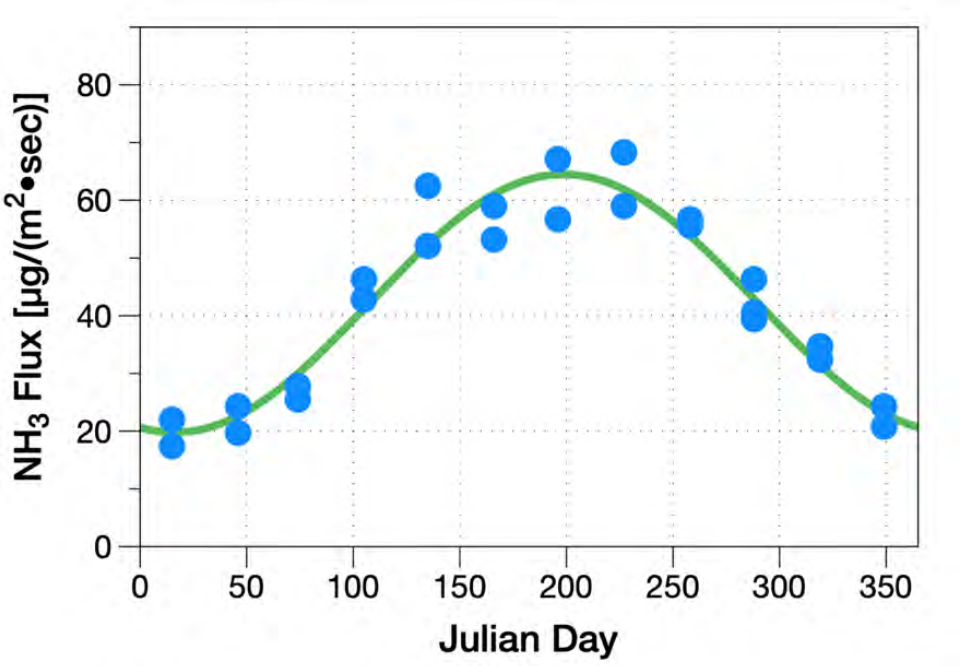


Figure 5 **Seasonal variation in ammonia emission flux for freestall dairy barns**

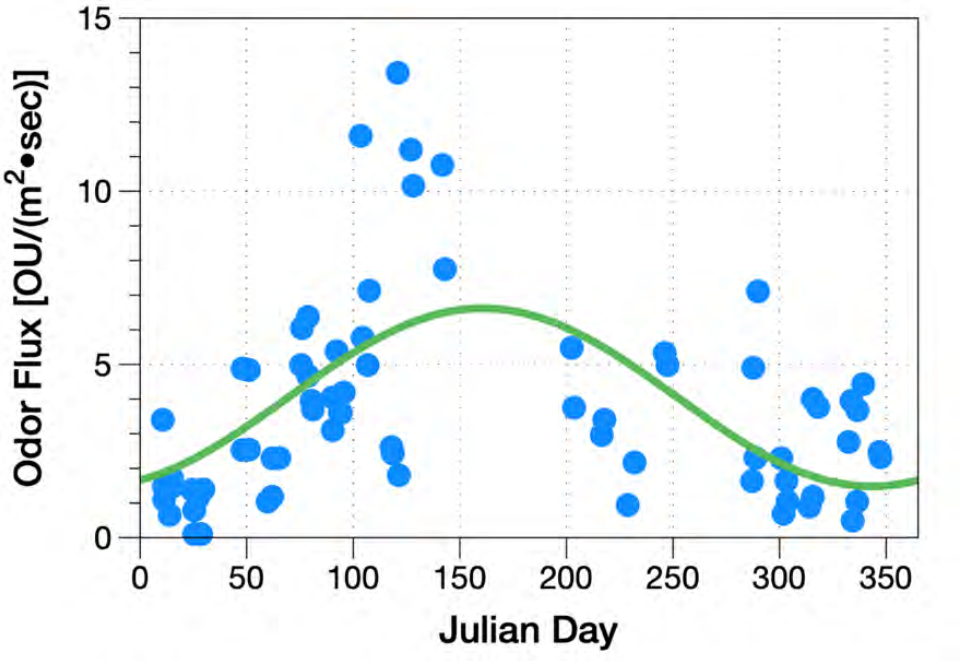


Figure 6 **Seasonal variation in odor emission flux for freestall dairy barns**

4.2 Straw-Covered Manure Basin

The straw-covered dairy manure storage basin (Basin #3) at the expanded dairy was modeled as a source of odor, hydrogen sulfide, and ammonia. The basin was assumed to have a 1-inch thick layer of straw floating on the manure surface. The BasinOdor algorithms estimated the hourly hydrogen sulfide and ammonia emissions from the straw-covered basin based on the manure chemistry provided in Table 5. To illustrate the range and variability in the hourly emissions, the estimated 2018 noon-hour emission flux rates for hydrogen sulfide and ammonia are provided in Figures 7 and 8, respectively.

The calculated odor emission rates for the straw-covered dairy basin varied hourly based on a linear correlation between odor flux and basin temperature. As shown in Figure 9, correlated odor fluxes ranged from 0 OU/(m^2•sec) at 5°C up to 8.8 OU/(m^2•sec) at 25°C. Hourly basin temperatures were calculated by the BasinOdor algorithms.

Table 5 Chemical characteristics of stored dairy manure

Parameter	Units	Value
pH	-log10[H+]	7.8
Sulfide	mg S/L	1.3
Ammonia	mg N/L	856

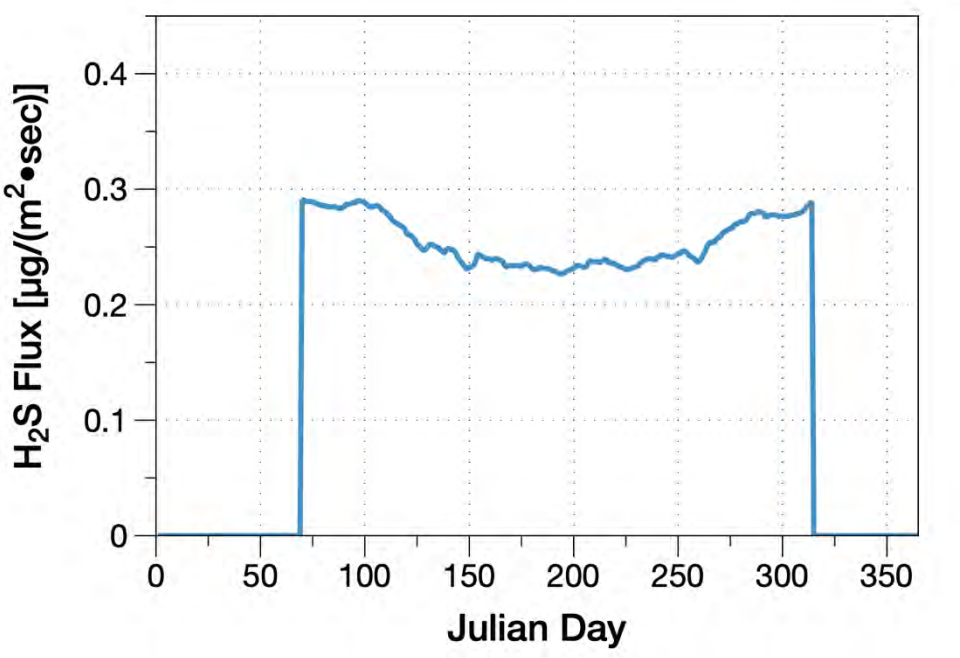


Figure 7 Estimated 2018 noon-hour hydrogen sulfide (H_2S) flux rates for a straw-covered dairy manure storage basin

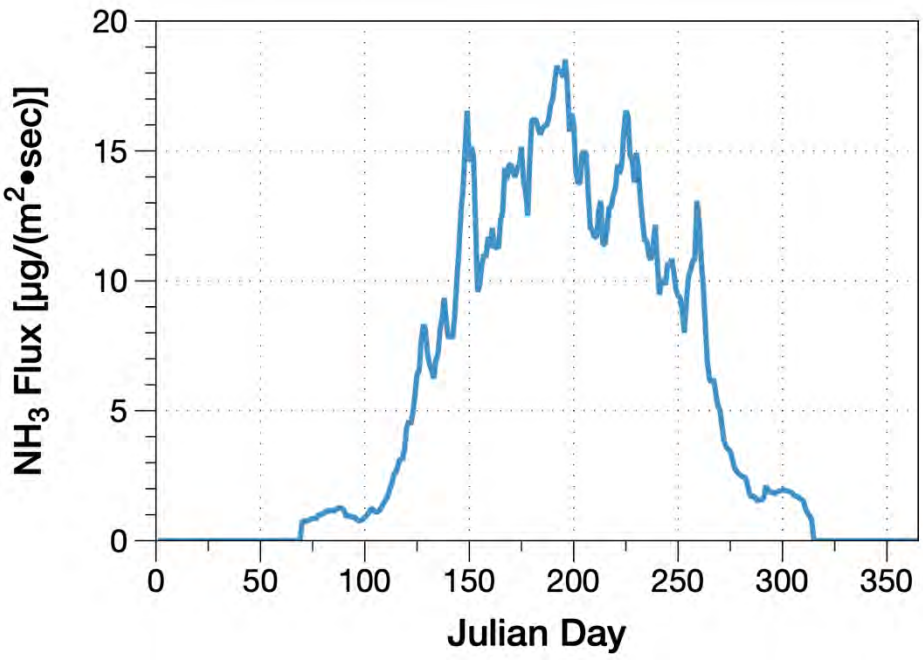


Figure 8 **Estimated 2018 noon-hour ammonia (NH_3) flux rates for a crust-covered dairy manure storage basin.**

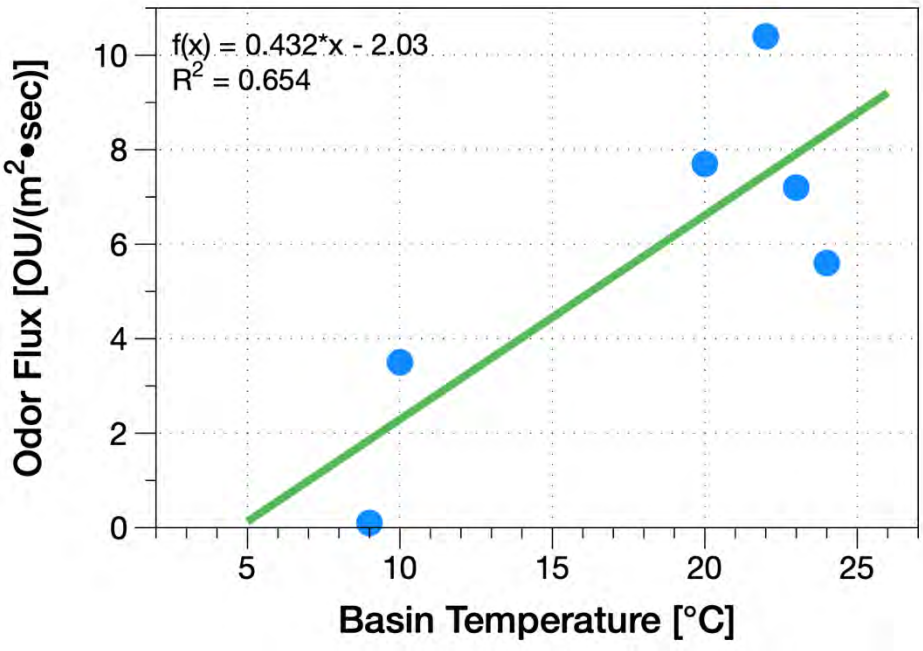


Figure 9 **Linear correlation between basin temperature and odor emission flux for dairy manure basins[32]**

[32] Zhao L. Y. *et al*. 2007. Temporal variations in gas and odor emissions from a dairy manure storage pond. *Sixth International Dairy Housing Conference Proceeding*, 16-18 June 2007, Minneapolis, MN, ASABE Publication Number 701P0507e, 17 pp.

4.3 HDPE-Covered Manure Storage Basins

For the seven geomembrane-covered storage basins at the expanded West River Dairy, the hydrogen sulfide and ammonia fluxes were constant and equal to $9.12 \cdot 10^{-9}$ and $9.34 \cdot 10^{-10}$ g/(m^2•sec), respectively. These fluxes are based on the reported permeability of the geomembrane to water vapor, on the assumption that the gases under the cover are in equilibrium with the dissolved gases in the liquid manure, and on the manure chemistry provided in Table 5.

Odor emission flux rates for the HDPE-covered basins varied hourly and were equal to 5 percent of the values provided in Figure 9. HDPE covers reduce the emission of odor by 95 percent.[33]

4.4 Bedding Stacking Pad

The two bedding stacking pad at the expanded dairy were modeled as non-buoyant area sources with variable hydrogen sulfide, ammonia, and odor emission flux rates. The OpenLotFlux algorithms calculated the emission flux rates, based on the wind speed, bedding temperature, and effective surface concentrations. Temperature effects on hydrogen sulfide and ammonia flux rates were calculated using the correlations of Koziel *et al*. (2005).[34] The impact of temperature on odor emission flux rates were addressed by monthly scalars.[35]

To illustrate the range and variability in the hourly emissions from a stacking pad, the estimated 2018 noon-hour emission flux rates for hydrogen sulfide are provided in Figure 10. The estimated 2018 noon-hour odor flux rates are provided in Figure 11.

[33] Chastain J. P. 2008. Covers: A Method to Reduce Odor from Manure Storages. Agricultural & Natural Resource Engineering Application, Clemson University Extension, ANREA-081.

[34] Koziel, J. *et al*. 2005. Ammonia and hydrogen sulfide emissions from beef cattle feedlots. Livestock Emissions Research Symposium, California Air Resources Board, Fresno, CA.

[35] Duysen R. D. *et al*. 2003. Ammonia, hydrogen sulfide and odor emissions from a beef cattle feedlot. ASAE Meeting Paper No. 034109. St. Joseph, MI.

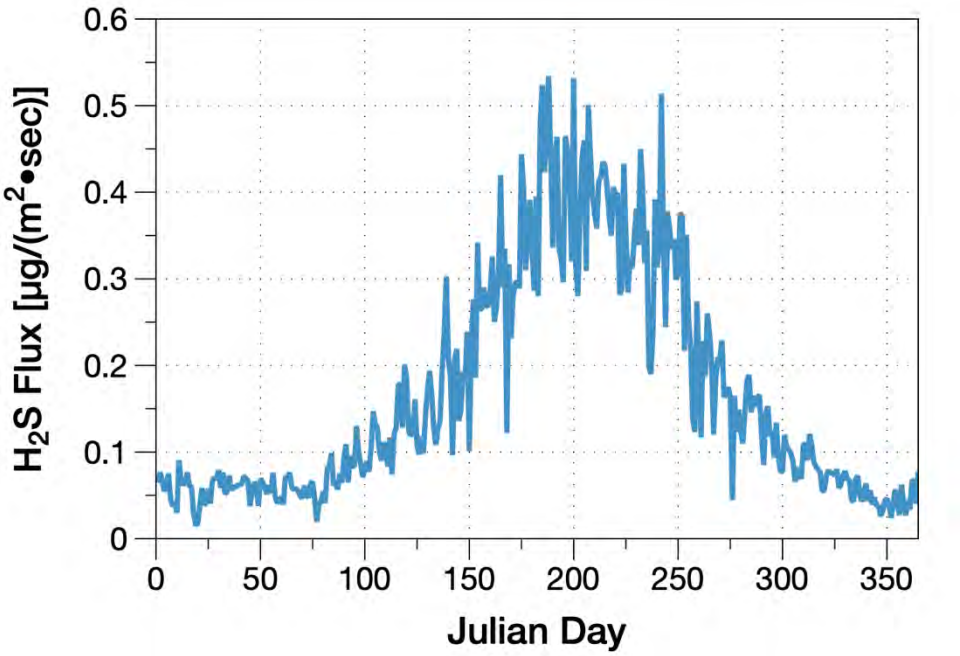


Figure 10 **Estimated 2018 noon-hour hydrogen sulfide (H_2S) emission flux rates for a bedding stacking pad**

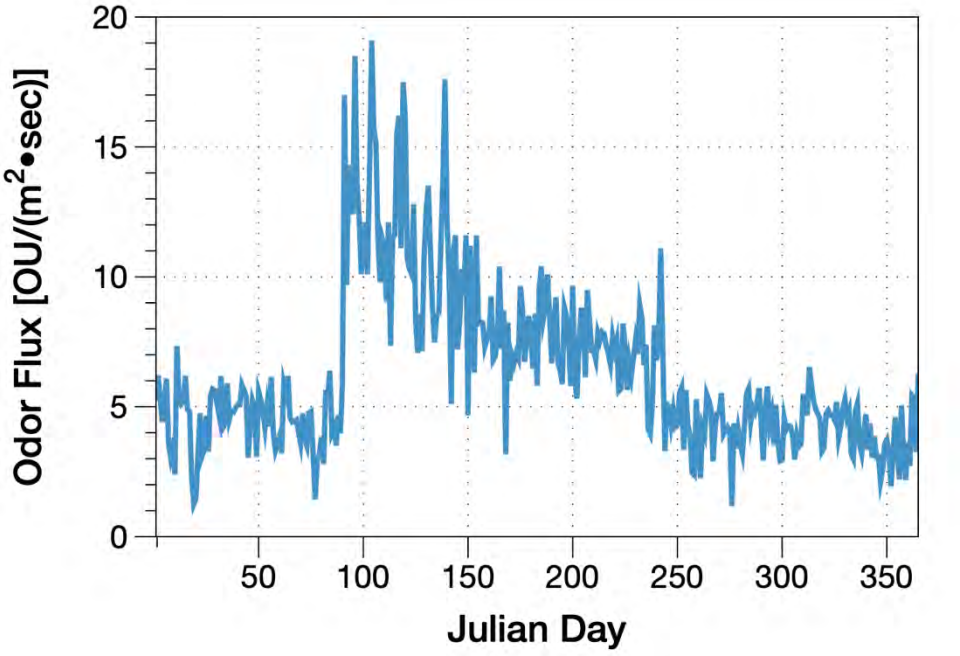


Figure 11 **Estimated 2018 noon-hour odor emission flux rates for a bedding stacking pad**

5 Hydrogen Sulfide at Property Lines and Neighbors

The AERMOD results suggest that the expanded West River Dairy will comply with the Minnesota ambient air quality standard for hydrogen sulfide (H_2S). The calculated high-third-high (H3H) concentrations at the expanded dairy's property lines are provided in Table 6. When a background concentration of 17 ppb is added to the AERMOD-calculated concentrations, the maximum H3H hydrogen sulfide concentration is 29.44 ppb, which does not exceed the standard of 30 ppb. Thus, no violations of the hydrogen sulfide standard were modeled.

Table 6 Hourly high-third-high (H3H) hydrogen sulfide (H_2S) concentrations at the property lines for the expanded West River Dairy

Property Line	H3H H_2S Concentration Without Background (ppb)	H3H H_2S Concentration With a 17-ppb Background (ppb)
North	7.43	24.43
East	12.44	29.44
Near South	7.42	24.42
South	3.05	20.05
Near West	6.81	23.81
West	8.39	25.39

The AERMOD results also suggest that the expanded West River Dairy will not create exceedances of the subchronic (13-week) hydrogen sulfide iHRV at the neighboring residences. As provided in Table 7, when a background concentration of 1.00 µg/m^3 is added to the AERMOD-calculated concentrations, the maximum monthly hydrogen sulfide concentration for a neighboring residence is 1.21 µg/m^3, which is below the subchronic iHRV for hydrogen sulfide of 10 µg/m^3.

Table 7 Maximum monthly H_2S concentrations for neighboring residences

Neighbor	H_2S Concentration Without Background (µg/m^3)	H_2S Concentration With a 1 µg/m^3 Background (µg/m^3)
A1	0.07	1.07
A2	0.07	1.07
A3	0.08	1.08
B1	0.21	1.21
C1	0.09	1.09
D1	0.09	1.09
D2	0.04	1.04
D3	0.08	1.08
D4	0.15	1.15
G1	0.04	1.04
I1	0.04	1.04

6 Ammonia at Property Lines and Neighbors

The AERMOD-calculated maximum hourly ammonia (NH_3) concentrations at the property lines for the expanded dairy are provided in Table 8. The highest calculated property-line concentration with a background concentration of 148 µg/m^3 is 2,009 µg/m^3, which is below the acute iHRV for ammonia of 3,200 µg/m^3. Thus, no exceedances of the acute ammonia iHRV were modeled.

Table 8 Maximum hourly ammonia concentrations at the property lines for the expanded West River Dairy

Property Line	NH_3 Concentration Without Background (µg/m^3)	NH_3 Concentration With a 148 µg/m^3 Background (µg/m^3)
North	1,073	1,221
East	1,861	2,009
Near South	1,249	1,397
South	504	652
Near West	1,245	1,393
West	1,413	1,561

The AERMOD results also suggest that the ammonia emissions from the expanded West Dairy will not cause exceedances of the chronic ammonia iHRV at the nearest neighbors. As provided in Table 9, the highest annual ammonia concentration for a neighbor with a background concentration of 5.72 µg/m^3 is 15.11 µg/m^3, which is below the chronic ammonia iHRV of 80 µg/m^3.

Table 9 Maximum annual NH_3 concentrations for neighboring residences

Neighbor	NH_3 Concentration Without Background (µg/m^3)	NH_3 Concentration With a 5.72 µg/m^3 Background (µg/m^3)
A1	2.31	8.03
A2	2.46	8.18
A3	2.54	8.26
B1	9.39	15.11
C1	3.87	9.59
D1	4.23	9.95
D2	1.94	7.66
D3	2.63	8.35
D4	4.91	10.63
G1	1.56	7.28
I1	1.55	7.27

7 Odor Concentrations at Property Lines and Neighbors

AERMOD calculated the ground-level odor concentrations at the property lines for the expanded West River Dairy and at 11 of the dairy's neighboring residences. The maximum hourly odor concentrations along the dairy's property lines were below the moderate odor threshold of 244 OU (Table 2), except for one hourly exceedance along the near-south property line. The maximum odor concentration for the near-south property line was 260 OU (Table 10). The calculated hourly odor concentration at any property-line receptor was less than or equal to the faint odor threshold of 83 OU at least 99.67 percent of the time.

Table 10 **Maximum hourly odor concentrations and the maximum frequency at which the "faint" odor threshold of 83 OU is equaled or exceeded at the property lines for the expanded West River Dairy**

Property Line	Maximum Hourly Odor Concentration (OU, d/t)	Frequency at Which the Faint Odor Threshold is Exceeded (percent)
North	126	0.08
East	203	0.33
Near South	260	0.22
South	76	0.00
Near West	140	0.20
West	167	0.13

The AERMOD-calculated ground-level odor concentrations at the 11 neighboring residences are provided in Table 11. The calculated maximum odor concentration for a neighboring residence is 74 OU, which is below the faint odor threshold of 83 OU. Thus, only very-faint odor intensities were modeled for the neighboring residences.

Table 11 **Maximum hourly neighbor odor concentrations and the maximum frequency at which the "faint" odor threshold of 83 OU is equaled or exceeded**

Neighbor	Maximum Hourly Odor Concentration (OU, d/t)	Frequency at Which the Faint Odor Threshold is Exceeded (percent)
A1	29	0.00
A2	29	0.00
A3	29	0.00
B1	74	0.00
C1	54	0.00
D1	71	0.00
D2	44	0.00
D3	47	0.00
D4	72	0.00
G1	33	0.00
I1	30	0.00

Figure 12 suggests that moderate odors generated by the expanded West River Dairy will be entirely confined to inside the dairy's property lines. Modeled off-site odor concentrations correspond to very faint and faint odor intensities. Figure 13 suggests that off-site faint odors will occur infrequently.

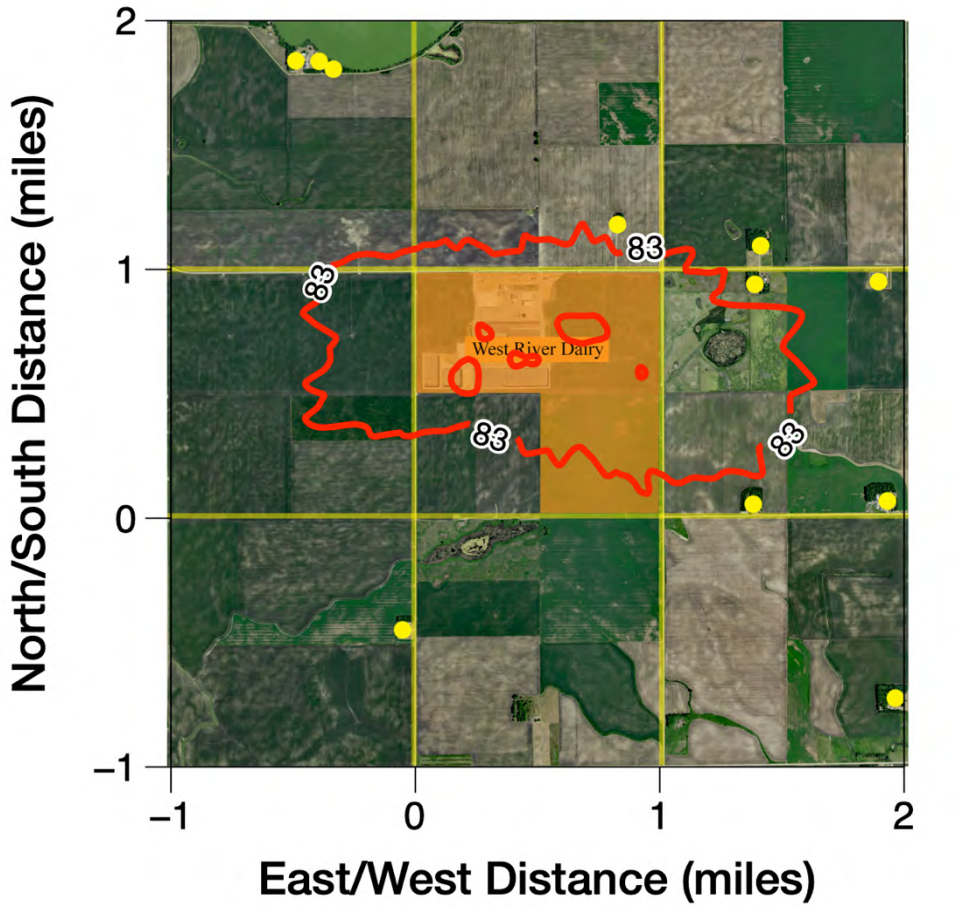


Figure 12 **Maximum AERMOD-calculated hourly odor concentrations the expanded West River Dairy. Plotted are the thresholds for "faint" odors (83 OU) and for "moderate" odors (244 OU).**

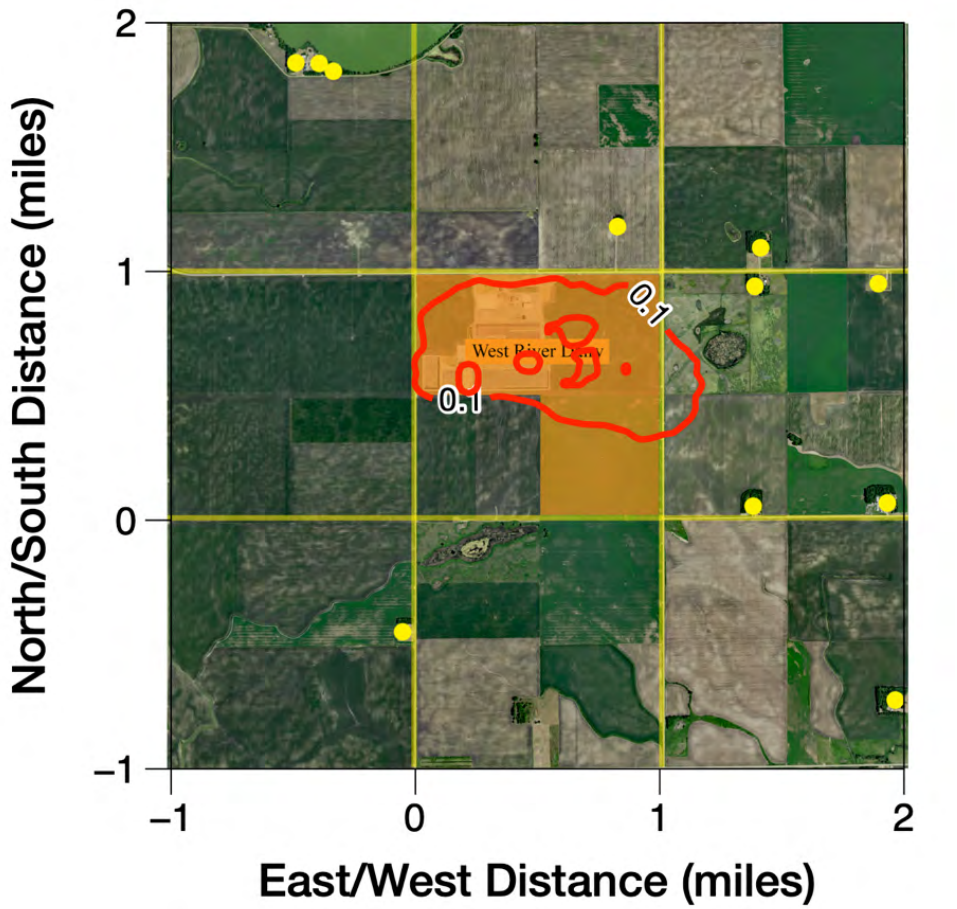


Figure 13 **Frequency at which the AERMOD-calculated hourly odor concentrations exceed the 83-OU threshold for faint odors. Plotted are the contour lines for frequencies of 0.1 and 1 percent.**

8 Summary

The AERMOD modeling results suggest that the expanded West River Dairy will comply with the ambient air quality standard for hydrogen sulfide at the dairy's property lines. The results also suggest that the proposed dairy will not create exceedances of the acute ammonia iHRV at its property lines.

The modeling results suggest that the expanded dairy will not create exceedances at the neighboring residences of the subchronic iHRV for hydrogen sulfide and of the chronic iHRV for ammonia.

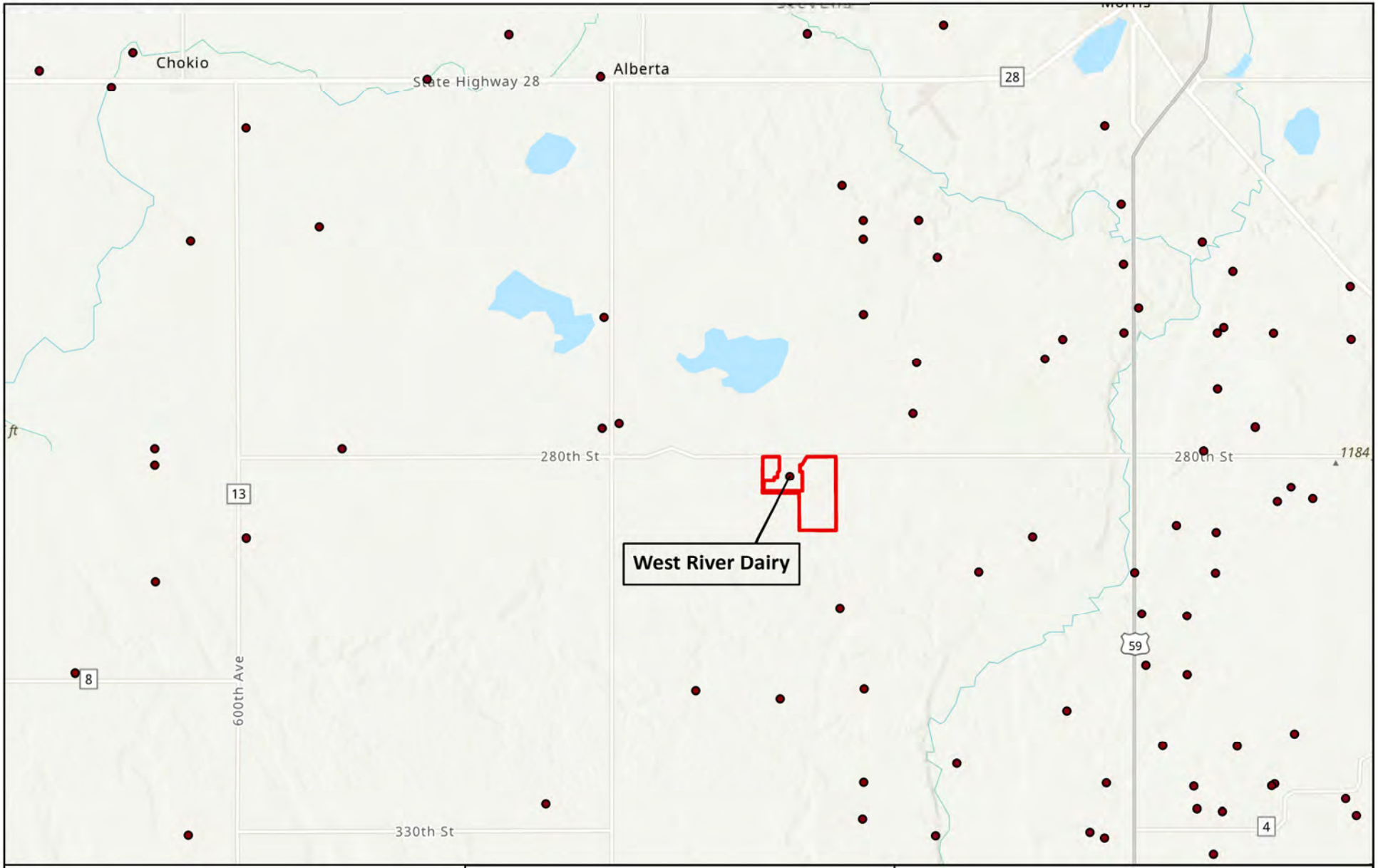
The calculated property-line odor concentrations for the expanded West River Dairy were below the 244-OU threshold for moderate odors, except for one hourly exceedance along the near south property line. Modeled property-line odor concentrations were below the 83-OU threshold for faint odors at least 99.67 percent of the time. For the 11 neighboring residences, odor intensities were below the faint odor threshold of 83 OU. Thus, only very-faint odor intensities were modeled for the neighboring residences.

Attachment 14

MPCA Feedlot Map

Attachment 14

Stevens County, Swift County



MPCA Feedlot Map

West River Dairy Expansion
Synnes Township

Project Boundary

Registered Feedlots

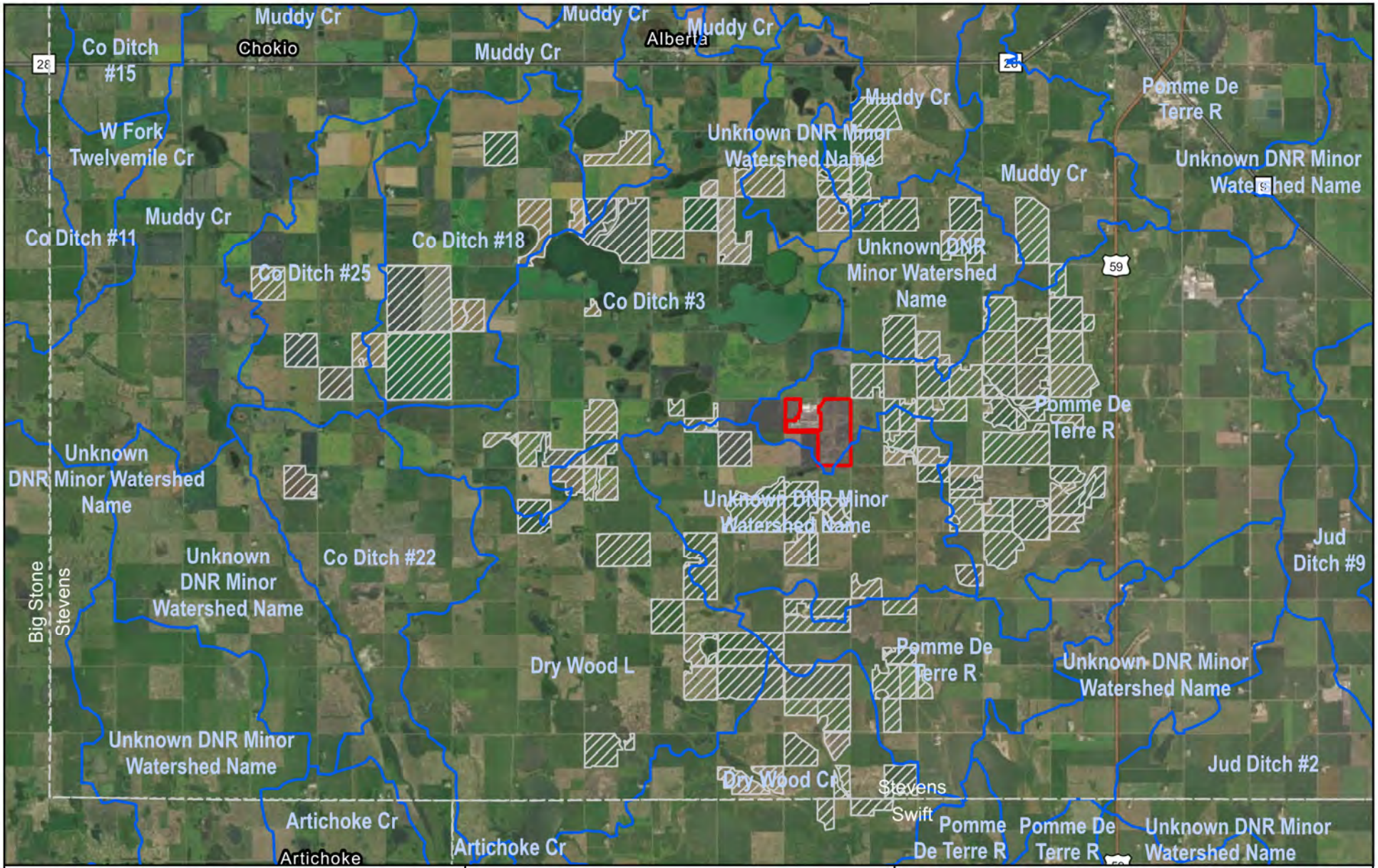
N

0 1 2 3 4 5
Miles

ENVIRONMENTAL SCIENTIFIC

Attachment 15

Minor Watershed Map with Manure Application Acres



Minor Watershed Map with Manure Application Fields

West River Dairy Expansion
Synnes Township

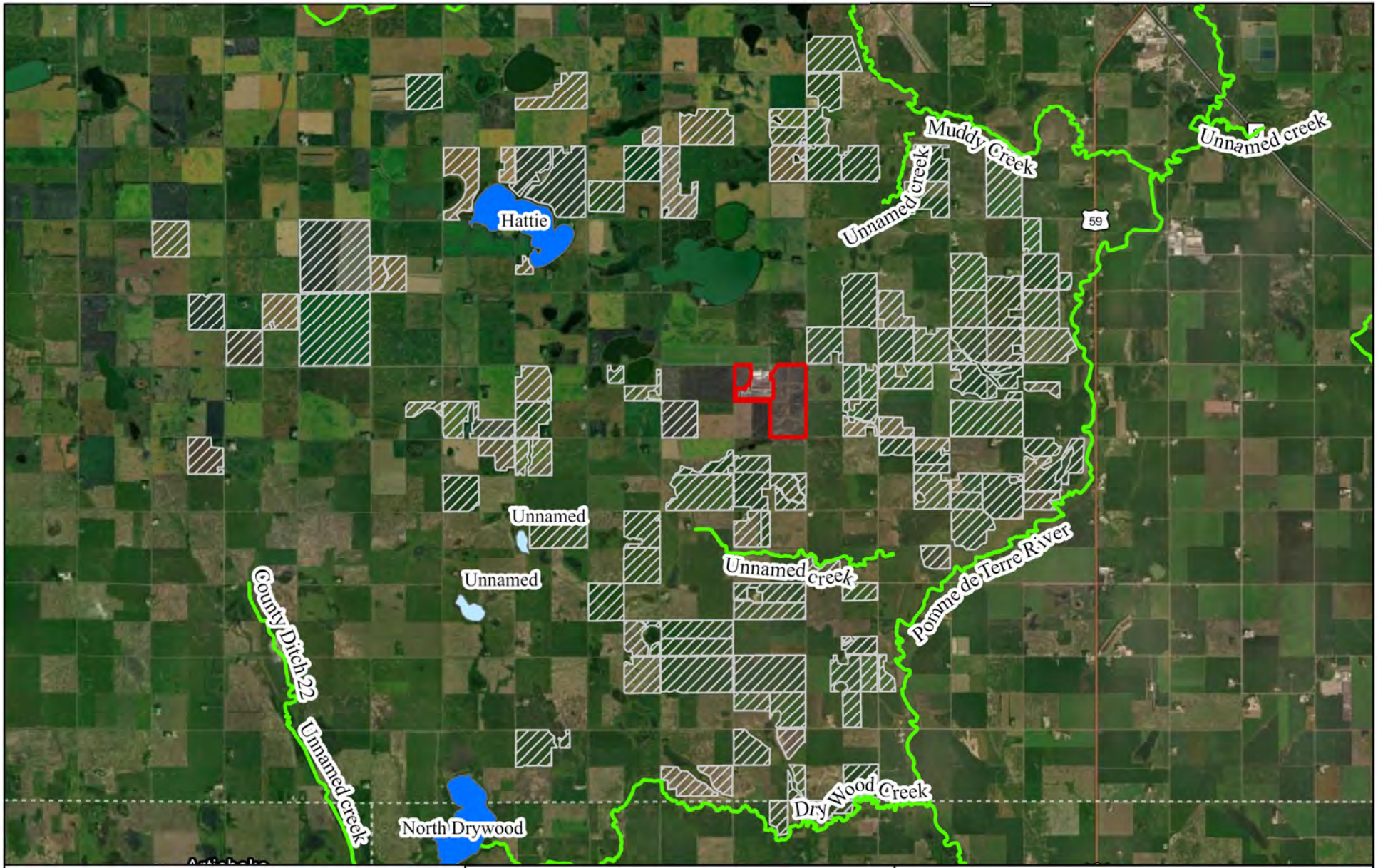
Project Boundary
Available Manure Application Acres
MnDNR Level 07 - Minor Watersheds
County Boundary

N
0 1 2 3 4 5
Miles

ENVIRONMENTAL SCIENTIFIC

Attachment 16

MPCA Impaired Waters Map



MPCA Impaired Waters Map

West River Dairy Expansion
Morris, MN

- Project Boundary
- Available Manure Application Acres
- Impaired Wetlands (2024 List)
- Impaired Streams (2024 List)
- Impaired Lakes (2024 List)

N

0 1 2 3 4 5
Miles

ENVIRONMENTAL SCIENTIFIC

Attachment 17

Soil Boring Report with MDH Well Records

REPORT OF GEOTECHNICAL EXPLORATION AND REVIEW

West River Dairy Additions
Stevens County
Morris, Minnesota

AET Project No. P-0042453

Date:
May 2, 2025

Prepared for:

Riverview, LLP
26406 470th Avenue
Morris, MN 56267

Geotechnical • Materials
Forensic • Environmental
Building Technology
Petrography/Chemistry

American Engineering Testing
601 East 48th Street North
Sioux Falls, SD 57104
TeamAET.com • 605.332.5371

May 2, 2025

Riverview, LLP
26406 470th Avenue
Morris, Minnesota 56267

Attn: Jordan Nieland
jordan.nieland@riverviewllp.com

RE: Report of Geotechnical Exploration
Proposed West River Dairy Expansion
Synnes Township, Stevens County
Morris, Minnesota
AET Project No. P-0042453

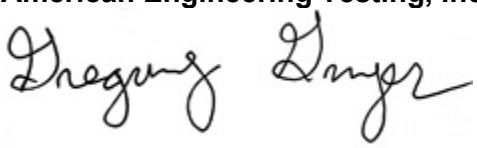
Dear Mr. Nieland:

American Engineering Testing, Inc. (AET) is pleased to present the results of our subsurface exploration program and geotechnical engineering review for your West River Dairy Expansion project in Stevens County, near Morris, Minnesota. These services were performed according to our proposal to you dated April 7, 2025. Previously AET performed soil borings, laboratory testing, and prepared a Geotechnical Engineering Report (AET#P-0020556, dated May 18, 2023 and AET#P-0027867, dated December 8, 2023) for the same general area. We understand the proposed site layout has been modified for the proposed construction of the additions to the West River Dairy Facility.

We are submitting one electronic copy of the report to you.

Please contact me if you have any questions about the report. I can also be contacted for arranging construction observation and testing services during the earthwork phase.

Sincerely,
American Engineering Testing, Inc.



Gregory A. Guyer, PE
Senior Engineer
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C: 507.420.3867

SIGNATURE PAGE

Prepared for:
Riverview, LLP
26406 470th Avenue
Morris, MN 56267

Attn: Mr. Jordan Nieland

Prepared by:
American Engineering Testing, Inc.
1730 First Avenue
Mankato, MN 56001
507.387.2222/www.teamAET.com

Authored by:

Gregory A. Guyer, PE
Senior Engineer

Reviewed by:

Zane L. Hiller, PE (SD)
Engineer II

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under Minnesota Statute Section 326.02 to 326.15

Name: Gregory A. Guyer
Date: May 2, 2025 License #: 44618

TABLE OF CONTENTS

1.0 INTRODUCTION

You are proposing to construct an addition to the existing West River Dairy facility in Section 1 in Synnes Township in Stevens County, Minnesota. To assist planning and design, you have authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site, conduct soil laboratory testing, and perform a geotechnical engineering review for the project. This report presents the results of the above services and provides our engineering recommendations based on this data.

2.0 SCOPE OF SERVICES

AET's services were performed according to our proposal to you dated April 7, 2025, which you authorized on April 8, 2025. The authorized scope consists of the following.

- Drilling and sampling three (3) standard penetration test borings to a depth of 20 feet.
- Soil laboratory testing.
- Geotechnical engineering review based on the data and preparation of this report.

These services are intended for geotechnical purposes only. The scope is not intended to explore for the presence or extent of environmental contamination in the soil or groundwater.

3.0 PROJECT INFORMATION

We understand that you are planning to construct three clay lined liquid manure storage areas (LMSA) at the existing West River Dairy facility located in Section 1 of Synnes Township in Stevens County, Minnesota. Two separate concrete LMSA structures are also planned. Specific grading plans and details of the construction were not available at the time of this report. We understand the bottom elevation of the three LMSAs located on the site will be between 10 to 18 feet below existing grade. The effluent depth for the ponds will range from 12 to 18 feet. The ponds will be constructed to meet a maximum seepage rate of 1/56 inch per day.

The above-stated information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 FIELD EXPLORATION PROGRAM

The subsurface exploration program conducted for the project consisted of 3 new soil borings and 38 previous standard penetration test borings. The proposed soil boring locations and the respective depths were selected by Riverview. The logs of the borings and details of the methods used appear in Appendix A. The logs contain information concerning soil layering, soil classification, geologic origins, and moisture condition. A density description or consistency is also noted for the natural soils, which is based on the standard penetration resistance (N-value).

The approximate boring locations are shown on Figure 2 in Appendix A. The borings were located in the field, and the surface elevation of each boring location was provided by Riverview. The surface elevation is recorded on each boring log within Appendix A.

4.2 LABORATORY TESTING

The laboratory test program included performing water content, dry density, Atterberg Limits, unconfined compressive strength, Standard Proctor, sieve/hydrometer, and permeability tests. The test results appear in Appendix A on the individual boring logs adjacent to the samples upon which they were performed, or on the data sheets following the logs.

5.0 SITE CONDITIONS

5.1 SURFACE OBSERVATIONS

The proposed project site is located in Section 1 of Synnes Township in Stevens County, Minnesota. The proposed expansion areas are located to the east and south of the

existing West River Dairy facility. The approximately 200-acre project site is bordered by 280th Street on the north and 520th Avenue on the east. Nearby site features include agricultural land in all directions. Current site vegetation consists of grass or crop residue.

The general site topography is level to gently rolling. Based upon the soil boring surface elevation information provided to us, it appears that the existing ground surface in the proposed project area varies from about elevation 1137.5 to 1158.9 feet.

5.2 SUBSURFACE SOILS/ GEOLOGY

The site geology consists of a layer of dark brown and black, lean clay topsoil or black and gray and very dark brown to dark brown to brown fill soils underlain by various alluvial deposits with clay till present at depth.

The surficial fill/topsoil layer was about ½ foot to 5 feet deep at the boring locations. The fill was encountered within borings 123, 126, 127, 128, 129, 209, 211, 212, 215, 216, 217, 306, 307, 308, 309, 310, and 311; consisted mostly of a mixture of brown to dark brown to very dark brown and gray organic lean clay, silty clay, sandy lean clay and lean clay. Additionally, fill contained a little gravel at several boring locations. The topsoil consisted mostly of dark brown and black, lean clay with numerous visible organics.

Underlying the surficial deposits, brown, dark brown, brown mottled, gray, grayish brown and gray mottled fat clay, lean clay, clayey sand, and sandy lean clay, alluvial deposits were encountered at the boring locations. Based upon the penetration resistance, N values, the consistency of the more cohesive portions varied from soft to stiff.

The main geologic deposit encountered at the site consisted of sandy lean clay, glacial till. The till varied in color from brown mottled and brown nearer the surface to gray at depth. Additionally, the till contained some gravel and numerous lenses and layers of sand. The consistency of the till varied from soft to very stiff.

5.3 GROUNDWATER

Subsurface water was noted at borings 129 and 304 of the boring locations at the time

our field work was performed. The borings were monitored for groundwater seepage during drilling operations and were measured for groundwater accumulation shortly after completion of drilling. Free groundwater was not observed entering the boreholes during drilling and when measured for groundwater accumulation shortly after completing the borings. Groundwater levels fluctuate due to varying seasonal and annual rainfall and snow melt amounts, as well as other factors.

Based upon our previous experience with clay soils in the general project area, it is our opinion that the subsurface water levels at the site could be quite near the ground surface during periods of significant precipitation, particularly during the spring of the year. It should also be recognized that groundwater levels can fluctuate due to natural seasonal variations in rainfall and snowmelt amounts.

5.3.1 GROUND WATER DEPTH AND ELEVATIONS

Boring	Surface Elevation (ft)	Water Level (ft)	Water Elevation (ft)
129	1151.4	14.5	1136.9
304	1139.8	9.5	1130.3

5.4 REVIEW OF SOIL PROPERTIES

5.4.1 TOPSOIL/FILL

We have no documentation regarding the extent of excavation made prior to placing the fill, nor do we have reports indicating fill soil density and water content quality control procedures. Fill soils that are placed without density and water content quality control procedures can behave unpredictably when subject to structural loads. As such, we judge the fill to have unpredictable strength and compressibility characteristics. Lean clays, silty clay, and sandy lean clays are fine-grained soils that are slow-draining and susceptible to freeze-thaw movements.

The topsoil consisted mostly of dark brown and black, lean clay with numerous visible organics. The topsoil deposits are judged to be low strength and compressible.

5.4.2 GLACIAL TILL

The main geologic deposit encountered at the site consisted of sandy lean clay, glacial till. The till varied in color from brown mottled and brown nearer the surface to gray at depth. Additionally, the till contained some gravel and numerous lenses and layers of sand. N-values recorded in the glacial till ranged from 3 to 23 blows per foot (bpf); indicating these soils exhibit soft to very stiff consistency. Accordingly, we judge the glacial till to have low to moderate strength and moderately low to moderate compressibility when subject to the anticipated structural loads. The sandy lean clay is a slow-draining soil type that is susceptible to freeze-thaw movements when subject to freezing temperatures.

5.4.3 FINE ALLUVIUM

The N-values recorded in the fine alluvium ranged from 2 to 10 bpf, indicating these soils exhibit soft to stiff consistency. We judge the fine alluvium to have low to moderate strength and compressibility characteristics. The lean clay and sandy lean clay soils are slow-draining soil types that are susceptible to freeze-thaw movements when subject to freezing temperatures. The fat clay, fine alluvial soils are generally a slow to very slow draining soil type with moderate to high susceptibility to freeze-thaw frost movements.

The fat clay has the potential to shrink when the moisture content decreases and to swell when the moisture content increases. The fat clay soils have a tested in-situ moisture of 32% to 37% and a liquid limit (LL) of 56,a plastic limit (PL) of 26, and a plasticity index (PI) of 30. The risk of expansion is greatest when the fat clay is relatively dry/desiccated, and the potential for shrinkage is greatest when the fat clay is relatively soft and has a higher moisture content.

5.4.4 MIXED ALLUVIUM

The N-value recorded in the mixed alluvium was 4 to 10 bpf, indicating these soils exhibit soft to stiff consistency. We judge the sandy lean clay, mixed alluvium to have low to moderate strength and compressibility characteristics. The mixed alluvial soils observed in our borings are judged to be moderately frost susceptible.

6.0 RECOMMENDATIONS

6.1 APPROACH DISCUSSION

Based on the results of the field exploration and laboratory testing, it is our opinion the fine-grained native soils encountered in our borings (sandy lean clay, fat clay, and lean clay soils) are suitable for dike and liner construction of the proposed LMSA ponds. We do not recommend using lean clay topsoil materials or silty clay for liner construction. In addition, some of the borings encountered layers and lenses of water bearing sand. Significant dewatering may be required during construction of the deep LMSAs.

Based on the laboratory test results, the moisture content of the clay soils was generally above the optimum moisture content based on the standard Proctor optimum moisture contents, at the time the borings were completed. Depending upon the conditions at the time of construction, the moisture content may need to be adjusted to near optimum moisture content prior to use as liner and dike material.

6.2 GENERAL EARTHWORK RECOMMENDATIONS

6.2.1 SITE PREPARATION

Site preparation should include removing all vegetation and topsoil-type materials from borrow areas and areas receiving new engineered fill (including dike embankments). Site grading to rapidly drain surface runoff well away from exposed subgrade soils should be established as soon as possible after stripping and maintained through the duration of construction.

We anticipate that excavation of the site soils to the proposed depths can be accomplished using conventional earth excavating equipment such as bulldozers and scrapers. Based on the proposed LMSA pond bottom elevations, the excavations will terminate in firm to stiff clay till or alluvial soils. Depending upon the moisture content of the clay soils and the amount of water encountered, we expect final excavation work will likely need to be completed with an excavator. As stated previously, the in-place water content of the clay soils was above the optimum water content of representative soils as determined by the Standard Proctor test. The clay soils from the area of the proposed

LMSA holding ponds will likely need to be moisture conditioned (dried) to our recommended soils water content for compaction discussed in the following sections.

6.2.2 SHRINKAGE

It is our opinion, the clay soils encountered at the site will experience a moderate amount of shrinkage when excavated and replaced during the construction of the pond. We recommend that a shrinkage factor of 20% be used for the estimation purposes of the earthwork volumes.

6.3 SOIL LMSA CONSTRUCTION

6.3.1 DIKE CONSTRUCTION

The existing lean clay topsoil or any significantly organic lean clay fill soils should not be used for dike construction. We recommend the existing topsoil/fill be removed from the base areas of the proposed dikes to expose the sandy lean clay, lean clay, or fat clay soils. The topsoil can be stockpiled and used for establishing vegetation after mass grading is completed.

Prior to constructing the dikes, we recommend scarifying the top 6 inches of the exposed clay soils and recompacting them to at least 95% of the Standard Proctor density (ASTM:D698). Following the scarification and surface compaction operations, the dike embankments could be raised using the on-site, nonorganic clay soils. The dikes should be constructed with maximum loose layer soil thicknesses of 8 inches. The soils should be moisture conditioned to within +/-3 percent of optimum moisture content and compacted to at least 95% of Standard Proctor density.

We recommend the interior and exterior slopes of the dikes be restricted to a maximum of 3 feet horizontal to 1 foot vertical. We did not perform slope stability analysis for this project; in general, slopes will remain stable provided they are not subject to excessive groundwater seepage. The maintenance and integrity of the liner soils is critical in the performance of the dike embankment slopes.

6.3.2 CLAY LINER CONSTRUCTION

Based on our review of the boring logs as well as the results of the laboratory tests, it is our opinion that the clay soils encountered in our borings are suitable for use as liner material. The results of the laboratory tests indicate these soils should satisfy the recommended seepage rate of less than 1/56 inch per day at maximum operating depth if placed at the recommended compaction and moisture specifications listed below. We recommend that a geotechnical engineer or representative be on-site during the initial excavation at the site to assist with identifying suitable liner material.

We recommend a minimum thickness of 24 inches be used for the proposed liner. The excavation for the pond should extend through the topsoil and into the clay soils to a depth of 18 inches below the designed bottom of the pond. The excavation should then be followed by scarifying, moisture conditioning, and recompacting a minimum of 6 inches of the exposed clay soils followed by the placement of an additional 18 inches of clay soils. The clay soils should be placed in a maximum loose lift thickness of 8 inches. The clay liner should be compacted to at least 95% of the Standard Proctor density at a moisture content ranging from optimum to 3% over optimum moisture content as determined by the Standard Proctor.

If sand soils or cobbles and boulders are encountered within the excavation for the ponds, they should be completely removed or excavated to a depth of at least 2’ below the designed pond bottom elevation.

During construction, and once the liner has been completed, the liner soils should not be allowed to dry out. Drying of the liner will cause cracking, which will be very difficult to repair and may result in seepage rates above the desired rate. Therefore, once the liner has been completed, we recommend that compaction tests along with a representative number of permeability tests be performed as soon as possible so that the pond can be flooded. If construction staging does not allow for immediate flooding, it may be advisable to place a layer of soil over the completed liner to reduce the drying effects.

6.3.3 EROSION CONTROL

Once the clay liner has been completed, the inner slopes of the dikes should be protected

from erosion. The erosion protection could include riprap placement or vegetative cover. If vegetative cover is chosen, the correct type of plant growth should be selected such that root development will not penetrate the liner and breach the liner integrity.

6.4 CONCRETE LMSA RECOMMENDATIONS

Soil borings 403 and 405 were advanced at the locations of proposed concrete LMSA tanks. We were not provided any specific information on the proposed concrete tank sizes or depths. The tanks can be supported on the natural nonorganic soils. Due to the presence of soft, sandy lean clay soils at soil boring 403, we recommend performing a soil correction to remove the soft clay soils to a minimum depth of 7 feet. If fill is required to reach footing grade it should be granular material with a 2-inch maximum size and less than 12% passing the #200 sieve. The fill should be placed and compacted in lifts not exceeding 1 foot to a minimum of 95% of Standard Proctor Density (ASTM D698).

The above-stated minimum granular depth below the footings is for cut areas within the structure. For fill areas where a fill greater than those minimum depths is needed, we recommend that granular engineered fill be used within the concrete LMSA footprint and oversize areas. We do not recommend reusing any fat clay or silty clay soils as fill within the LMSA structures or any other building areas.

The tank foundations should extend a minimum of 60 inches below grade for frost protection. If the tank will ever be empty and exposed to freezing weather the footings/floor should be provided with a minimum of 2 feet of granular non frost susceptible base. Potential buoyancy effects should be accounted for in design.

6.4.1 LATERAL EARTH PRESSURE

Below-grade concrete walls will retain soils and must be designed to resist the resulting lateral earth pressures. For design, we recommend the ultimate lateral earth pressure values (given in equivalent fluid pressure values) presented in Table A below. The use of saturated soil conditions will depend upon the design groundwater level with respect to the wall bottom elevation.

Table A – Recommended Lateral Earth Pressure Design Parameters

Soil Type	Equivalent Fluid Density, Drained			Equivalent Fluid Density, Saturated		
	Active (pcf)	At-Rest (pcf)	Passive (pcf)	Active (pcf)	At-Rest (pcf)	Passive (pcf)
Sands (SP or SP-SM)	35	60	330	80	90	265
Silty Sand (SM)	45	65	290	85	95	250
Fine-Grained Soils (SC, CL, or ML)	70	90	220	90	100	235

Active and passive earth pressure design assumes the top of the wall is free to rotate. For coarse-grained soils (SM, SP, or SP-SM), deflections on the order of 1 to 2 percent of the subsurface wall height are necessary in order to fully mobilize active or passive earth pressure. For fine-grained soils (SC, CL, or ML), wall deflections on the order of 2 to 5 percent are necessary to fully develop active or passive state earth pressure. At-rest earth pressures should be used for walls which are restrained from rotation by the superstructure or floor system.

The above values for lateral earth pressure (equivalent fluid density) and sliding friction are ultimate and do not include a factor of safety. Therefore, the designer should apply appropriate safety factors for the respective design element. Typically, a factor of 1.5 is applied to these values.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 POTENTIAL DIFFICULTIES

7.1.1 RUNOFF WATER IN EXCAVATION

Water can be expected to collect in the excavation bottom during times of inclement weather or snow melt. To allow observation of the excavation bottom, to reduce the potential for soil disturbance, and to facilitate filling operations, we recommend water be removed from within the excavation during construction. Based on the soils encountered, we anticipate the groundwater can be handled with conventional sump pumping.

7.1.2 DISTURBANCE OF SOILS

The on-site soils can be disturbed under construction traffic, especially if the soils are wet. If soils become disturbed, they should be subcut to the underlying undisturbed soils. The subcut soils can then be dried and recompacted back into place, or they should be removed and replaced with drier imported fill.

7.1.3 COBBLES AND BOULDERS

The soils at this site can include cobbles and boulders. This may make excavating procedures somewhat more difficult than normal if they are encountered.

7.1.4 WINTER CONSTRUCTION

If construction occurs during the winter, it is necessary for the contractor to protect the base soils from freezing each day and each night before new fill is placed. Fill should not be placed over frozen soils, snow, or ice, nor should the use of frozen fill soils be permitted. The contractor must protect base soils from freezing before and after fill placement, and before, during, and after concrete placement. If the interior footings will be exposed to freezing temperatures during construction, we recommend that you consider lowering the footings to protect against frost penetration into the footing subgrade soils. We recommend that a special pre-construction meeting be held to discuss the procedures and precautions that must be followed.

7.2 EXCAVATION BACKSLOPING

If excavation faces are not retained, the excavations should maintain maximum allowable slopes in accordance with *OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations"* (can be found on www.osha.gov). Even with the required OSHA sloping, water seepage or surface runoff can potentially induce sideslope erosion or sloughing which could require slope maintenance.

7.3 OBSERVATIONS AND TESTING

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observation by a geotechnical

engineer/technician during construction to evaluate these potential changes. Soil density testing and permeability testing should also be performed on new fill placed in order to document that project specifications for compaction, moisture content and allowable seepage rates have been satisfied.

8.0 ASTM STANDARDS

When we refer to an ASTM Standard in this report, we mean that our services were performed in general accordance with that standard. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

9.0 LIMITATIONS

Within the limitations of scope, budget, and schedule, we have endeavored to provide our services according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, express or implied, is intended.

Important information regarding risk management and proper use of this report is given in Appendix B entitled “Geotechnical Report Limitations and Guidelines for Use.”

Standard Data Sheets

Freezing Weather Effects on Building Construction

FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION

GENERAL

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/strength loss depends on the soil type and moisture condition. Heave is greater in soils with higher percentages of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about 1/4" to 3/8" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

DESIGN CONSIDERATIONS

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 12% passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

Adfreezing can occur on exterior piers (such as deck, fence or other similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where soils become saturated. Additional footing embedment and/or widened footings below the frost zones (which include tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

CONSTRUCTION CONSIDERATIONS

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

Appendix A

Geotechnical Field Exploration and Testing
Boring Log Notes
Unified Soil Classification System
Site Location Map
Boring Location Map (Furnished by Settje Agri-Services) Subsurface Boring Logs (41)
Proctor Reports (3)
Permeability Test Data (3)
Hydrometer Test Data (3)

Appendix A
Geotechnical Field Exploration and Testing
Report No. P-0042453

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling twenty-nine standard penetration test borings. The locations of the borings appear on Figure 2, preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS)

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586 The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as “DS” or “SU” on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of “topsoil” layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The groundwater level measurements are shown at the bottom of the boring logs. The following information appears under “Water Level Measurements” on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests

Conducted per AET Procedure 01-LAB-010, which is performed in general accordance with ASTM: D2216 and AASHTO: T265.

A.5.2 Dry Density Tests

Conducted per AET Procedure 01-LAB-020, which is performed in general accordance with ASTM: D7263.

A.5.3 Atterberg Limits Tests

Conducted per AET Procedure 01-LAB-030, which is performed in general accordance with ASTM: D4318 and AASHTO: T89, T90.

A.5.3 Particle Size Analysis of Soils (with hydrometer)

Conducted per AET Procedure 01-LAB-060, which is performed in general accordance with ASTM: D7928 and AASHTO: T88.

A.5.4 Unconfined Compressive Strength of Cohesive Soil

Conducted per AET Procedure 01-LAB-090, which is performed in general accordance with ASTM: D2166 and AASHTO: T208.

A.5.5 Standard Proctor Test

Conducted per AET Procedure 01-LAB-120, which is performed in general accordance with ASTM: D698, Test Method A.

A.5.6 Hydraulic Conductivity of Remolded Saturated Clay by Flexible Wall Permeater

Conducted per AET Procedure 01-LAB-220, which is performed in general accordance with ASTM D5084.

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D2487, D2488

AMERICAN ENGINEERING TESTING, INC.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and $1 > Cc > 3$[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried < 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried < 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]

Notes

[A]Based on the material passing the 3-in (75-mm) sieve.

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60} / D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains ≥15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.

[K]If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.

[M]If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

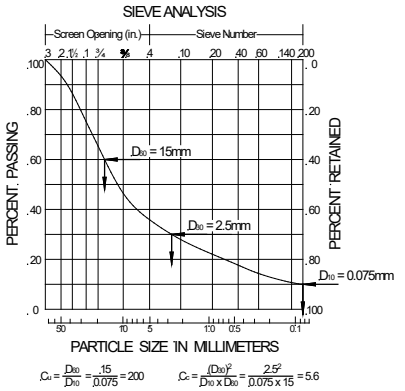
[N]PI≥4 and plots on or above "A" line.

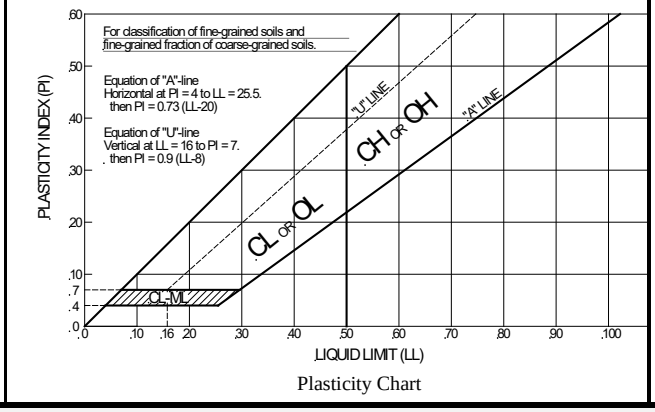
[O]PI<4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.

[R]Fiber Content description shown below.





Plasticity Chart

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition (MC Column)

D (Dry): Absence of moisture, dusty, dry to touch.

M (Moist): Damp, although free water not visible. Soil may still have a high water content (over "optimum").

W (Wet/ Waterbearing): Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.

F (Frozen): Soil frozen

Layering Notes

Laminations: Layers less than ½" thick of differing material or color.

Lenses: Pockets or layers greater than ½" thick of differing material or color.

Fiber Content of Peat

Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic/Roots Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. *Slightly organic* used for borderline cases.

Root Inclusions

With roots: Judged to have sufficient quantity of roots to influence the soil properties.

Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
AR:	Sample of material obtained from cuttings blown out the top of the borehole during air rotary procedure.
B, H, N:	Size of flush-joint casing
CAS:	Pipe casing, number indicates nominal diameter in inches
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
DP:	Direct push drilling; a 2.125 inch OD outer casing with an inner 1½ inch ID plastic tube is driven continuously into the ground.
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RDA:	Rotary drilling with compressed air and roller or drag bit.
RDF:	Rotary drilling with drilling fluid and roller or drag bit
REC:	In split-spoon (see notes), direct push and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
SS:	Standard split-spoon sampler (steel; 1.5" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
▽:	Estimated water level based solely on sample appearance

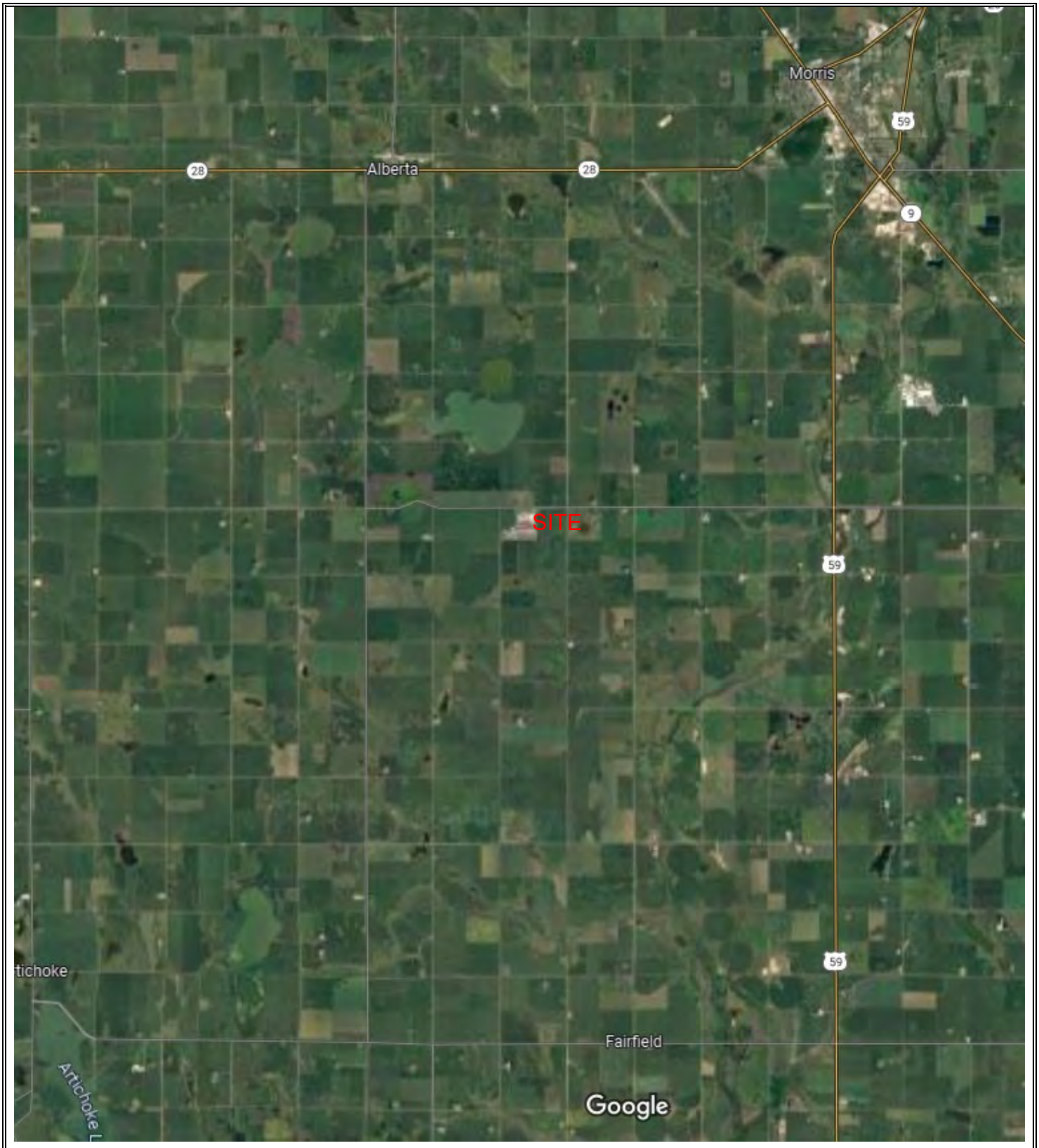
TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (approximate)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remolded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

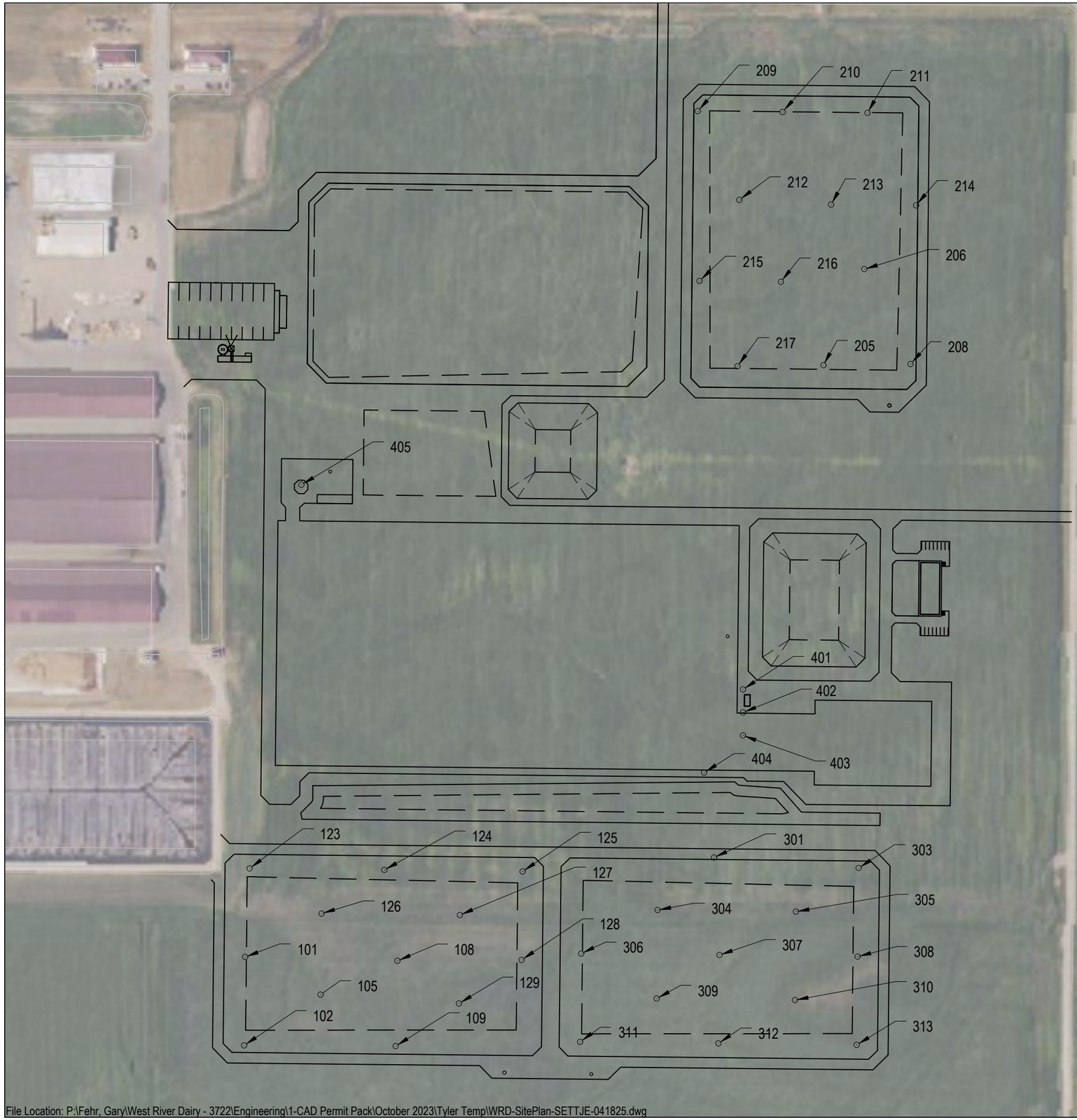
STANDARD PENETRATION TEST NOTES
(Calibrated Hammer Weight)

The standard penetration test consists of driving a split-spoon sampler with a drop hammer (calibrated weight varies to provide N_{60} values) and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM: D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM: D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").



AMERICAN ENGINEERING TESTING	Project: West River Dairy Morris, MN			AET Job No. P-0027867
	Subject: Site Location			Date: December 1, 2023
	Scale: NTS	Drawn By: GG	Checked By: ZH	Figure: 1



101	30 FEET	LMSA
102	25 FEET	LMSA
105	30 FEET	LMSA
108	25 FEET	LMSA
109	25 FEET	LMSA
123	30 FEET	LMSA
124	25 FEET	LMSA
125	20 FEET	LMSA
126	30 FEET	LMSA
127	25 FEET	LMSA
128	20 FEET	LMSA
129	25 FEET	LMSA
205	25 FEET	LMSA 2
206	30 FEET	LMSA 2
208	25 FEET	LMSA 2
209	30 FEET	LMSA 2
210	30 FEET	LMSA 2
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212	30 FEET	LMSA 2
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214	30 FEET	LMSA 2
215	30 FEET	LMSA 2
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303	10 FEET	LMSA 3
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305	10 FEET	LMSA 3
306	15 FEET	LMSA 3
307	10 FEET	LMSA 3
308	15 FEET	LMSA 3
309	10 FEET	LMSA 3
310	20 FEET	LMSA 3
311	15 FEET	LMSA 3
312	10 FEET	LMSA 3
313	15 FEET	LMSA 3
401	20 FEET	CONCRETE LMSA
402	20 FEET	CONCRETE LMSA
403	20 FEET	CONCRETE LMSA
404	20 FEET	CONCRETE LMSA

Figure 2:Soil Boring Locations

NOT FOR CONSTRUCTION

File Location: P:\Fehr, Gary\West River Dairy - 3722\Engineering\1-CAD Permit Pack\October 2023\Tyler Temp\WRD-SitePlan-SETTJE-041825.dwg

Date Printed	4/18/25
Drawn By	TLC
Reviewed By	

BORING LOCATIONS

0 300 600 Feet

N

West River Dairy Expansion
N 1/2 & SE 1/4 of Sec. 1, T-123N, R-43W
Stevens County, MN

15460 NW 48th St.
Raymond, NE 68428
Office: (402) 783-2100
Web Site: www.settje.com

SETTJE
Agri-Services & Engineering, Inc.

B-1

SUBSURFACE BORING LOG

AET No: **P-0020556** Log of Boring No. **101 (p. 1 of 1)**

Project: **Proposed West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1155.3'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, frozen (CL-OL)	TOPSOIL		F	SS						
2	LEAN CLAY, brown mottled, frozen (CL)	FINE ALLUVIUM									
3	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff to firm to stiff (CL)	TILL	13	M	SS	12	15				
5			8	M	SS	18	20				
8			8	M	SS	18	23				
10			10	M	SS	18					
13			7	M	SS	18	27				
15			6	M	SS	18					
20			11	M	SS	18	24				
25	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff to firm (CL)		9	M	SS	18					
30			6	M	SS	18					
31	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-29½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	4/3/23						**None**	
BORING COMPLETED: **4/3/23**								
DR: **MH** LG: **ZH** Rig: **68C**								

AET_CORP P-0020556.GPJ AET+CPT+WELL.GDT 5/17/23

SUBSURFACE BORING LOG

AET No: **P-0020556** Log of Boring No. **102 (p. 1 of 1)**

Project: **Proposed West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1153.5'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, frozen (CL-OL)	TOPSOIL		F	SS						
2	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm to stiff, frozen to 3.5' (CL)	TILL									
3			14	F	SS	18	15				
4											
5			11	M	SS	18					
6											
7											
8			9	M	SS	18	23				
9											
10			7	M	SS	18					
11											
12											
13			7	M	SS	18	24				
14											
15			9	M	SS	18					
16											
17											
18											
19											
20			13	M	SS	18	25				
21											
22											
23											
24											
25	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff (CL)		9	M	SS	18					
26	**END OF BORING**										

DEPTH: DRILLING METHOD

0-24½' 3.25" HSA

BORING COMPLETED: **4/3/23**

DR: **MH** LG: **ZH** Rig: **68C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
4/3/23						**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0020556.GPJ AET+CPT+WELL.GDT 5/17/23

SUBSURFACE BORING LOG

AET No: **P-0020556** Log of Boring No. **105 (p. 1 of 1)**

Project: **Proposed West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1157.0'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, frozen (CL-OL)	TOPSOIL		F	SS						
2	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm to stiff, frozen to 3' (CL)	TILL									
3			21	F	SS	17	18				
4											
5			13	M	SS	18	20				
6											
7											
8			9	M	SS	18	24				
9											
10			9	M	SS	18					
11											
12											
13			8	M	SS	18	25				
14											
15			10	M	SS	18					
16											
17											
18											
19											
20			15	M	SS	18	25				
21											
22											
23											
24											
25	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff to firm, a lens of sand (CL)		11	M	SS	18	22				
26											
27											
28											
29											
30			8	M	SS	18					
31	**END OF BORING**										
	Bag sample obtained from 15'-20'.										

DEPTH:	DRILLING METHOD
0-29½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
3/30/23		**31'**	**29.5'**	**31'**		**None**

BORING COMPLETED: **3/30/23**

DR: **MH** LG: **ZH** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0020556.GPJ AET+CPT+WELL.GDT 5/17/23

SUBSURFACE BORING LOG

AET No: **P-0020556** Log of Boring No. **108 (p. 1 of 1)**

Project: **Proposed West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1152.5'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, frozen (CL-OL)	TOPSOIL		F	SS						
2	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff, frozen to 3.5' (CL)	TILL									
3			11	F	SS	18	20				
4											
5			6	M	SS	18	22				
6											
7											
8			10	M	SS	18					
9											
10			9	M	SS	18	26				
11											
12											
13			10	M	SS	18	26				
14											
15			9	M	SS	18					
16											
17											
18											
19											
20	SANDY LEAN CLAY, with a little gravel, gray, moist, stiff (CL)		11	M	SS	18	24				
21											
22											
23											
24											
25			15	M	SS	18					
26	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½' 3.25" HSA	**3/30/23**						**None**	
BORING COMPLETED: **3/30/23**								
DR: **MH** LG: **ZH** Rig: **68C**								

AET_CORP P-0020556.GPJ AET+CPT+WELL.GDT 5/17/23

SUBSURFACE BORING LOG

AET No: **P-0020556** Log of Boring No. **109 (p. 1 of 1)**

Project: **Proposed West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1050.8'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, frozen (CL-OL)	TOPSOIL		F	SS						
2–3	SANDY LEAN CLAY, with a little gravel, brown mottled, moist, stiff to very stiff, a lens of sand at 8' (CL)	TILL	11	M	SS	15	18				
4–5			12	M	SS	16					
6–8			13	M	SS	18	16				
9–10			12	M	SS	18					
11–13			14	M	SS	18	20				
14–15			18	M	SS	18					
16–20	SANDY LEAN CLAY, with a little gravel, gray, moist, stiff (CL)		9	M	SS	18					
21–25			11	M	SS	18	21				
26	**END OF BORING**										

DEPTH: **0-24½'** DRILLING METHOD: **3.25" HSA**

BORING COMPLETED: **3/29/23**

DR: **MH** LG: **ZH** Rig: **68C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
3/29/23		**26'**	**24.5'**	**26'**		**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0020556.GPJ AET+CPT+WELL.GDT 5/17/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **123 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1156.0'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, dark brown and brown, very moist	FILL	5	M	SS	8					
2	FILL, mixture of LEAN CLAY and SANDY LEAN CLAY, with a little gravel, brown, very moist to moist	TILL	7	M	SS	10	20				
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm to stiff, a layer of silt at 12' (CL)		9	M	SS	10	24				
8			9	M	SS	12	18				
10			6	M	SS	12	26				
13			7	M	SS	15	37				
15			11	M	SS	15					
20			10	M	SS	18					
25			11	M	SS	18	22				
29	SANDY LEAN CLAY, with a little gravel, gray, moist, very stiff (CL)		17	M	SS	18					
31	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-29½'	**3.25" HSA**
BORING COMPLETED:	**11/14/23**
DR: **MH**	LG: **MH** Rig: **68C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/14/23						**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **124 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1149.5'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, dark brown, very moist, soft (CL-OL)	TOPSOIL	3	M	SS	8					
2	LEAN CLAY, brown mottled, very moist to moist, firm	FINE ALLUVIUM									
3			7	M	SS	8	22				
4	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm to stiff (CL)	TILL									
5			10	M	SS	18	24				
6											
7											
8			8	M	SS	10	24				
9											
10			8	M	SS	10	24				
11											
12											
13			12	M	SS	18	23				
14											
15	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff to firm (CL)		13	M	SS	18					
16											
17											
18											
19											
20			8	M	SS	18					
21											
22											
23											
24											
25			8	M	SS	18					
26	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½' 3.25" HSA	**11/15/23**						**None**	
BORING COMPLETED: **11/15/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **125 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1144.1'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, dark brown, very moist, firm (CL-OL)	TOPSOIL	4	M	SS	8					
2	LEAN CLAY, brown mottled, very moist to moist, firm (CL)	FINE ALLUVIUM	7	M	SS	8	23				
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff to firm to stiff (CL)	TILL	7	M	SS	8					
8			11	M	SS	15	24				
10			8	M	SS	10	21				
13			12	M	SS	15	23				
15	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff to firm (CL)		14	M	SS	18					
20			7	M	SS	18					
21	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½' 3.25" HSA	**11/15/23**						**None**	
BORING COMPLETED: **11/15/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **126 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

Surface Elevation **1156.8'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, dark brown and black, very moist	FILL	8	M	SS	8					
2	FILL, mixture of LEAN CLAY and SANDY LEAN CLAY, with a little gravel, brown, very moist to moist	TILL	8	M	SS	10	23				
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff to firm to stiff, a lens of silt at 14.5' (CL)		8	M	SS	10	21				
8			9	M	SS	10	25				
10			8	M	SS	10	24				
13			7	M	SS	12	26				
15			7	M	SS	12	30				
20			8	M	SS	15	27				
25			14	M	SS	18					
26	SANDY LEAN CLAY, with a little gravel, gray, moist, stiff (CL)										
30			11	M	SS	18					
31	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½' 3.25" HSA	**11/15/23**						**None**	
BORING COMPLETED: **11/15/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **127 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1150.0'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, dark brown and black, very moist	FILL	7	M	SS	6					
2											
3	FILL, mixture of LEAN CLAY and SANDY LEAN CLAY, with a little gravel, brown, very moist to moist		9	M	SS	18					
4											
5	SANDY LEAN CLAY, with a little gravel, brown mottled, moist, stiff (CL)	TILL	10	M	SS	18	23				
6											
7											
8			10	M	SS	18					
9											
10			10	M	SS	18	23				
11											
12											
13			14	M	SS	18	24				
14											
15			15	M	SS	18	24				
16											
17											
18											
19											
20			11	M	SS	18	22				
21											
22											
23											
24											
25			12	M	SS	18					
26	**END OF BORING**										

Bag sample taken from 15'-20'.

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'	**3.25" HSA**	**11/15/23**						**None**	
BORING COMPLETED:	**11/15/23**								
DR: **MH**	LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **128 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1147.0'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, dark brown and black, very moist	FILL	5	M	SS	8					
2											
3	FILL, mixture of LEAN CLAY and SANDY LEAN CLAY, with a little gravel, brown, very moist to moist		7	M	SS	9	23				
4											
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff (CL)	TILL	7	M	SS	9					
6											
7											
8			8	M	SS	10	26	99			
9											
10			9	M	SS	10	26				
11											
12											
13			11	M	SS	18	27				
14											
15			13	M	SS	18					
16											
17											
18											
19											
20			14	M	SS	18					
21	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½' 3.25" HSA	**11/15/23**						**None**	
BORING COMPLETED: **11/15/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **129 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1151.4'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, dark brown and black, very moist	FILL	4	M	SS	8					
2	FILL, mixture of LEAN CLAY and SANDY LEAN CLAY, with a little gravel, brown, very moist to moist		10	M	SS	18	22				
4	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm to stiff (CL)	TILL	9	M	SS	12	21				
8			9	M	SS	12	26				
10			9	M	SS	15	23				
13			8	M	SS	15	25				
15			10	M	SS	18	24				
16	CLAYEY SAND, fine to medium grained, with a little gravel, brown, waterbearing, loose (SC)	MIXED ALLUVIUM									
19	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, firm to stiff (CL)	TILL	6	M	SS	15					
25			12	M	SS	18					
26	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½' 3.25" HSA	**11/15/23**	**11:02**	**21'**	**19.5'**	**21'**		**14.5'**	
BORING COMPLETED: **11/15/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0020556** Log of Boring No. **205 (p. 1 of 1)**

Project: **Proposed West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1154.8'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, frozen (CL-OL)	TOPSOIL		F	SS						
2	LEAN CLAY, brown mottled, very moist, firm, frozen to 2.5' (CL)	FINE ALLUVIUM									
3			6	M	SS	10	18				
4											
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff to very stiff to stiff, cobbles at 10.5' (CL)	TILL	7	M	SS	17	22				
6											
7											
8			9	M	SS	18	24				
9											
10			17	M	SS	18	23				
11											
12											
13			10	M	SS	18					
14											
15			9	M	SS	18	25				
16											
17											
18											
19	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)										
20			6	M	SS	18	22				
21											
22											
23											
24											
25			8	M	SS	18					
26	**END OF BORING**										

DEPTH: DRILLING METHOD

0-24½' 3.25" HSA

BORING COMPLETED: **3/29/23**

DR: **MH** LG: **ZH** Rig: **68C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
3/29/23		**26'**	**24.5'**	**26'**		**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0020556.GPJ AET+CPT+WELL.GDT 5/17/23

SUBSURFACE BORING LOG

AET No: **P-0020556** Log of Boring No. **206 (p. 1 of 1)**

Project: **Proposed West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1057.3'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, frozen (CL-OL)	TOPSOIL		F	SS						
2	SANDY LEAN CLAY, with a little gravel, brown mottled, moist, stiff to very stiff, frozen to 3' (CL)	TILL									
3			13	M	SS	15	22				
4											
5			13	M	SS	16	21				
6											
7											
8			11	M	SS	18					
9											
10			14	M	SS	18					
11											
12											
13			12	M	SS	18	23				
14											
15			12	M	SS	18					
16											
17											
18											
19											
20			13	M	SS	18	25				
21											
22											
23											
24											
25			17	M	SS	18					
26											
27											
28											
29											
30			16	M	SS	18	25				
31	**END OF BORING**										
	Bag sample taken form 15'-20'.										

DEPTH:	DRILLING METHOD
0-29½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
3/28/23						**None**

BORING COMPLETED: **3/28/23**

DR: **MH** LG: **ZH** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0020556.GPJ AET+CPT+WELL.GDT 5/17/23

SUBSURFACE BORING LOG

AET No: **P-0020556** Log of Boring No. **208 (p. 1 of 1)**

Project: **Proposed West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1153.1'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, frozen (CL-OL)	TOPSOIL		F	SS						
2	FAT CLAY, brown mottled, very moist, firm, frozen to 3.5' (CH)	FINE ALLUVIUM	8	F	SS	12	17				
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist, firm (CL)	TILL	5	M	SS	15	24				
8			5	M	SS	18					
10			5	M	SS	18	23				
13			8	M	SS	18					
15	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)		8	M	SS	18	25				
20			8	M	SS	18	25				
25			8	M	SS	18					
26	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½' 3.25" HSA	**3/29/23**						**None**	
BORING COMPLETED: **3/29/23**								
DR: **MH** LG: **ZH** Rig: **68C**								

AET_CORP P-0020556.GPJ AET+CPT+WELL.GDT 5/17/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **209 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1154.5'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, black and dark brown, very moist	FILL	3	M	SS	6					
2	LEAN CLAY, brown mottled, very moist, firm (CL)	FINE ALLUVIUM									
3			7	M	SS	10	22				
4	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff, a layer of silt at 12' & 19.5' (CL)	TILL									
5			7	M	SS	10	22				
6											
7											
8			8	M	SS	10	23				
9											
10			7	M	SS	18	23	102			
11											
12											
13			8	M	SS	18	33				
14											
15			11	M	SS	18					
16											
17											
18											
19											
20			9	M	SS	18	32				
21											
22											
23											
24											
25			12	M	SS	18					
26											
27											
28											
29											
30			13	M	SS	18					
31	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½' 3.25" HSA	**11/14/23**						**None**	
BORING COMPLETED: **11/14/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **210 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

Surface Elevation **1155.8'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, dark brown, very moist, soft (CL-OL)	TOPSOIL	4	M	SS	6					
2	LEAN CLAY, brown mottled, very moist, firm (CL)	FINE ALLUVIUM	6	M	SS	8	21				
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff (CL)	TILL	8	M	SS	10	24				
8			8	M	SS	10	22				
10			9	M	SS	12	24				
13			13	M	SS	18					
15			10	M	SS	18					
20	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff to firm (CL)		9	M	SS	18	26				
25			6	M	SS	18	28				
30	LEAN CLAY, gray, very moist, soft (CL)	FINE ALLUVIUM	4	M	SS	18	27				
31	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-29½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/14/23						**None**

BORING COMPLETED: **11/14/23**

DR: **MH** LG: **MH** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **211 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1156.1'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, dark brown, very moist	FILL	4	M	SS	6					
2											
3	FILL, mixture of LEAN CLAY and SANDY LEAN CLAY, with a little gravel, brown, very moist		7	M	SS	8	19				
4		TILL									
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff (CL)		7	M	SS	10	22				
6											
7											
8			8	M	SS	10	22				
9											
10			9	M	SS	18	22				
11											
12											
13			10	M	SS	18	25				
14											
15			10	M	SS	18					
16											
17											
18											
19											
20	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff (CL)		9	M	SS	18	26				
21											
22											
23											
24											
25			10	M	SS	18					
26											
27											
28											
29											
30	LEAN CLAY, grayish brown, moist, stiff (CL)	FINE ALLUVIUM	10	M	SS	18					
31	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½' 3.25" HSA	**11/14/23**						**None**	
BORING COMPLETED: **11/14/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **212 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1156.5'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1–2	FILL, ORGANIC LEAN CLAY, black, very moist	FILL	4	M	SS	6					
3–4	FILL, mixture of LEAN CLAY and SANDY LEAN CLAY, with a little gravel, brown and gray, very moist to moist		6	M	SS	8	24				
5–6	SANDY LEAN CLAY, with a little gravel, brown mottled, moist, stiff (CL)	TILL	12	M	SS	18	21				
7–8			11	M	SS	18					
9–10			10	M	SS	18	24				
11–12			12	M	SS	18					
13–14			13	M	SS	18	25				
15–16											
17–18											
19–20	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)		8	M	SS	18	25				
21–22											
23–24											
25–26			5	M	SS	18	27				
27–28											
29–30			8	M	SS	18					
31	**END OF BORING**										

Bag sample taken from 15'-20'.

DEPTH:	DRILLING METHOD
0-29½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/14/23						**None**

BORING COMPLETED: **11/13/23**

DR: **MH** LG: **MH** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **213 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1155.8'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, very moist, soft (CL-OL)	TOPSOIL	4	M	SS	6					
2	LEAN CLAY, dark brown, very moist, firm (CL)	FINE ALLUVIUM									
3			7	M	SS	10	25				
4											
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff to firm (CL)	TILL	6	M	SS	10	26				
6											
7											
8			9	M	SS	18	22				
9											
10			6	M	SS	10	25				
11											
12											
13			8	M	SS	18	26				
14											
15			7	M	SS	18					
16											
17											
18											
19											
20			7	M	SS	18	24				
21	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)										
22											
23											
24											
25			8	M	SS	18	26				
26											
27											
28											
29											
30			5	M	SS	18					
31	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½' 3.25" HSA	**11/14/23**						**None**	
BORING COMPLETED: **11/14/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **214 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1155.1'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, black, very moist, soft (CL-OL)	TOPSOIL	4	M	SS	6					
2	LEAN CLAY, gray and brown mottled, very moist, stiff (CL)	FINE ALLUVIUM	10	M	SS	10	26				
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm to stiff to firm, a layer of silt at 7' (CL)	TILL	10	M	SS	12	22				
8			7	M	SS	18	30				
10			10	M	SS	18	25				
13			9	M	SS	18					
15			8	M	SS	18	28				
20			8	M	SS	18	27				
21	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, firm to stiff (CL)										
25			6	M	SS	18	26				
30			9	M	SS	18					
31	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½' 3.25" HSA	**11/14/23**						**None**	
BORING COMPLETED: **11/14/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **215 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1157.5'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, black and dark brown, very moist	FILL	7	M	SS	6					
2											
3	FILL, mixture of LEAN CLAY and SANDY LEAN CLAY, with a little gravel, brown, very moist to moist		10	M	SS	6	19				
4		TILL									
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm to stiff to very stiff (CL)		9	M	SS	15	23				
6											
7											
8			8	M	SS	15	23				
9											
10			7	M	SS	15	23				
11											
12											
13			10	M	SS	17					
14											
15			11	M	SS	18					
16											
17											
18											
19											
20			11	M	SS	18	24				
21											
22											
23											
24											
25			18	M	SS	18					
26											
27											
28											
29											
30			23	M	SS	18					
31	**END OF BORING**										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½'	**3.25" HSA**								
		11/13/23						**None**	
BORING COMPLETED:	**11/13/23**								
DR: **MH**	LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **216 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1158.9'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, black and dark brown, very moist	FILL	4	M	SS	6					
2	FILL, mixture of SILTY CLAY, LEAN CLAY and SANDY LEAN CLAY, with a little gravel, dark brown and brown, very moist to moist		8	M	SS	6	19				
3											
4											
5	SANDY LEAN CLAY, with a little gravel, brown mottled, moist, firm to stiff (CL)	TILL	6	M	SS	12	22				
6											
7			10	M	SS	18	23				
8											
9			9	M	SS	18	26				
10											
11			15	M	SS	18	24				
12											
13			15	M	SS	18					
14											
15											
16											
17											
18											
19			11	M	SS	18					
20											
21											
22											
23											
24			13	M	SS	18	23				
25											
26											
27											
28											
29	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff to firm (CL)		10	M	SS	18					
30											
31											
32											
33											
34											
35			7	M	SS	18					
36	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-34½' 3.25" HSA	**11/13/23**						**None**	
BORING COMPLETED: **11/13/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **217 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1157.3'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, LEAN CLAY, brown, very moist, some organics	FILL	4	M	SS	10					
2											
3	FILL, mixture of LEAN CLAY and SANDY LEAN CLAY, with a little gravel, brown, very moist		5	M	SS	10	22				
4		TILL									
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff to firm (CL)		7	M	SS	18	23				
6											
7											
8			9	M	SS	18	24				
9											
10			8	M	SS	17					
11											
12											
13			9	M	SS	18	25				
14											
15			8	M	SS	18	24				
16	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff to firm (CL)										
17											
18											
19											
20			11	M	SS	18	26				
21											
22											
23											
24											
25			9	M	SS	18					
26											
27											
28											
29											
30			8	M	SS	18					
31	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½' 3.25" HSA	**11/13/23**						**None**	
BORING COMPLETED: **11/13/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0020556** Log of Boring No. **301 (p. 1 of 1)**

Project: **Proposed West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1138.4'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, frozen (CL-OL)	TOPSOIL		F	SS						
3	FAT CLAY, very dark brown, very moist, firm, frozen to 3.5' (CH)	FINE ALLUVIUM	5	F	SS	10	32				
5	FAT CLAY, grayish brown mottled, very moist, soft (CH)		4	M	SS	18	37		56	26	
8	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to wet, soft (CL)	TILL	3	M	SS	18	33				
10			4	M	SS	18	28				
13	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)		6	M	SS	18	24				
15				M	3T		24	102			2500
17			6	M	SS	18	26				
18	**END OF BORING**										

DEPTH: DRILLING METHOD **0-16½' 3.25" HSA**

BORING COMPLETED: **3/29/23**

DR: **MH** LG: **ZH** Rig: **68C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
3/29/23		**16'**	**16.5'**	**18'**		**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0020556.GPJ AET+CPT+WELL.GDT 5/17/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **303 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1137.5'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, very moist, soft (CL-OL)	TOPSOIL	4	M	SS	10					
2	LEAN CLAY, dark brown, very moist, soft (CL/CH)	FINE ALLUVIUM									
3			4	M	SS	10	31				
4											
5			2	M	SS	8	38				
6											
7											
8			4	M	SS	8	37				
9											
10			4	M	SS	6	26				
11	**END OF BORING**										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	**3.25" HSA**	**11/16/23**						**None**	
BORING COMPLETED:	**11/16/23**								
DR: **MH**	LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **304 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1139.8'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, very moist, firm (CL-OL)	TOPSOIL	5	M	SS	8					
2	LEAN CLAY, dark brown, very moist, soft (CL/CH)	FINE ALLUVIUM									
3			4	M	SS	8	26				
4											
5	SANDY LEAN CLAY, brown mottled, very moist, firm (CL)	MIXED ALLUVIUM	5	M	SS	10	26				
6											
7											
8	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm (CL)	TILL	9	M	SS	18	19				
9				▼							
10			6	M	SS	18	19				
11											
12											
13			6	M	SS	18					
14	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-12½' 3.25" HSA	**11/16/23**	**10:13**	**11'**	**9.5'**	**11'**		**9.5'**	
BORING COMPLETED: **11/16/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **305 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1138.0'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, very moist, soft (CL-OL)	TOPSOIL	3	M	SS	6					
2	LEAN CLAY, dark brown, very moist, soft to firm (CL/CH)	FINE ALLUVIUM									
3			3	M	SS	6	25				
4											
5			5	M	SS	10	26				
6											
7											
8			7	M	SS	10	25				
9											
10			8	M	SS	10	25				
11	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½' 3.25" HSA	**11/16/23**						**None**	
BORING COMPLETED: **11/16/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **306 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1141.2'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, black, very moist	FILL	3	M	SS	6					
2											
3	FILL, mixture of LEAN CLAY and SILTY CLAY, dark brown and brown, very moist		3	M	SS	8	36				
4	SANDY LEAN CLAY, with a little gravel, brown mottled, moist, firm to stiff (CL)	TILL									
5			6	M	SS	10	25				
6											
7											
8			10	M	SS	15	22				
9											
10											
11	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)		8	M	SS	15	20				
12											
13											
14			7	M	SS	18					
	END OF BORING										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-12½' 3.25" HSA	**11/15/23**						**None**	
BORING COMPLETED: **11/15/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **307 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1138.9'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, black, very moist	FILL	3	M	SS	6					
2	FILL, LEAN CLAY, brown and gray, very moist										
3	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff to firm (CL)	TILL	7	M	SS	10	28				
4											
5			9	M	SS	10	25				
6											
7											
8			10	M	SS	18	27				
9											
10			8	M	SS	18					
11	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-9½'	**3.25" HSA**
BORING COMPLETED:	**11/16/23**
DR: **MH**	LG: **MH** Rig: **68C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/16/23						**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **308 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1144.3'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, black, very moist	FILL	5	M	SS	6					
2											
3	FILL, mixture of LEAN CLAY and SANDY LEAN CLAY, brown and dark brown, very moist		7	M	SS	18	21				
4		TILL									
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff (CL)		7	M	SS	18	22				
6											
7											
8			9	M	SS	18	22				
9											
10			9	M	SS	18					
11											
12											
13			15	M	SS	18					
14											
	END OF BORING										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-12½' 3.25" HSA	**11/16/23**						**None**	
BORING COMPLETED: **11/16/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **309 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1138.6'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, black, very moist	FILL	5	M	SS	8					
2	FILL, LEAN CLAY, black, dark brown and gray, very moist		2	M	SS	8	36				
3											
4	SANDY LEAN CLAY, with a little gravel, brown mottled, wet to very moist, soft to firm to stiff, a layer of silt at 4.5' (CL)	TILL									
5			3	M	SS	8	31				
6											
7											
8			5	M	SS	10	29				
9											
10			9	M	SS	18	23				
11											
12	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)										
13			5	M	SS	18					
14											
	END OF BORING										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-12½' 3.25" HSA	**11/15/23**						**None**	
BORING COMPLETED: **11/15/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **310 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1144.4'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, dark brown, very moist	FILL	6	M	SS	6					
2											
3	FILL, mixture of LEAN CLAY, SILTY CLAY and SANDY LEAN CLAY, brown and dark brown, very moist to moist		10	M	SS	10	18				
4											
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm to stiff (CL)	TILL	11	M	SS	10	21				
6											
7											
8			10	M	SS	18	23				
9											
10			10	M	SS	18	21				
11											
12											
13			7	M	SS	15	22				
14											
15			9	M	SS	15	22				
16											
17											
18											
19											
20			11	M	SS	18					
21	**END OF BORING**										

Bag sample taken from 15'-20'.

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½'	**3.25" HSA**								
		11/15/23						**None**	
BORING COMPLETED:	**11/15/23**								
DR: **MH**	LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **311 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1138.1'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	FILL, ORGANIC LEAN CLAY, dark brown, very moist	FILL	3	M	SS	6					
2											
3	FILL, LEAN CLAY, black, very dark brown and gray, very moist		6	M	SS	8	26				
4											
5	LEAN CLAY, gray, very moist, soft to firm (CL/CH)	FINE ALLUVIUM	5	M	SS	10	31				
6											
7											
8			5	M	SS	18	42				
9											
10											
11			4	M	SS	18	36				
12											
13											
14			6	M	SS	18					
	END OF BORING										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-12½'	**3.25" HSA**	**11/15/23**						**None**
BORING COMPLETED:	**11/15/23**							
DR: **MH** LG: **MH** Rig: **68C**								

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **312 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1138.0'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, dark brown, very moist, soft (CL-OL)	TOPSOIL	4	M	SS	8					
2	LEAN CLAY, dark brown, very moist, firm (CL)	FINE ALLUVIUM									
3			5	M	SS	8	22				
4											
5			7	M	SS	10	22				
6	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)	TILL									
7											
8			7	M	SS	10	21				
9											
10			7	M	SS	18					
11	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½' 3.25" HSA	**11/15/23**						**None**	
BORING COMPLETED: **11/15/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **313 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1140.7'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, very moist, soft (CL-OL)	TOPSOIL	3	M	SS	6					
2	LEAN CLAY, gray, very moist, firm (CL/CH)	FINE ALLUVIUM									
3			5	M	SS	8	29				
4											
5			5	M	SS	8	25				
6											
7	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff (CL)	TILL									
8			7	M	SS	18	25				
9											
10			7	M	SS	18	25				
11											
12											
13			9	M	SS	18					
14	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-12½' 3.25" HSA	**11/16/23**						**None**	
BORING COMPLETED: **11/16/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0042453** Log of Boring No. **401 (p. 1 of 1)**

Project: **West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1143.7'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, very moist (CL-OL)	TOPSOIL		M	HSAS						
3	SANDY LEAN CLAY, brown mottled, very moist, firm (CL)	MIXED ALLUVIUM	7	M	SS	16	24				
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm to stiff (CL)	TILL	9	M	SS	18	22				
8			8	M	SS	18	27				
10			6	M	SS	18	26				
13			8	M	SS	18	25				
15			10	M	SS	18	25				
20	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)		5	M	SS	18					
21	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-19½' 3.25" HSA	**4/24/25**		**21'**	**19.5'**	**21'**		**None**
	4/24/25		**21'**	**---**	**19'**		**None**
BORING COMPLETED: **4/24/25**							
DR: **BK** LG: **AK** Rig: **4**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0042453.GPJ AET+CPT+WELL.GDT 4/29/25

SUBSURFACE BORING LOG

AET No: **P-0042453** Log of Boring No. **402 (p. 1 of 1)**

Project: **West River Dairy Additions; Stevens County, Minnesota**

DEPTH IN FEET	Surface Elevation **1141.5'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1–2	LEAN CLAY, black, very moist (CL-OL)	TOPSOIL		M	HSAS						
3–4	SANDY LEAN CLAY, brown mottled, very moist, soft (CL)	MIXED ALLUVIUM	4	M	SS	12	25				
5–6	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, firm to stiff to firm (CL)	TILL	5	M	SS	14	27				
7–8			7	M	SS	18	22				
9–10			8	M	SS	18	25				
11–12			9	M	SS	18	25				
13–14											
15–16	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)		8	M	SS	18	25				
17–18											
19–20			5	M	SS	18	26				
21	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½' 3.25" HSA	**4/24/25**		**21'**	**19.5'**	**21'**		**None**	
	4/24/25		**21'**	**---**	**19'**		**None**	
BORING COMPLETED: **4/24/25**								
DR: **BK** LG: **AK** Rig: **4**								

AET_CORP P-0042453.GPJ AET+CPT+WELL.GDT 4/29/25

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **403 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1140.2'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, dark brown, very moist, soft (CL-OL)	TOPSOIL	3	M	SS	6					
2	SANDY LEAN CLAY, brown and gray mottled, very moist, soft (CL)	FINE ALLUVIUM									
3			4	M	SS	8	23				
4											
5			4	M	SS	8	26				
6											
7	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, firm (CL)	TILL									
8			8	M	SS	10	25	100			
9											
10			8	M	SS	15	23				
11											
12	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff to firm to stiff (CL)										
13			10	M	SS	14					
14											
15			7	M	SS	18	25				
16											
17											
18											
19											
20			9	M	SS	10					
21	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½' 3.25" HSA	**11/14/23**						**None**	
BORING COMPLETED: **11/14/23**								
DR: **MH** LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

SUBSURFACE BORING LOG

AET No: **P-0042453** Log of Boring No. **404 (p. 1 of 1)**

Project: **West River Dairy Additions; Stevens County, Minnesota**

Surface Elevation **1140.4'**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, black, very moist (CL-OL)	TOPSOIL		M	HSAS						
3	SANDY LEAN CLAY, brown mottled, very moist, soft (CL)	MIXED ALLUVIUM	4	M	SS	12	32				
5	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist, firm (CL)	TILL	5	M	SS	14	28				
8			5	M	SS	16	28				
10			6	M	SS	18	29				
13	SANDY LEAN CLAY, with a little gravel, gray, very moist, firm (CL)		8	M	SS	18	28				
15			6	M	SS	18	28				
20			5	M	SS	18					
21	**END OF BORING**										

DEPTH: DRILLING METHOD

0-19½' 3.25" HSA

BORING COMPLETED: **4/24/25**

DR: **BK** LG: **AK** Rig: **4**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
4/24/25		**21'**	**19.5'**	**21'**		**None**
4/24/25		**21'**	**---**	**19'**		**None**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0042453.GPJ AET+CPT+WELL.GDT 4/29/25

SUBSURFACE BORING LOG

AET No: **P-0027867** Log of Boring No. **405 (p. 1 of 1)**

Project: **West River Dairy; Morris Minnesota**

DEPTH IN FEET	Surface Elevation **1156.8'** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	qu
1	LEAN CLAY, dark brown, very moist, firm (CL-OL)	TOPSOIL	5	M	SS	8					
2	SANDY LEAN CLAY, brown and gray mottled, very moist, firm (CL)	FINE ALLUVIUM									
3			8	M	SS	8	26				
4											
5			5	M	SS	10	23				
6											
7	SANDY LEAN CLAY, with a little gravel, brown mottled, very moist to moist, stiff to firm (CL)	TILL									
8			10	M	SS	15					
9											
10			8	M	SS	15	22	101			
11											
12											
13			8	M	SS	15	25				
14											
15	SANDY LEAN CLAY, with a little gravel, gray, very moist to moist, stiff to firm (CL)		9	M	SS	18	24				
16											
17											
18											
19											
20			9	M	SS	18					
21											
22											
23											
24											
25			6	M	SS	18					
26	**END OF BORING**										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'	**3.25" HSA**	**11/14/23**						**None**	
BORING COMPLETED:	**11/14/23**								
DR: **MH**	LG: **MH** Rig: **68C**								

AET_CORP P-0027867.GPJ AET+CPT+WELL.GDT 12/4/23

American Engineering Testing, Inc.
Sioux Falls
601 E. 48th St. N.
Sioux Falls, SD 57104
(605) 332-5371
www.teamAET.com

Proctor Report

Report No: PTR:AET-142383-S1
Issue No: 1

Client: Riverview, LLP **CC:**

Project: West River Dairy

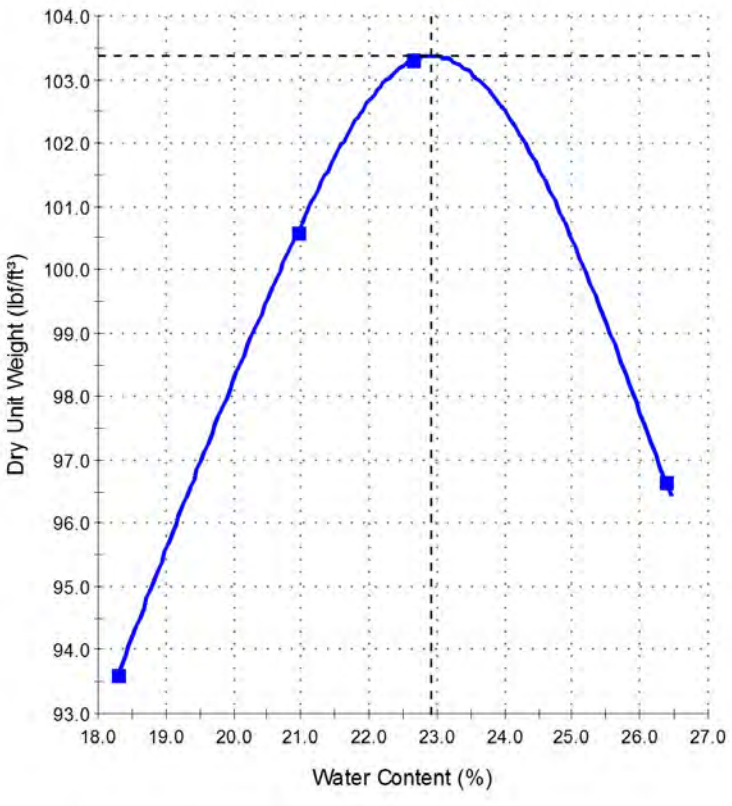
Morris MN
Job No: P-0027867

Date of Issue: 11/27/2023
Reviewed By: Adam Johnson
Senior Engineering Technician

Sample Details

Sample ID:	AET-142383-S1	**Field ID:**	Boring #127
Date Sampled:	11/15/2023		
Date Received:	11/15/2023		
Sampling Method:	Auger		
Source:	Boring		
Material:	Sandy Lean Clay, Brown (CL)		
General Location:	Boring #127		
Location:	15'-20'		
Sampled By:	Matt Hanson		

Dry Unit Weight - Water Content Relationship



Test Results

ASTM D 698

Maximum Dry Unit Weight (lbf/ft³):	**103.4**
Optimum Water Content (%):	**22.9**
Method:	A
Preparation Method:	Moist
Rammer Type:	standard
Tested By:	Nicholas Stern
Date Tested:	11/22/2023

Comments

-#200 - 67%
Liquid Limit - 43
Plastic Limit - 20
Plasticity Index-23

American Engineering Testing, Inc.
Sioux Falls
601 E. 48th St. N.
Sioux Falls, SD 57104
(605) 332-5371
www.teamAET.com

Proctor Report

Report No: PTR:AET-142383-S2
Issue No: 1

Client: Riverview, LLP **CC:**

Project: West River Dairy

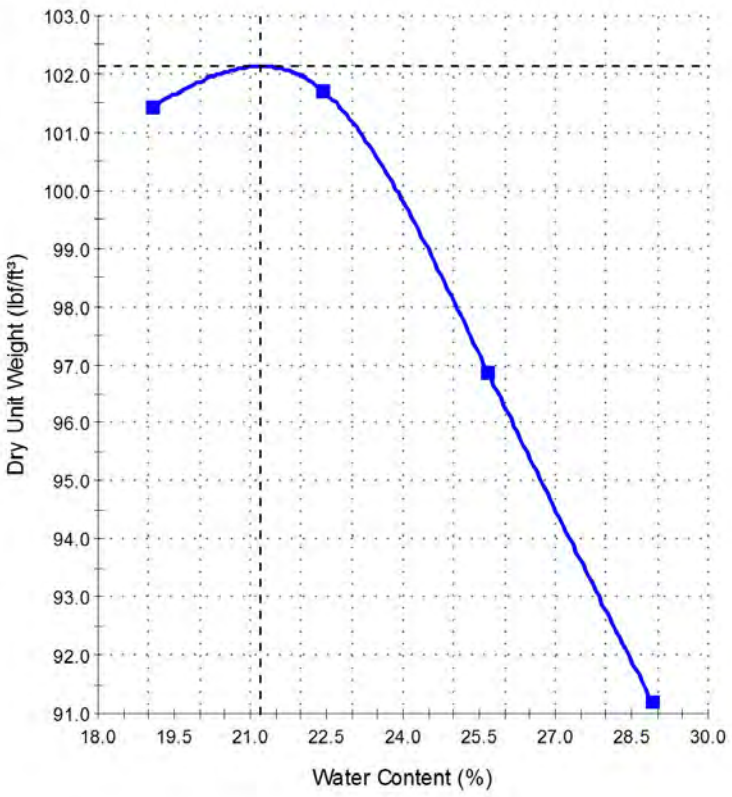
Morris MN
Job No: P-0027867

Date of Issue: 11/27/2023
Reviewed By: Adam Johnson
Senior Engineering Technician

Sample Details

Sample ID: AET-142383-S2
Field ID: Boring #212
Date Sampled: 11/15/2023
Date Received: 11/15/2023
Sampling Method: Auger
Source: Boring
Material: Sandy Lean Clay, Brown (CL)
General Location: Boring #212
Location: 15'-20'
Sampled By: Matt Hanson

Dry Unit Weight - Water Content Relationship



Test Results

ASTM D 698

Maximum Dry Unit Weight (lbf/ft³):	**102.1**
Optimum Water Content (%):	**21.2**
Method:	A
Preparation Method:	Moist
Rammer Type:	standard
Tested By:	Nicholas Stern
Date Tested:	11/22/2023

Comments

-#200 - 64%
Liquid Limit - 41
Plastic Limit - 19
Plasticity Index - 22

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601 E. 48th St. N.
Sioux Falls, SD 57104
(605) 332-5371
www.teamAET.com

Proctor Report

Report No: PTR:AET-142383-S3
Issue No: 1

Client: Riverview, LLP **CC:**

Project: West River Dairy

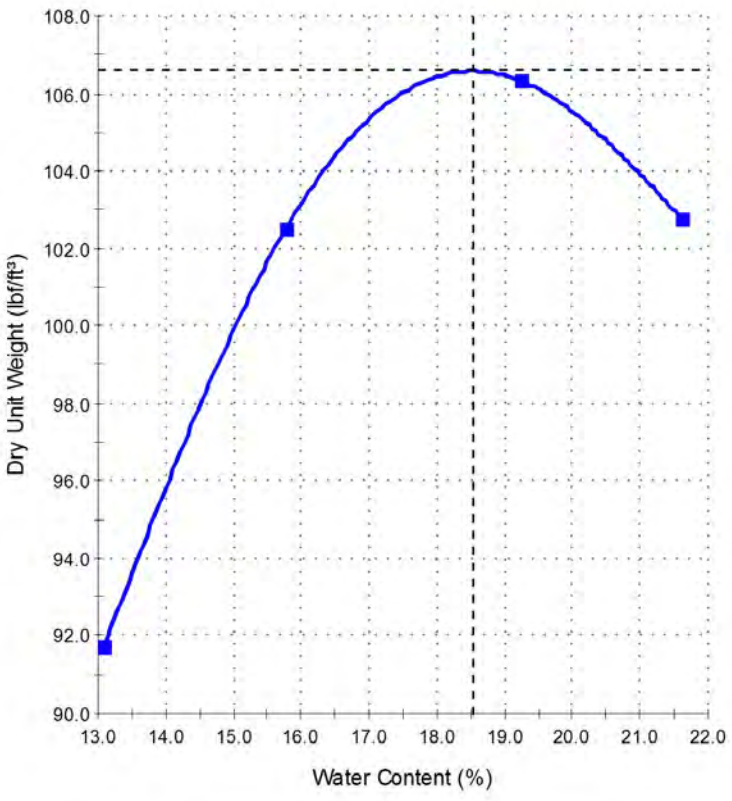
Morris MN
Job No: P-0027867

Date of Issue: 11/27/2023
Reviewed By: Adam Johnson
Senior Engineering Technician

Sample Details

Sample ID: AET-142383-S3
Field ID: Boring #310
Date Sampled: 11/15/2023
Date Received: 11/15/2023
Sampling Method: Auger
Source: Boring
Material: Sandy Lean Clay, Brown (CL)
General Location: Boring #310
Location: 15'-20'
Sampled By: Matt Hanson

Dry Unit Weight - Water Content Relationship



Test Results

ASTM D 698

Maximum Dry Unit Weight (lbf/ft³):	**106.6**
Optimum Water Content (%):	**18.5**
Method:	A
Preparation Method:	Moist
Rammer Type:	standard
Tested By:	Paul DeWeese
Date Tested:	11/22/2023

Comments

-#200 - 62%
Liquid Limit - 39
Plastic Limit - 18
Plasticity Index - 21

PERMEABILITY TEST DATA

PROJECT	**West River Dairy**	**DATE**	**11/30/2023**
	Morris, Minnesota		
REPORTED TO	**Riverview LLP**	**AET PROJECT NO:**	**P-0027867**

Boring #	#127	#212	#310	
Depth	15' - 20'	15' - 20'	15' - 20'	
Location	Morris, MN	Morris, MN	Morris, MN	
Type of Sample	Bag	Bag	Bag	
Date Received	11/15/2023	11/15/2023	11/15/2023	
Soil Classification (ASTM: D2487) Symbol	Sandy Lean Clay, brown (CL)	Sandy Lean Clay, brown (CL)	Sandy Lean Clay, brown (CL)	
In-place Moisture Content (%)	NA	NA	NA	
Max. Dry Density (PCF) (ASTM: D698)	103.4	102.1	106.6	
Optimum Moisture Content (%)	22.9	21.2	18.5	
Permeability Test				
Trial No.	10	10	10	
Type of Test	Falling Head	Falling Head	Falling Head	
Type of Specimen	Remolded	Remolded	Remolded	
Specimen Height (inches)	2.998	2.999	2.998	
Specimen Diameter (inches)	2.781	2.780	2.781	
Dry Density (PCF)	97.9	96.6	101.2	
Percent of Max. Density	94.7	94.6	94.9	
Moisture Content (%)	23.0	21.8	18.9	
Max. Head Differential (ft)	5	5	5	
Confining Pressure (effective-PSI)	2	2	2	
Water Temperature (^{o}C)	20	20	20	
Coefficient of Permeability				
K @ 20^{o}C (cm/sec)	$1.87x10^{-8}$	$2.51x10^{-8}$	$2.05x10^{-8}$	
K @ 20^{o}C (ft/min)	$3.67x10^{-8}$	$4.92x10^{-8}$	$4.01x10^{-8}$	
Atterberg Limits				
Liquid Limit (%)	43	41	39	
Plastic Limit (%)	20	19	18	
Plastic Index	23	22	21	

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Phone (605) 332-5371 | (800) 972-6364 | Fax (651) 659-1379 | teamAET.com| AA/EEO

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Sioux Falls, SD 57104
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www.teamAET.com

Material Test Report

Report No: MAT:AET-142645-S2
Issue No: 1

Client: Riverview, LLP **CC:**

Project: West River Dairy

Morris MN
Job No: P-0027867

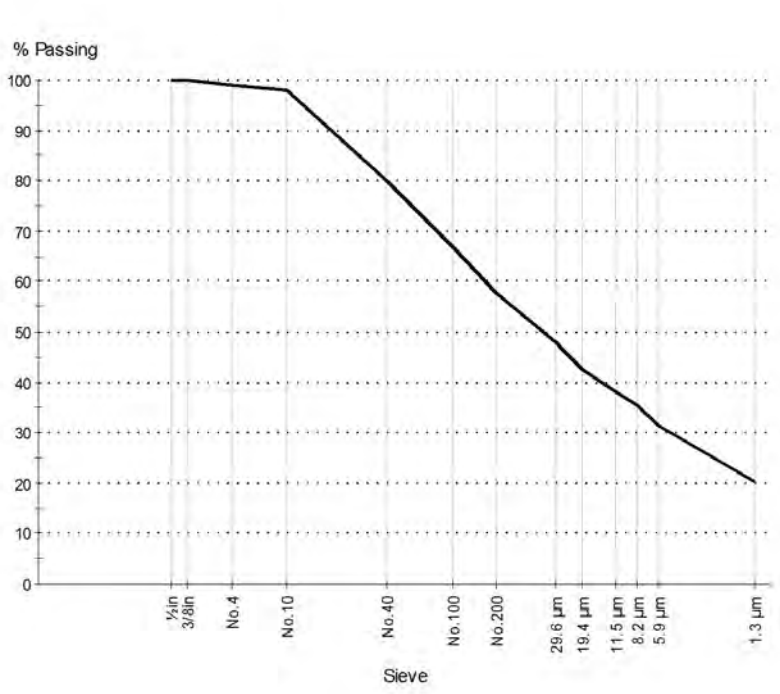
Date of Issue: 11/29/2023
Reviewed By: Adam Johnson
Senior Engineering Technician

Sample Details

Sample ID	AET-142645-S2
Field Sample ID	Boring #127
Date Sampled	11/15/2023
Source	Boring
Material	Sandy Lean Clay, Brown (CL)
Specification	HYDROMETER TEST
Sampling Method	Auger
General Location	Boring #127
Location	15'-20'
Date Submitted	11/15/2023

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(0.0%)	(1.0%)	(0.7%)	(18.0%)	(22.3%)	(28.7%)	(29.1%)

Grading: ASTM D 422

Date Tested: 11/29/2023
Tested By: Adam Johnson

Sieve Size	% Passing	Limits
½in (12.5mm)	100	
3/8in (9.5mm)	100	
No.4 (4.75mm)	99	
No.10 (2.0mm)	98	
No.40 (425µm)	80	
No.100 (150µm)	67	
No.200 (75µm)	57.9	
29.6 µm	47.9	
19.4 µm	42.4	
11.5 µm	38.3	
8.2 µm	35.5	
5.9 µm	31.3	
1.3 µm	20.3	

D85: 0.6535 **D60:** 0.0880 **D50:** 0.0360
D30: 0.0049 **D15:** N/A **D10:** N/A

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Material Test Report

Report No: MAT:AET-142645-S2
Issue No: 1

Client: Riverview, LLP **CC:**

Project: West River Dairy

Morris MN
Job No: P-0027867

Date of Issue: 11/29/2023
Reviewed By: Adam Johnson
Senior Engineering Technician

Sample Details

Sample ID	AET-142645-S2
Field Sample ID	Boring #127
Date Sampled	11/15/2023
Source	Boring
Material	Sandy Lean Clay, Brown (CL)
Specification	HYDROMETER TEST
Sampling Method	Auger
General Location	Boring #127
Location	15'-20'
Date Submitted	11/15/2023

Other Test Results

Description	Method	Result	Limits
Dispersion device	ASTM D 422	Dispersant by hand	
Dispersion time (min)			
Shape			
Hardness			
Fm		N/A	
Cu		N/A	
Cc		N/A	
CuS		4.96	
CcS		0.68	
Dm (mm)		N/A	
U-Number		41	
D50S (mm)		0.357	
D50G (mm)		5.435	
D95			

Comments

N/A

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Material Test Report

Report No: MAT:AET-142645-S1
Issue No: 1

Client: Riverview, LLP **CC:**

Project: West River Dairy

Morris MN
Job No: P-0027867

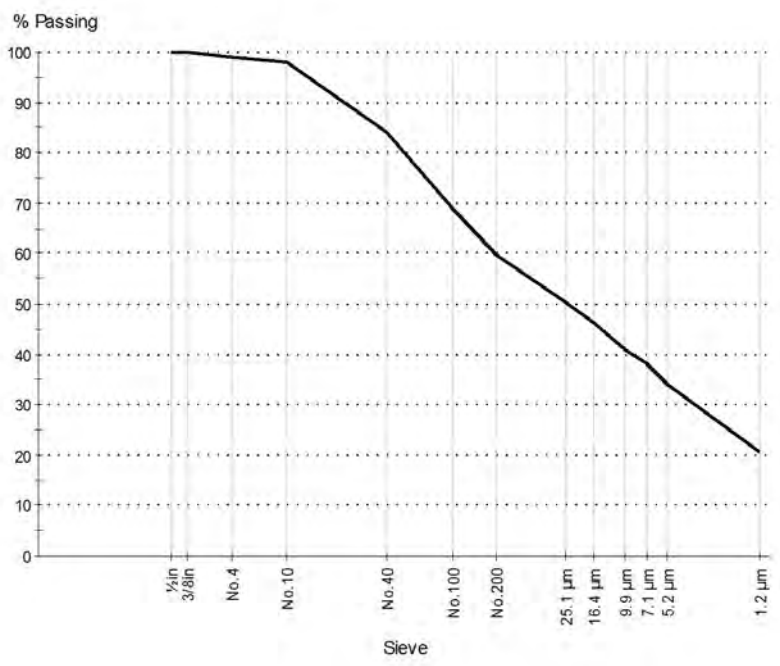
Date of Issue: 11/29/2023
Reviewed By: Adam Johnson
Senior Engineering Technician

Sample Details

Sample ID	AET-142645-S1
Field Sample ID	Boring #212
Date Sampled	11/15/2023
Source	Boring
Material	Sandy Lean Clay, Brown (CL)
Specification	HYDROMETER TEST
Sampling Method	Auger
General Location	Boring #212
Location	15'-20'
Date Submitted	11/15/2023

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(0.0%)	(0.8%)	(0.8%)	(14.6%)	(23.9%)	(26.5%)	(33.4%)

Grading: ASTM D 422

Date Tested: 11/29/2023
Tested By: Adam Johnson

Sieve Size	% Passing	Limits
½in (12.5mm)	100	
3/8in (9.5mm)	100	
No.4 (4.75mm)	99	
No.10 (2.0mm)	98	
No.40 (425µm)	84	
No.100 (150µm)	69	
No.200 (75µm)	59.9	
25.1 µm	50.5	
16.4 µm	46.4	
9.9 µm	40.9	
7.1 µm	38.2	
5.2 µm	34.1	
1.2 µm	20.5	

D85: 0.4747 **D60:** 0.0756 **D50:** 0.0238
D30: 0.0033 **D15:** N/A **D10:** N/A

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Material Test Report

Report No: MAT:AET-142645-S1
Issue No: 1

Client: Riverview, LLP **CC:**

Project: West River Dairy

Morris MN
Job No: P-0027867

Date of Issue: 11/29/2023
Reviewed By: Adam Johnson
Senior Engineering Technician

Sample Details

Sample ID	AET-142645-S1
Field Sample ID	Boring #212
Date Sampled	11/15/2023
Source	Boring
Material	Sandy Lean Clay, Brown (CL)
Specification	HYDROMETER TEST
Sampling Method	Auger
General Location	Boring #212
Location	15'-20'
Date Submitted	11/15/2023

Other Test Results

Description	Method	Result	Limits
Dispersion device	ASTM D 422	Dispersant by hand	
Dispersion time (min)			
Shape			
Hardness			
Fm		N/A	
Cu		N/A	
Cc		N/A	
CuS		3.97	
CcS		0.80	
Dm (mm)		N/A	
U-Number		43	
D50S (mm)		0.309	
D50G (mm)		4.775	
D95			

Comments

N/A

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Material Test Report

Report No: MAT:AET-142645-S3
Issue No: 1

Client: Riverview, LLP **CC:**

Project: West River Dairy

Morris MN
Job No: P-0027867

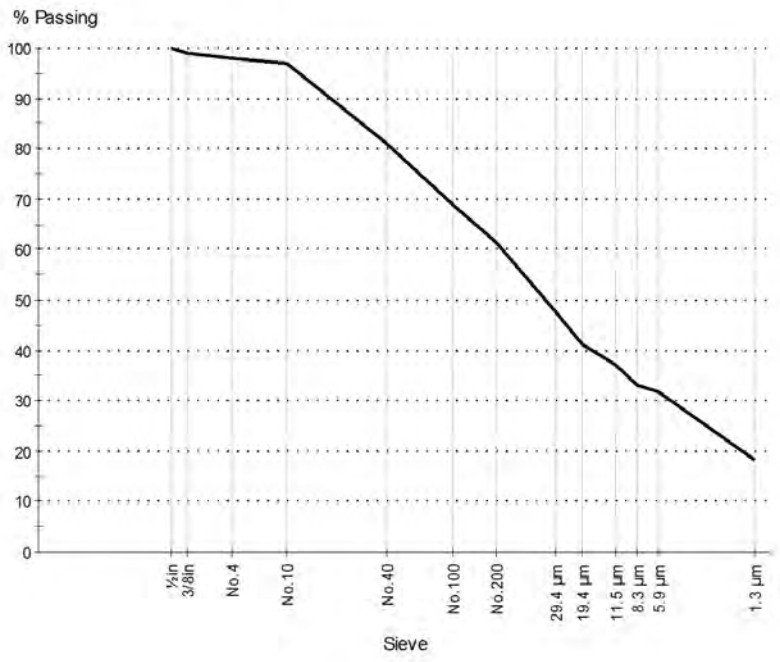
Date of Issue: 11/29/2023
Reviewed By: Adam Johnson
Senior Engineering Technician

Sample Details

Sample ID	AET-142645-S3
Field Sample ID	Boring #310
Date Sampled	11/15/2023
Source	Boring
Material	Sandy Lean Clay, Brown (CL)
Specification	HYDROMETER TEST
Sampling Method	Auger
General Location	Boring #310
Location	15'-20'
Date Submitted	11/15/2023

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(0.0%)	(2.2%)	(1.0%)	(16.0%)	(19.4%)	(32.4%)	(29.1%)

Grading: ASTM D 422

Date Tested: 11/29/2023
Tested By: Adam Johnson

Sieve Size	% Passing	Limits
½in (12.5mm)	100	
3/8in (9.5mm)	99	
No.4 (4.75mm)	98	
No.10 (2.0mm)	97	
No.40 (425µm)	81	
No.100 (150µm)	69	
No.200 (75µm)	61.5	
29.4 µm	47.8	
19.4 µm	41.1	
11.5 µm	37.1	
8.3 µm	33.1	
5.9 µm	31.7	
1.3 µm	18.3	

D85: 0.6260 **D60:** 0.0677 **D50:** 0.0342
D30: 0.0049 **D15:** N/A **D10:** N/A

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Material Test Report

Report No: MAT:AET-142645-S3
Issue No: 1

Client: Riverview, LLP **CC:**

Project: West River Dairy

Morris MN
Job No: P-0027867

Date of Issue: 11/29/2023
Reviewed By: Adam Johnson
Senior Engineering Technician

Sample Details

Sample ID	AET-142645-S3
Field Sample ID	Boring #310
Date Sampled	11/15/2023
Source	Boring
Material	Sandy Lean Clay, Brown (CL)
Specification	HYDROMETER TEST
Sampling Method	Auger
General Location	Boring #310
Location	15'-20'
Date Submitted	11/15/2023

Other Test Results

Description	Method	Result	Limits
Dispersion device	ASTM D 422	Dispersant by hand	
Dispersion time (min)			
Shape			
Hardness			
Fm		N/A	
Cu		N/A	
Cc		N/A	
CuS		4.99	
CcS		0.70	
Dm (mm)		N/A	
U-Number		40	
D50S (mm)		0.364	
D50G (mm)		8.245	
D95			

Comments

N/A

Appendix B

Geotechnical Report Limitations and Guidelines for Use

Appendix B
Geotechnical Report Limitations and Guidelines for Use
Report No. P-0042453

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by GBA[1], of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Understand the Geotechnical Engineering Services Provided for this Report

Geotechnical engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical engineering services is typically a geotechnical engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

B.2.2 Geotechnical Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client.

Likewise, geotechnical engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. If you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

---

1 Geoprofessional Business Association, 1300 Piccard Drive, LL14, Rockville, MD 20850
Telephone: 301/565-2733: www.geoprofessional.org, 2019

B.2.3 Read the Full Report
Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. Read and refer to the report in full.

B.2.4 You Need to Inform Your Geotechnical Engineer About Change
Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, always inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

B.2.5 Most of the "Findings" Related in This Report Are Professional Opinions
Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

B.2.6 This Report's Recommendations Are Confirmation-Dependent
The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations only after observing actual subsurface conditions exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.

B.2.7 This Report Could Be Misinterpreted
Other design professionals' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

B.2.8 Give Constructors a Complete Report and Guidance
Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical engineering report, along with any attachments or appendices, with your contract documents, but be certain to note conspicuously that you've included the material

for information purposes only. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, only from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and be sure to allow enough time to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

B.2.9 Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.10 Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical engineering study. For that reason, a geotechnical engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated subsurface environmental problems have led to project failures. If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

B.2.11 Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

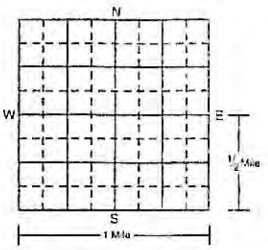
While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. Geotechnical engineers are not building-envelope or mold specialists.

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 103I

MINNESOTA UNIQUE WELL NO. 682248

WELL LOCATION
County Name: Stevens
Township Name: Lynnes | Township No.: 123 | Range No.: 43 | Section No.: 01 | Fraction: NE¼ NW¼ NE¼
House Number, Street Name, City, and Zip Code of Well Location: RR#3 Co Rd 8 Morris, MN 56267 | or Fire Number:

Show exact location of well in section grid with X. Sketch map of well location showing property lines, roads and buildings.



PROPERTY OWNER'S NAME
West River Dairy
Property owner's mailing address if different than well location address indicated above.
26410 470th Ave. Morris, Minn. 56267

WELL OWNER'S NAME
West River Dairy
Well owner's mailing address if different than property owner's address indicated above.
26410 470th Ave. Morris, Minn. 56267

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Clay	Yellow	Sticky	0	30
Clay	Blue	—	30	90
Clay	Blue	Med	90	114
Sand	Grey	Med	114	118
Clay	Blue	Med	118	132
Sand	Grey	Med	132	135
Rock	Black		135	137
Clay	Blue	Med	137	145

Use a second sheet, if needed

REMARKS, ELEVATION, SOURCE OF DATA, etc.

IMPORTANT - FILE WITH PROPERTY PAPERS
WELL OWNER COPY
682248

WELL DEPTH (completed): 135 ft. | Date Well Completed: 5-10-03

DRILLING METHOD: ☐ Cable Tool ☐ Driven ☐ Dug ☐ Auger ☑ Rotary ☐ Jetted ☐

DRILLING FLUID: Natural | WELL HYDROFRACTURED? ☐ YES ☑ NO FROM ____ ft. to ____ ft.

USE: ☑ Domestic ☐ Irrigation ☐ Environ. Bore Hole ☐ Monitoring ☐ Community PWS ☐ Noncommunity PWS ☐ Dewatering ☐ Heating/Cooling ☐ Industry/Commercial ☐ Remedial ☐ ____

CASING: ☐ Steel ☑ Plastic | Drive Shoe? ☐ Yes ☐ No | ☐ Threaded ☐ Welded ☐ ____ | HOLE DIAM.

CASING DIAMETER: 5 in. to 132 ft. | WEIGHT: SDR 21 lbs./ft.
____ in. to ____ ft. | ____ lbs./ft.
____ in. to ____ ft. | ____ lbs./ft.
HOLE DIAM: ____ in. to ____ ft. | ____ in. to ____ ft. | ____ in. to ____ ft.

SCREEN: ☑ Johnson Make Pete. 35. Type Stainless Diam. 5 Slot/Gauze 25 Length 4 Set between 128 ft. and 136 ft. FITTINGS: K-Packer
OPEN HOLE: from ____ ft. to ____ ft.

STATIC WATER LEVEL: 26 ft. ☑ below ☐ above land surface Date measured ____

PUMPING LEVEL (below land surface): 101 ft. after 6 hrs. pumping 60 g.p.m.

WELL HEAD COMPLETION: ☑ Pitless adapter manufacturer Bergen Model ____ ☐ Casing Protection ____ ☐ 12" above grade ☐ At-grade (Environmental Wells and Borings ONLY)

GROUTING INFORMATION: Well grouted? ☑ Yes ☐ No
Grout Material: ☐ Neat cement ☑ Bentonite ☐ Concrete ☐ High Solids Bentonite
from 0 to 30 ft. ____ ☐ yds ☐ bags
from ____ to ____ ft. ____ ☐ yds ☐ bags
from ____ to ____ ft. ____ ☐ yds ☐ bags

NEAREST KNOWN SOURCE OF CONTAMINATION: 2000 feet South direction Cattle type
Well disinfected upon completion? ☑ Yes ☐ No

PUMP: ☐ Not installed Date installed ____
Manufacturer's name Will be Submersible
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 If Yes, ____

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.

Layne Western Drilling Inc. 75330
Licensed Business Name — Lic. or Reg. No.

Authorized Representative Signature — 05-15-03 Date

Name of Driller — 05-15-03 Date

HE-01205-07 (Rev. 2/99)

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes, Chapter 103I

MINNESOTA UNIQUE WELL NO. 731318

WELL LOCATION

County Name: Stevens

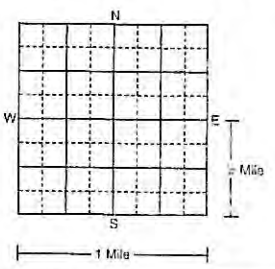
Township Name	Township No.	Range No.	Section No.	Fraction
Synnes	123N	43W	1	NE NW NE ¼

GPS LOCATION: Latitude ____ degrees ____ minutes ____ seconds ____ Longitude ____ degrees ____ minutes ____ seconds ____

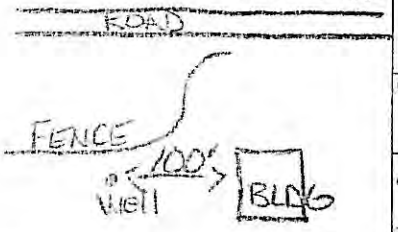
House Number, Street Name, City, and Zip Code of Well Location: Co Rd 8, Morris MN 56267

or Fire Number:

Show exact location of well in section grid with "X"



Sketch map of well location. Showing property lines, roads and buildings



PROPERTY OWNER'S NAME/COMPANY NAME

West River Dairy

Property owner's mailing address if different than well location address indicated above.

26410 470th AVE
Morris MN 56267

WELL OWNER'S NAME/COMPANY NAME

West River Dairy

Owner's mailing address if different than property owner's address indicated above.

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
** clay	blu	M	300	328
till			0	3
clay	yell		3	31
clay	blu		31	90
sand	blu		90	91
clay	blu		91	108
sand	blu		108	109
clay			109	120
sand	blu		120	121
clay	blu		121	125
sand			125	126
clay			126	129
sand	blu		129	134
clay			134	174
clay sandy	blu	M SF	174	207
clay sandy	tan	H	207	220
clay sandy	tan	M	220	242
sand	tan/bl/org		242	284
decomposed	wht/grn	H	284	288
sand	blu/opaq		288	297
rock		H	297	298
broken rock			298	300

Use a second sheet, if needed

REMARKS, ELEVATION, SOURCE OF DATA, etc.

IMPORTANT - FILE WITH PROPERTY PAPERS
WELL OWNER COPY

731318

IC 140-0020

WELL DEPTH (completed): 298 ft. Date Work Completed: 2/3/06

DRILLING METHOD: ☐ Cable Tool ☐ Auger ☐ Driven ☒ Rotary ☐ Dug ☐ Jetted

DRILLING FLUID: Bentonite

WELL HYDROFRACTURED? ☐ Yes ☒ No FROM ____ ft. TO ____ ft.

USE: ☐ Domestic ☐ Noncommunity PWS ☐ Community PWS ☐ Monitoring ☐ Environ. Bore Hole ☐ Irrigation ☐ Dewatering ☐ Heating/Cooling ☒ Industry/Commercial ☐ Remedial

CASING: ☐ Steel ☒ Plastic; Drive Shoe? ☐ Yes ☒ No; ☐ Threaded ☐ Welded

HOLE DIAM.: 12¼ in. to 300 ft.

CASING DIAMETER: 8 in. to 247 ft. WEIGHT ____ lbs./ft.

SCREEN: Make Johnson; Type stainless steel; Slot/Gauze 16/20slt; Set between 247 ft. and 298 ft.; Dia. 8"PS 51; Length ____; FITTINGS Inline

OPEN HOLE: FROM ____ ft. TO ____ ft.

STATIC WATER LEVEL: 97 ft. ☒ below ☐ above land surface. Date measured 2/3/06

PUMPING LEVEL (below land surface): 121 ft. after 4 hrs. pumping 265 g.p.m.

WELL HEAD COMPLETION: ☐ Pitless adapter manufacturer ____ Model ____; ☐ Casing Protection ____ ☒ 12" above grade; ☐ At-grade (Environmental Wells and Borings ONLY)

GROUTING INFORMATION: Well grouted ☒ Yes ☐ No; Grout material ☐ Neat cement ☐ Bentonite ☐ Concrete ☒ High Solids Bentonite

Quick Grout	from 0 ft. to 40 ft.	13	☐ yds.	☒ bags
cuttings	from 40 ft. to 237 ft.		☐ yds.	☐ bags
50/65 Red Flint	from 237 ft. to 298 ft.	33	☐ yds.	☒ bags

NEAREST KNOWN SOURCE OF CONTAMINATION: Quick Grout 300 319 2 Kloogs
40 feet West direction Sewer

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 If Yes, 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.

Steffl Drilling & Pump — Licensee Business Name — 34480 Lic. or Reg. No.

Authorized Representative's Signature — 2/9/06 Date

John Dahl — Name of Driller — 2/3/06

MDH 6115-03 (Rev. 03/03)

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes, Chapter 1031

MINNESOTA UNIQUE WELL AND BORING NO.

740629

WELL/BORING LOCATION

County Name: Stevens

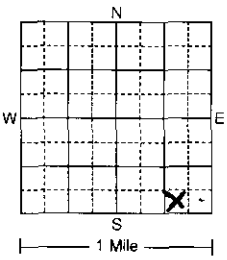
Township Name	Township No.	Range No.	Section No.	Fraction
Horton	123N	42W	17	SW¼ SE SE ¼

GPS LOCATION: Latitude ____ degrees ____ minutes ____ seconds ____ Longitude ____ degrees ____ minutes ____ seconds ____

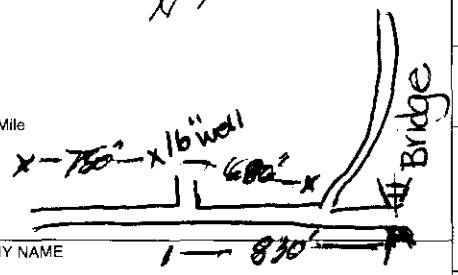
House Number, Street Name, City, and Zip Code of Well Location: Co Rd 58 & 500th AVE, Morris MN

or Fire Number:

Show exact location of well/boring in section grid with "X."



Sketch map of well location. Showing property lines, roads, buildings and direction.



PROPERTY OWNER'S NAME/COMPANY NAME: Dennis Wulf

Property owner's mailing address if different than well location address indicated above.

45594 325th ST
Hancock MN 56224

WELL/BORING OWNER'S NAME/COMPANY NAME: APEC

Well/boring owner's mailing address if different than property owner's address indicated above.

227 So Co Rd 22
Morris MN 56267

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
loam	blk	M	0	2
clay	tan	M	2	6
sand	tan	coarse	6	28
sand	blk/blu	coarse	28	54
rock	white	M	54	56

Use a second sheet, if needed.

REMARKS, ELEVATION, SOURCE OF DATA, etc.

MINN. DEPT OF HEALTH COPY 740629

WELL/BORING DEPTH (completed): 54 ft.

DATE WORK COMPLETED: 3/8/07

DRILLING METHOD: [ ] Cable Tool [ ] Driven [ ] Dug [ ] Auger [X] Rotary [ ] Jetted

DRILLING FLUID: Bentonite

WELL HYDROFRACTURED? [ ] Yes [X] No From ____ ft. To ____ ft.

USE: [ ] Domestic [ ] Monitoring [ ] Heating/Cooling [ ] Noncommunity PWS [ ] Environ. Bore Hole [ ] Industry/Commercial [ ] Community PWS [ ] Irrigation [ ] Remedial [ ] Elevator [ ] Dewatering [ ] ____

CASING MATERIAL: [X] Steel [ ] Plastic — Drive Shoe? [ ] Yes [X] No — [ ] Threaded [ ] Welded

CASING

Diameter	Weight	Specifications
16 in. to 38 ft.	____ lbs./ft.	____
____ in. to ____ ft.	____ lbs./ft.	____
____ in. to ____ ft.	____ lbs./ft.	____

HOLE DIAM.: 22 in. to 54 ft.; ____ in. to ____ ft.; ____ in. to ____ ft.

SCREEN — Make: Johnson — Type: stainless steel — Slot/Gauze: 100 — Set between: 38 ft. and 54 ft.

Diam.: 15"IPS — Length: 16 — FITTINGS: Inline

OPEN HOLE: From ____ ft. To ____ ft.

STATIC WATER LEVEL: 12' 4" ft. [X] Below [ ] Above land surface — Date measured: 3-14-07

PUMPING LEVEL (below land surface): 18' 8 3/4" ft. after 2 hrs. pumping 1062.92 g.p.m.

WELL HEAD COMPLETION: [ ] Pitless Adapter Manufacturer ____ Model ____ [ ] Casing Protection [X] 12 in. above grade [ ] At-grade (Environmental Well and Boring ONLY)

GROUTING INFORMATION: Well grouted? [X] Yes [ ] No

Grout materials: [ ] Neat cement [ ] Bentonite [ ] Concrete [ ] Other ____

Quick Grout	From 0 To 28 ft.	32	[ ] Yds.	[X] Bags
Red Flint	From 28 To 54 ft.	40	[ ] Yds.	[X] Bags
	From ____ To ____ ft.	____	[ ] Yds.	[ ] Bags

NEAREST KNOWN SOURCE OF CONTAMINATION: ____ feet ____ direction ____ type

Well disinfected upon completion? [X] Yes [ ] No

PUMP: [X] 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 [X] 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.

Steffl Drilling & Pump — Licensee Business Name — 1551 — Lic. or Reg. No.

Authorized Representative Signature — 3/14/07 — Date

John G Dahl — Name of Driller — 3/12/07

HE-01205-09 (Rev. 9/05)

IC 140-0020

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes, Chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO. 757860

WELL OR BORING LOCATION

County Name: Stevens

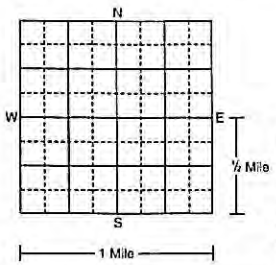
Township Name	Township No.	Range No.	Section No.	Fraction
Synnes	123N	43W	1	NE NW NE ¼

GPS LOCATION: Latitude ____ degrees ____ minutes ____ seconds ____
Longitude ____ degrees ____ minutes ____ seconds ____

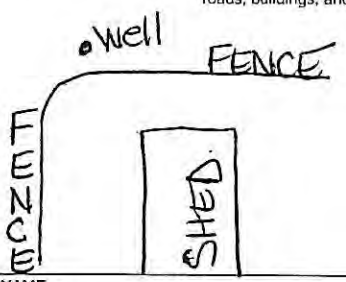
House Number, Street Name, City, and Zip Code of Well Location: Co Rd 8, Morris MN 56267

or Fire Number:

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: West River Dairy

Property owner's mailing address if different than well location address indicated above.
26410 470th AV
Morris MN 56267

WELL OWNER'S NAME/COMPANY NAME

Boring owner's mailing address if different than property owner's address indicated above.

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
fill	yell	S	0	3
clay	yell	M	3	29
clay	blu	gummy	29	88
sand	blu	12slt	88	90
clay	blu	M	90	107
sand	blu	12slt	107	108
clay	blu	M	108	167
sand	blu	12slt	167	174
clay	blu	M	174	190
clay	tan	M	190	222
sand	tan/blu	M	222	276
clay/rocks	blu	M	276	282
sand	blu	M	282	285
clay	blu	M	285	287
sand	blu	M	287	292

Use a second sheet, if needed.

REMARKS, ELEVATION, SOURCE OF DATA, etc.

MINN. DEPT. OF HEALTH COPY 757860

WELL/BORING DEPTH (completed): 290 ft. DATE WORK COMPLETED: 10/23/07

DRILLING METHOD: ☐ Cable Tool ☐ Driven ☐ Dug ☐ Auger ☒ Rotary ☐ Jetted ☐ ____

DRILLING FLUID: Bentonite

WELL HYDROFRACTURED? ☐ Yes ☒ No From ____ ft. To ____ ft.

USE: ☐ Domestic ☐ Monitoring ☐ Heating/Cooling ☐ Noncommunity PWS ☐ Environ. Bore Hole ☒ Industry/Commercial ☐ Community PWS ☐ Irrigation ☐ Remedial ☐ Elevator ☐ Dewatering ☐ ____

CASING MATERIAL: ☐ Steel ☒ Plastic Drive Shoe? ☐ Yes ☒ No ☐ Threaded ☐ Welded ☐ ____

CASING

Diameter		Weight	Specifications
8 in. to 229 ft.		____ lbs./ft.	____
____ in. to ____ ft.		____ lbs./ft.	____
____ in. to ____ ft.		____ lbs./ft.	____

HOLE DIAM.

12¼ in. to 292 ft.	
____ in. to ____ ft.	
____ in. to ____ ft.	

SCREEN
Make Johnson
Type stainless steel Diam. 8"IPS
Slot/Gauze 20slt Length 61'
Set between 229 ft. and 290 ft. FITTINGS Inline

OPEN HOLE From ____ ft. To ____ ft.

STATIC WATER LEVEL: 90 ft ☒ Below ☐ Above land surface Measured from ____ Date measured 10/23/07

PUMPING LEVEL (below land surface): 200 ft. after 31 hrs. pumping 300+ g.p.m.

WELLHEAD COMPLETION
☐ Pitless/adapter manufacturer ____ Model ____
☐ Casing Protection ____ ☒ 12 in. above grade
☐ At-grade (Environmental Well and Boring ONLY)

GROUTING INFORMATION
Well grouted ☒ Yes ☐ No
Grout materials ☐ Neat cement ☒ Bentonite ☐ Concrete ☐ Other ____

Quick Grout	From 0 To 70 ft.	15	☐ Yds.	☒ Bags
cuttings	From 70 To 219 ft.	____	☐ Yds.	☐ Bags
Red Flint	From 219 To 292 ft.	38	☐ Yds.	☒ Bags

NEAREST KNOWN SOURCE OF CONTAMINATION: 60 feet E direction pond 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.

Steffl Drilling & Pump 1551
Licensee Business Name Lic. or Reg. No.

Certified Representative Signature 550 11/7/07
Certified Rep. No. Date

John G Dahl 10/23/07
Name of Driller

IC 140-0020 HE-01205-11 (Rev. 3/07)

E

MINNESOTA UNIQUE WELL AND BORING NO.

768109

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD

Minnesota Statutes, Chapter 103I

WELL OR BORING LOCATION

County Name: Stevens

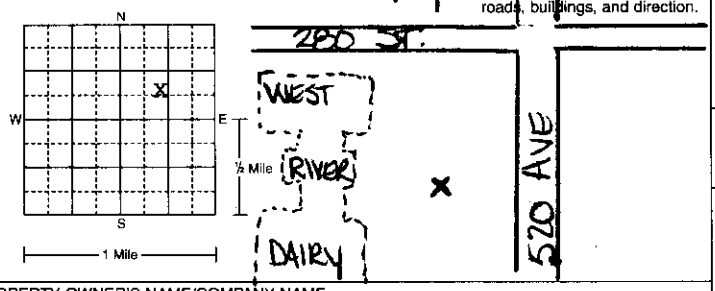
Township Name	Township No.	Range No.	Section No.	Fraction
Synnes	123N	43W	1	NE ¼ SW ¼ NE ¼

GPS LOCATION: Latitude ____ degrees ____ minutes ____ seconds ____ Longitude ____ degrees ____ minutes ____ seconds ____

House Number, Street Name, City, and Zip Code of Well Location: (no#) Int of 280 ST & 520 AVE, Morris MN

or Fire Number:

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: West River Dairy/Riverview Farms

Property owner's mailing address if different than well location address indicated above.
26406 470th AVE
Morris MN 56267

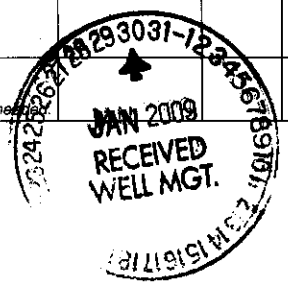
WELL OWNER'S NAME/COMPANY NAME: same

Well/boring owner's mailing address if different than property owner's address indicated above.

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
topsoil	blk	M	0	1
clay	yell	M	1	20
clay/sticky	blu	M	20	100
sand/gravel	multi	18-40slt	100	140
clay/rocks	blu	M	140	

Use a second sheet, if needed.

REMARKS, ELEVATION, SOURCE OF DATA, etc.



MINN. DEPT. OF HEATLH COPY 768109

WELL/BORING DEPTH (completed): 138 ft. DATE WORK COMPLETED: 12/12/08

DRILLING METHOD: ☐ Cable Tool ☐ Driven ☐ Dug ☐ Auger ☒ Rotary ☐ Jetted ☐ ____

DRILLING FLUID: Bentonite

WELL HYDROFRACTURED? ☐ Yes ☒ No From ____ ft. To ____ ft.

USE: ☐ Domestic ☐ Monitoring ☐ Heating/Cooling ☐ Noncommunity PWS ☐ Environ. Bore Hole ☐ Industry/Commercial ☐ Community PWS ☒ Irrigation ☐ Remedial ☐ Elevator ☐ Dewatering ☐ ____

CASING MATERIAL: ☐ Steel ☒ Plastic ☐ ____ Drive Shoe? ☐ Yes ☒ No ☐ Threaded ☐ Welded

HOLE DIAM.

CASING

Diameter		Weight	Specifications	HOLE DIAM.
12 in. to 118 ft.		____ lbs./ft.	____	18 in. to 140 ft.
____ in. to ____ ft.		____ lbs./ft.	____	____ in. to ____ ft.
____ in. to ____ ft.		____ lbs./ft.	____	____ in. to ____ ft.

SCREEN: Make Johnson; Type stainless steel; Diam. 12" TPS; Slot/Gauze 90slt; Length 20; Set between 118 ft. and 138 ft.; FITTINGS Inline

OPEN HOLE: From ____ ft. To ____ ft.

STATIC WATER LEVEL: 94 ft. ☒ Below ☐ Above land surface Measured from ____ Date measured 12/12/08

PUMPING LEVEL (below land surface): 114 ft. after 10 hrs. pumping 1050 g.p.m.

WELLHEAD COMPLETION: ☐ Pitless/adapter manufacturer ____ Model ____ ☐ Casing Protection ____ ☒ 12 in. above grade ☐ At-grade (Environmental Well and Boring ONLY)

GROUTING INFORMATION: Well grouted ☒ Yes ☐ No

Grout materials: ☐ Neat cement ☒ Bentonite ☐ Concrete ☐ Other ____

HSBentonite	From 0 ft. To 108 ft.	25	☐ Yds.	☒ Bags
90 Red Flint	From 108 ft. To 138 ft.	30	☐ Yds.	☒ Bags
	From ____ ft. To ____ ft.	____	☐ Yds.	☐ Bags

NEAREST KNOWN SOURCE OF CONTAMINATION: 660 feet west direction dairy barn 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.

Steffl Drilling & Pump — 1551
Licensee Business Name — Lic. or Reg. No.

550 — 1/6/08
Certified Representative Signature — Certified Rep. No. — Date

John G Dahl — 12/12/08
Name of Driller — Date

IC 140-0020

HE-01205-11 (Rev. 3/07)

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING CONSTRUCTION RECORD
Minnesota Statutes, chapter 103I

MINNESOTA UNIQUE WELL AND BORING NO. 869955

WELL OR BORING LOCATION

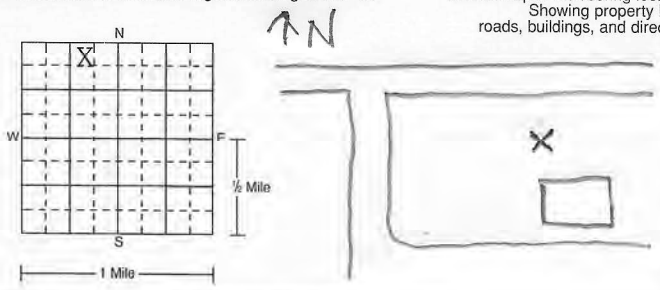
County Name: Stevens

Township Name	Township No.	Range No.	Section No.	Fraction (sm. → lg.)
Synnes	123	43	1	NW ¼ NE ¼ NW ¼

GPS LOCATION — decimal degrees (four decimal places).
Latitude 45 29 55 14 Longitude 96 00 27.54

House Number, Street Name, City, and ZIP Code of Well Location
52755 280th St, Morris MN 56267

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
Riverview, LLP - West River Dairy

Property owner's mailing address if different than well location address indicated above.
26406 470th Ave
Morris, MN 56267

WELL OWNER'S NAME/COMPANY NAME
Same

Well/boring owner's mailing address if different than property owner's address indicated above.

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Top Soil	Blk	M	0	1
~~Clay~~	~~Tan~~	~~M~~	~~1~~	~~30~~
clay	blue	S	30	107
~~clay sand~~	~~blue~~		~~107~~	~~115~~
clay	blue	M	115	120
~~sand gravel~~	~~blue~~	~~18-30slt~~	~~120~~	~~136~~
clay	blue	M	136	164
~~clay~~	~~blue~~	~~hard~~	~~164~~	~~190~~
clay	tangrey		190	222
~~sand~~	~~blue~~	~~12-20slt~~	~~222~~	~~281~~
decomposed	whttan	M-H	281	291

Use a second sheet, if needed.

REMARKS, ELEVATION, SOURCE OF DATA, etc.

MINN DEPT. OF HEALTH COPY 869955

ID #52603

WELL/BORING DEPTH (completed): 291 ft. DATE WORK COMPLETED: 3 28 2023

DRILLING METHOD: ☐ Cable Tool ☐ Auger ☐ Other ☐ Driven ☒ Rotary ☐ Dual Rotary ☐ Rotasonic

DRILLING FLUID: Bentonite 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 ☐

HOLE DIAM.

CASING

Diameter		Weight	Specifications	HOLE DIAM.
8 in. To 222 ft.		lbs./ft.	12 1/4 To 291 ft.	
in. To ft.		lbs./ft.		in. To ft.
8 in. To 281 ft.	291	lbs./ft.		in. To ft.

SCREEN: Make Johnson Type Johnson SS Slot/Gauze 30 Set between 222 ft. and 281 ft.
Diam. 8 PS Length 59 FITTINGS inline

OPEN HOLE From ft. To ft.

STATIC WATER LEVEL 119 ft. ☒ Below ☐ Above land surface
Date measured 05/30/2023 Dry hole ☐ Yes ☒ No

PUMPING LEVEL (below land surface) 150' 6" ft. after 6 hrs. pumping 361 g.p.m.

WELLHEAD COMPLETION
☒ Pitless/adapter manufacturer BOSHART Model
☐ 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		
H.S. Bent	0	212 ft.	22	☐ Yds. ☒ Bags
Red flint	212	291 ft.	45	☐ Yds. ☒ Bags
		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 6/20/2023
Manufacturer's name Grundfos
Model Number 150 S/150 8 bp HP 15 Volts 460
Length of drop pipe 200' ft. Capacity 150 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.

Steffl Drilling & Pump Inc 1551
Licensee Business Name Lic. or Reg. No.

Certified Representative Signature 550 6/23/23
Certified Rep. No. Date

Michael Gjerde
Name of Driller

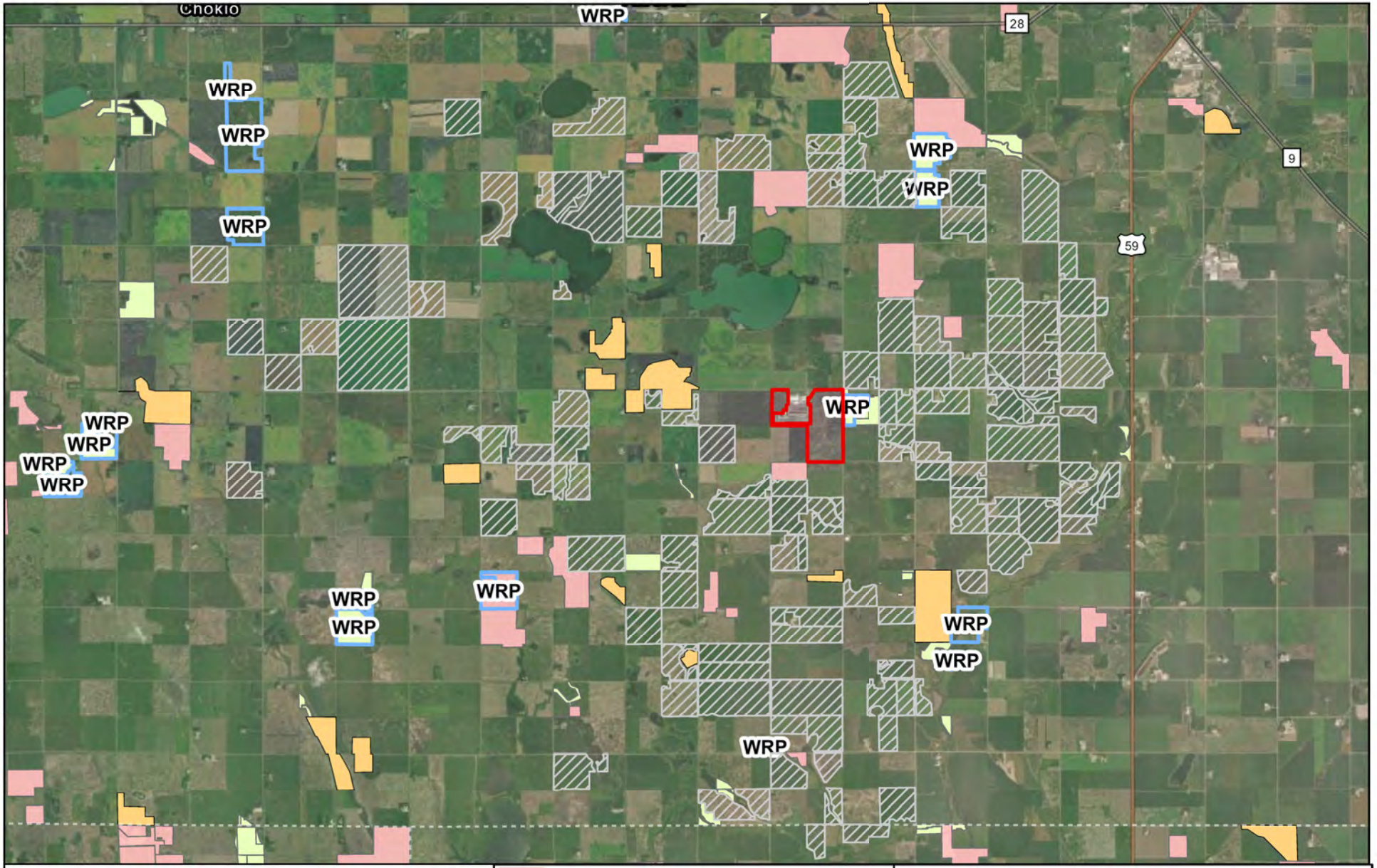
HE-01205-18 (Rev.3/19)

Attachment 18

Permanent Conservation Easements Map

Attachment 18

Stevens County, Swift County



Permanent Conservation Easements

West River Dairy Expansion
Synnes Township

- Project Boundary
- Available Manure Application Acres
- Wildlife Management Area (WMA)
- Waterfowl Production Area (WPA)
- RIM Easements
- WRP

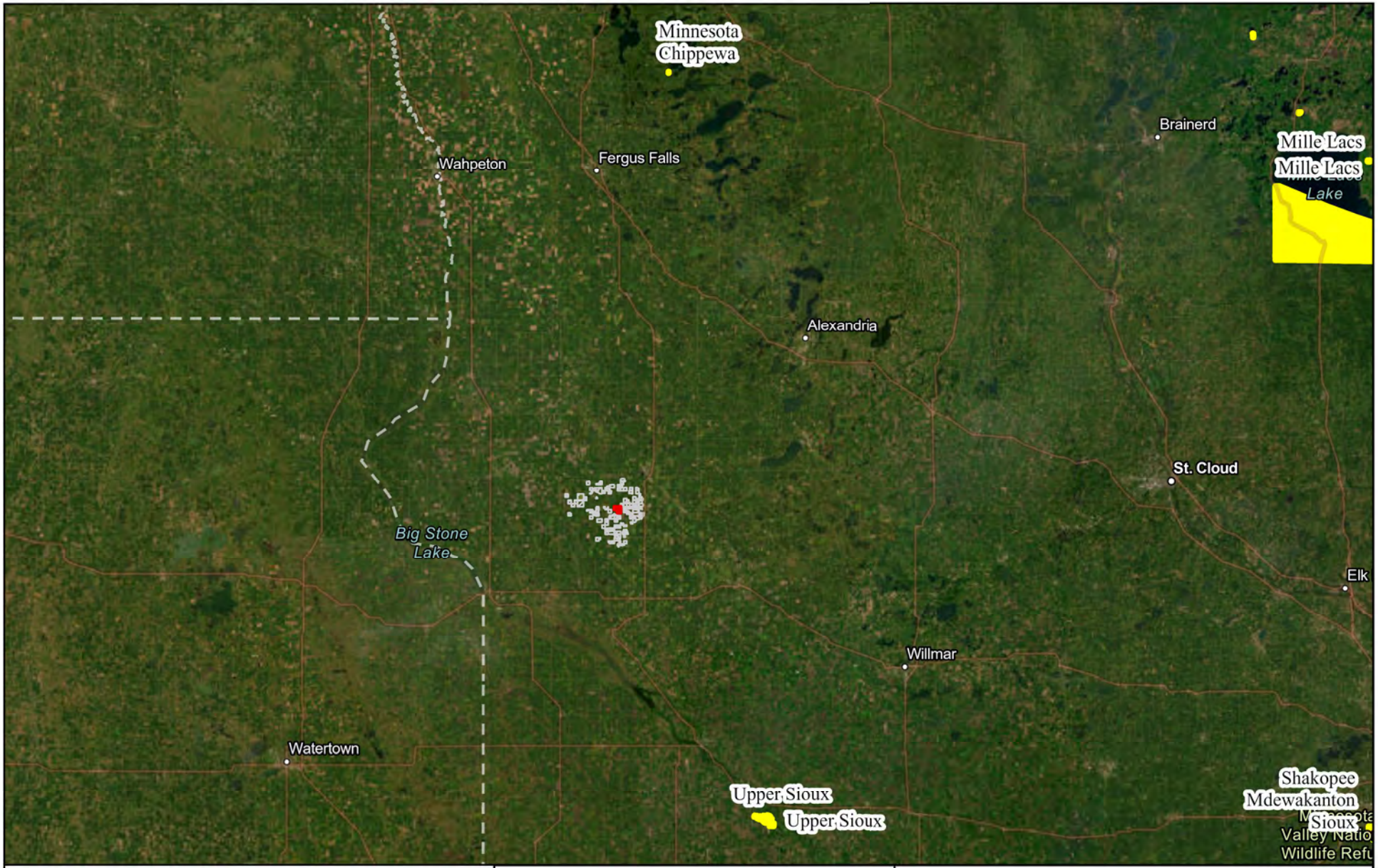
N

0 1 2 3 4 5
Miles

ENVIRONMENTAL SCIENTIFIC

Attachment 19

MN Tribal Lands Map



MN Tribal Lands

West River Dairy Expansion
Synnes Township, MN

Project Boundary
Available Manure Application Acres
MN Tribal Land

N
0 10 20 30 40 50 60
Miles

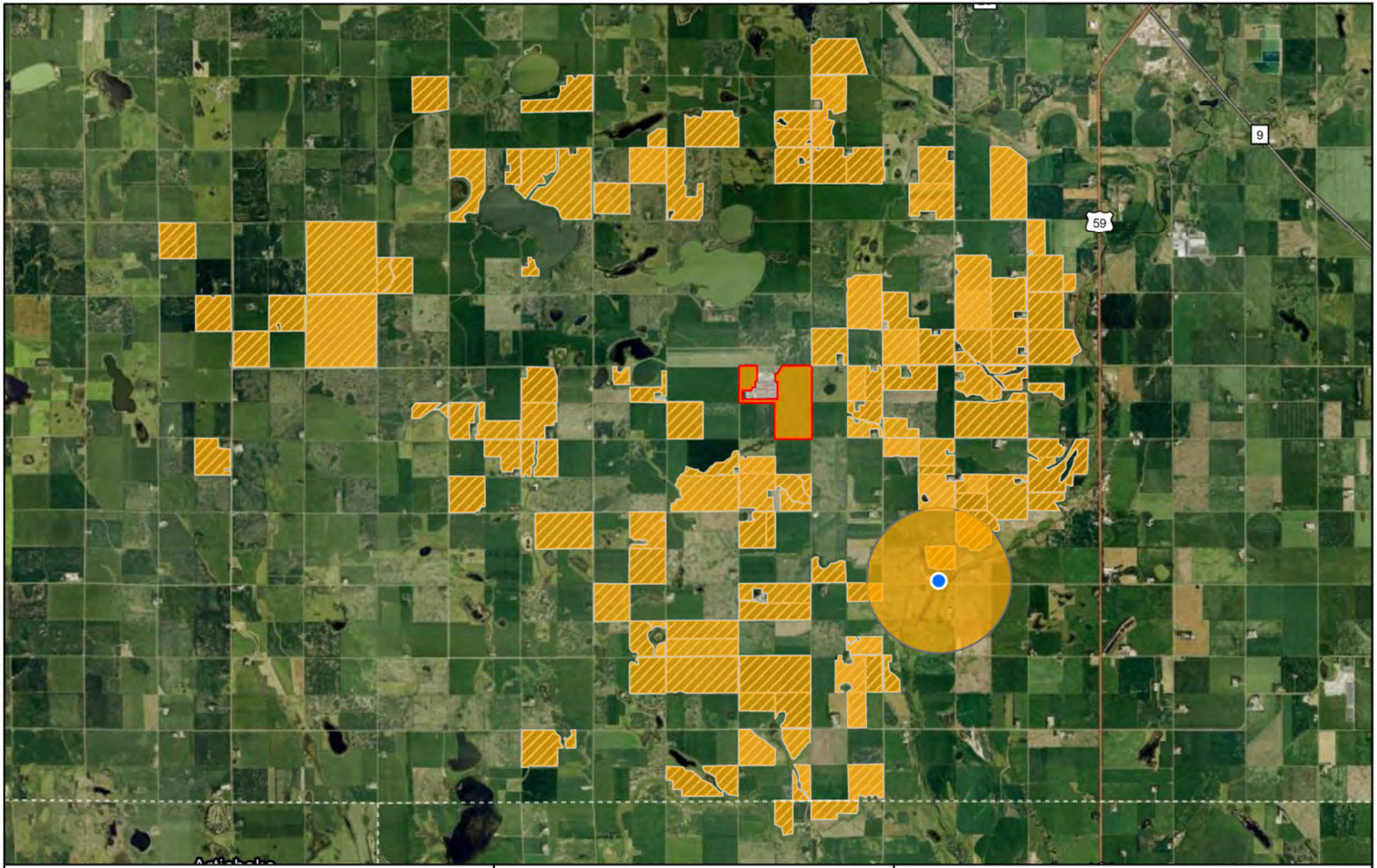
ENVIRONMENTAL SCIENTIFIC

Attachment 20

Environmentally Relevant Area Map

Attachment 20

Stevens County, Swift County



Environmentally Relevant Area Map

West River Dairy Expansion
Synnes Township, MN

Environmentally Relevant Area
Project Boundary
Available Manure Application Acres
Off-Site Well (Unique ID: 740629)

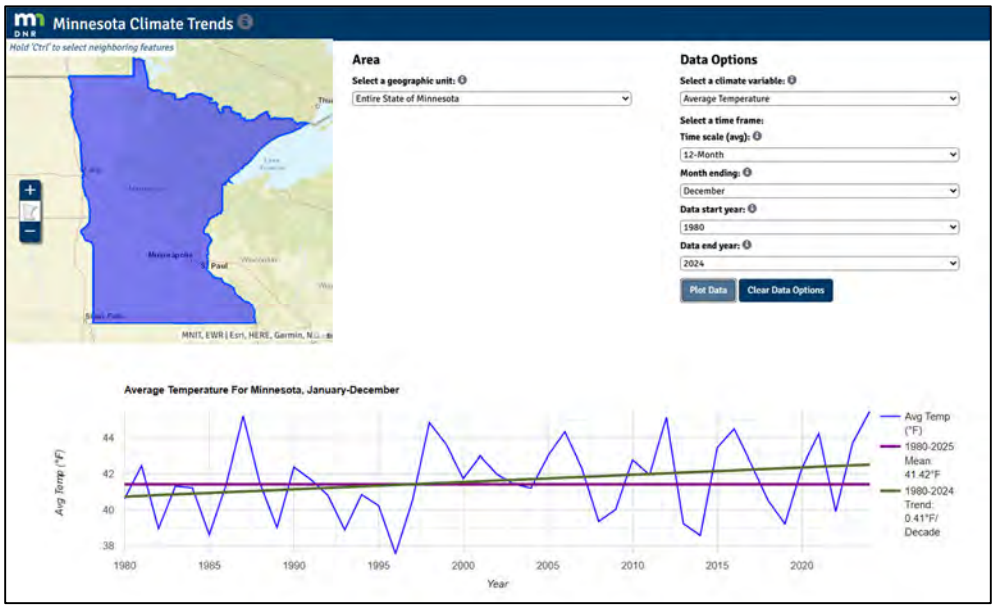
N
0 1 2 3 4 5
Miles

ENVIRONMENTAL SCIENTIFIC

Attachment 21

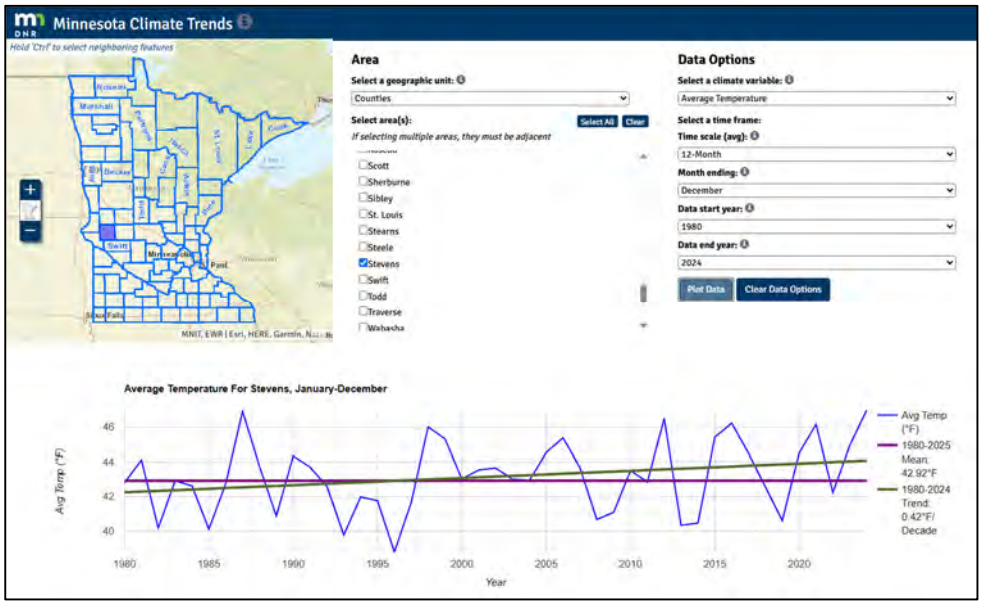
Climate Change and GHG Calculations

Average Annual Temperature



Year	Avg Temp (°F)	1980-2025 Mean: 41.42°F	1980-2025 Trend: 0.41°F/Decade
1980	40.62	41.42	40.74
2024	45.46	41.42	42.53

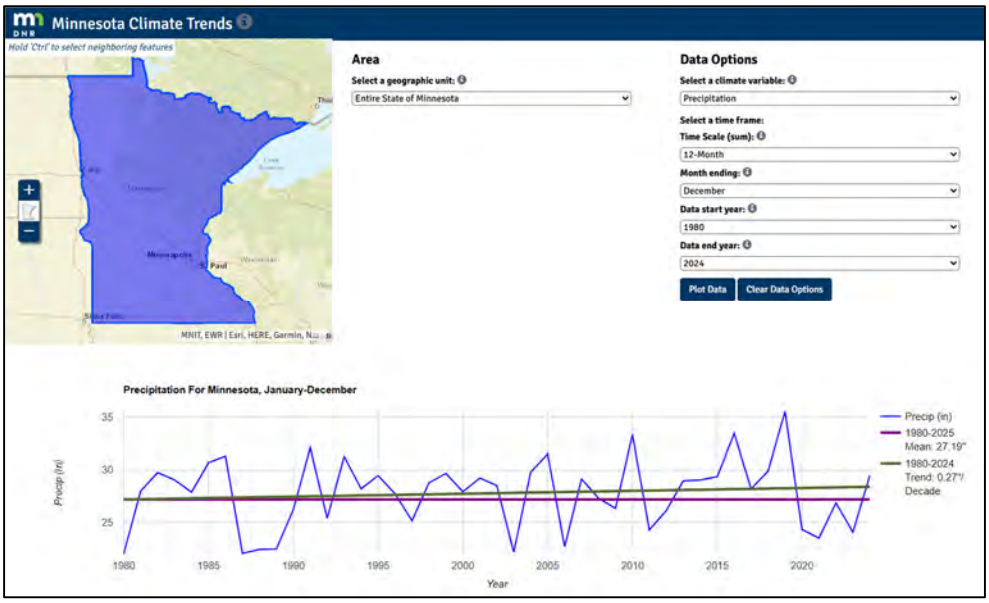
Figure 1: Average annual temperature in Minnesota has increased by 1.79°F since 1980



Year	Avg Temp (°F)	1980-2025 Mean: 42.92°F	1980-2025 Trend: 0.42°F/Decade
1980	42.81	42.92	42.25
2024	46.98	42.92	44.08

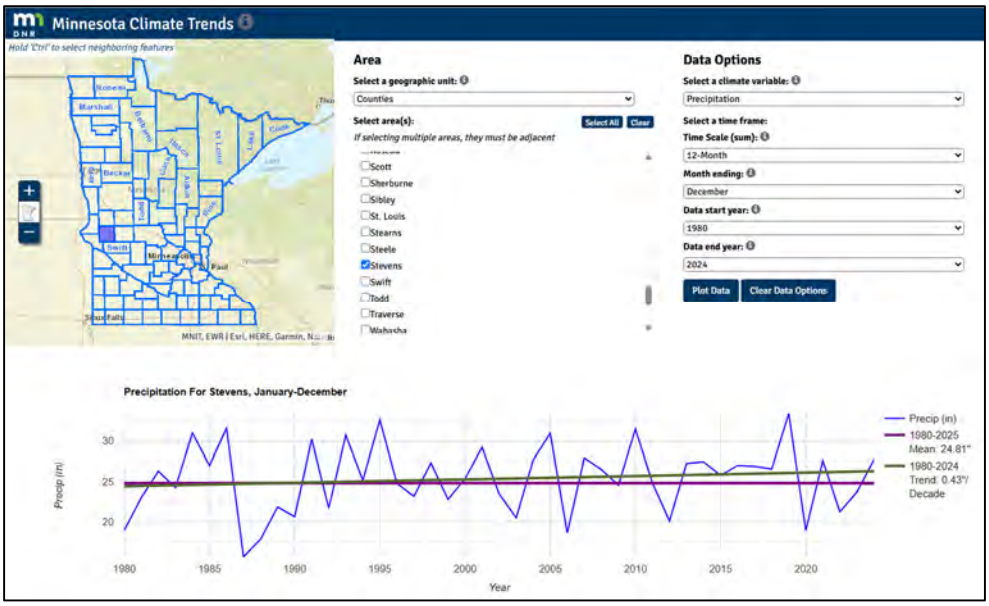
Figure 2: Average annual temperature in Stevens County has increased by 1.83°F since 1980

Average Annual Precipitation



Year	Precip (in)	1980-2025 Mean: 27.19"	1980-2024 Trend: 0.27"/Decade
1980	22.02	27.19	27.19
2024	29.46	27.19	28.4

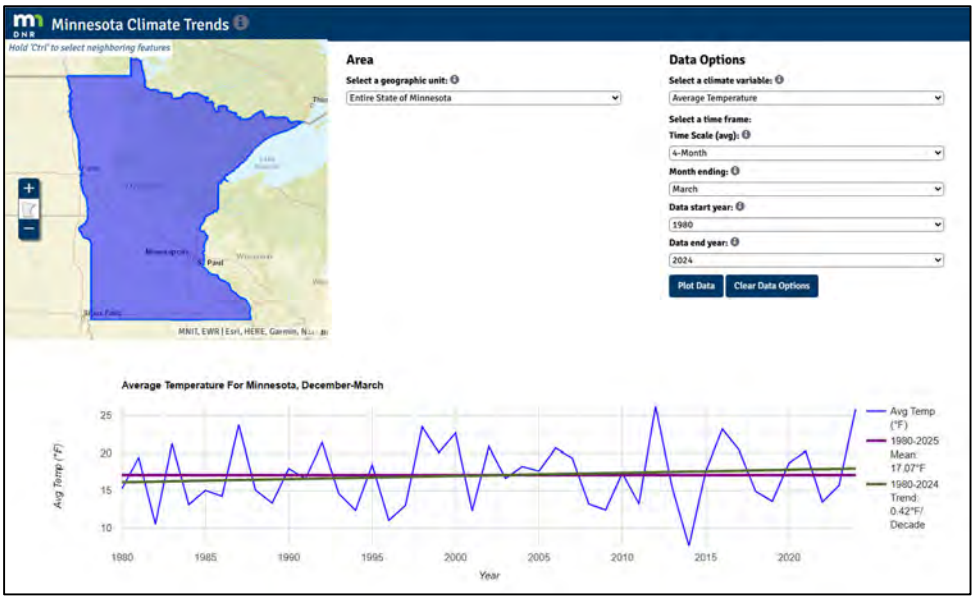
Figure 3: Average annual precipitation in Minnesota has increased by 1.21 inches since 1980



Year	Precip (in)	1980-2025 Mean: 24.81"	1980-2024 Trend: 0.43"/Decade
1980	18.95	24.81	24.43
2024	27.73	24.81	26.3

Figure 4: Average annual precipitation in Stevens County has increased by 1.87 inches since 1080

Cold Weather Warming



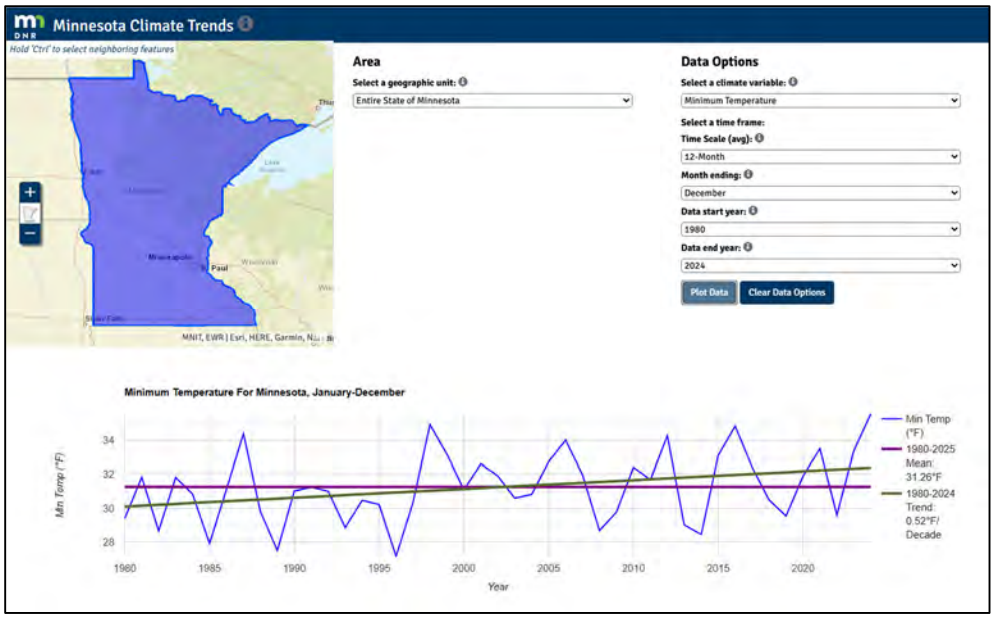
Year	Avg Temp (°F)	1980-2025 Mean: 17.07°F	1980-2024 Trend: 0.42°F/Decade
1980	15.29	17.07	16.12
2024	25.89	17.07	17.96

Figure 5: Average winter temperature in Minnesota has increased by 1.84°F since 1980

Year	Avg Temp (°F)	1980-2025 Mean: 18.22°F	1980-2024 Trend: 0.30°F/Decade
1980	17.66	18.22	17.54
2024	27.36	18.22	18.84

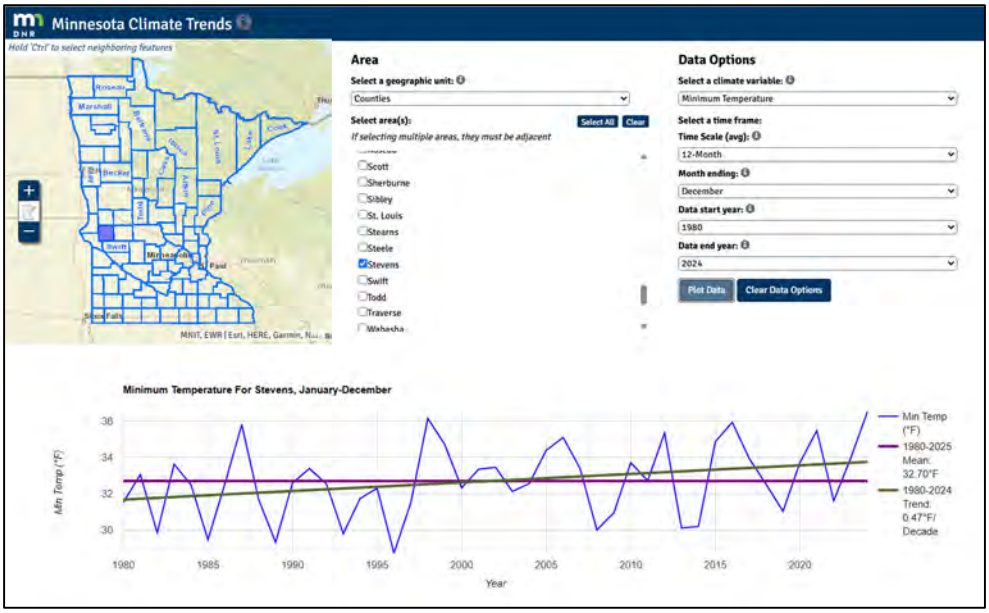
Figure 6: Average winter temperature in Stevens County has increased by 1.30°F since 1980

Nighttime Temperature Increasing



Year	Min Temp (°F)	1980-2025 Mean: 31.26°F	1980-2024 Trend: 0.52°F/Decade
1980	29.4	31.26	30.11
2024	35.52	31.26	32.38

Figure 7: Average nighttime temperature in Minnesota has increased by 2.27°F since 1980



Year	Min Temp (°F)	1980-2025 Mean: 32.70°F	1980-2024 Trend: 0.47°F/Decade
1980	31.53	32.7	31.68
2024	36.55	32.7	33.76

Figure 8: Average nighttime temperature in Minnesota has increased by 2.08°F since 1980

Heavier, More Damaging Rains

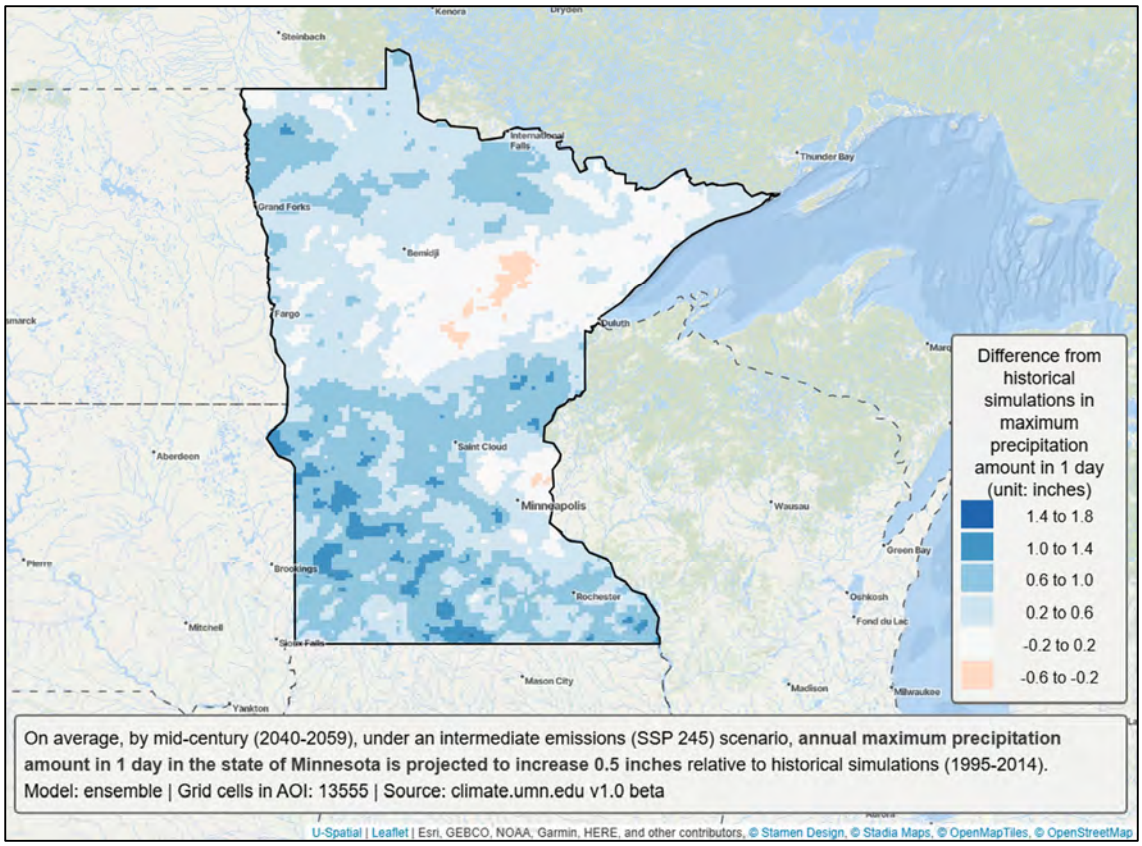


Figure 9: The maximum amount of rain in 1 day in Minnesota is expected to increase by 0.5 inches

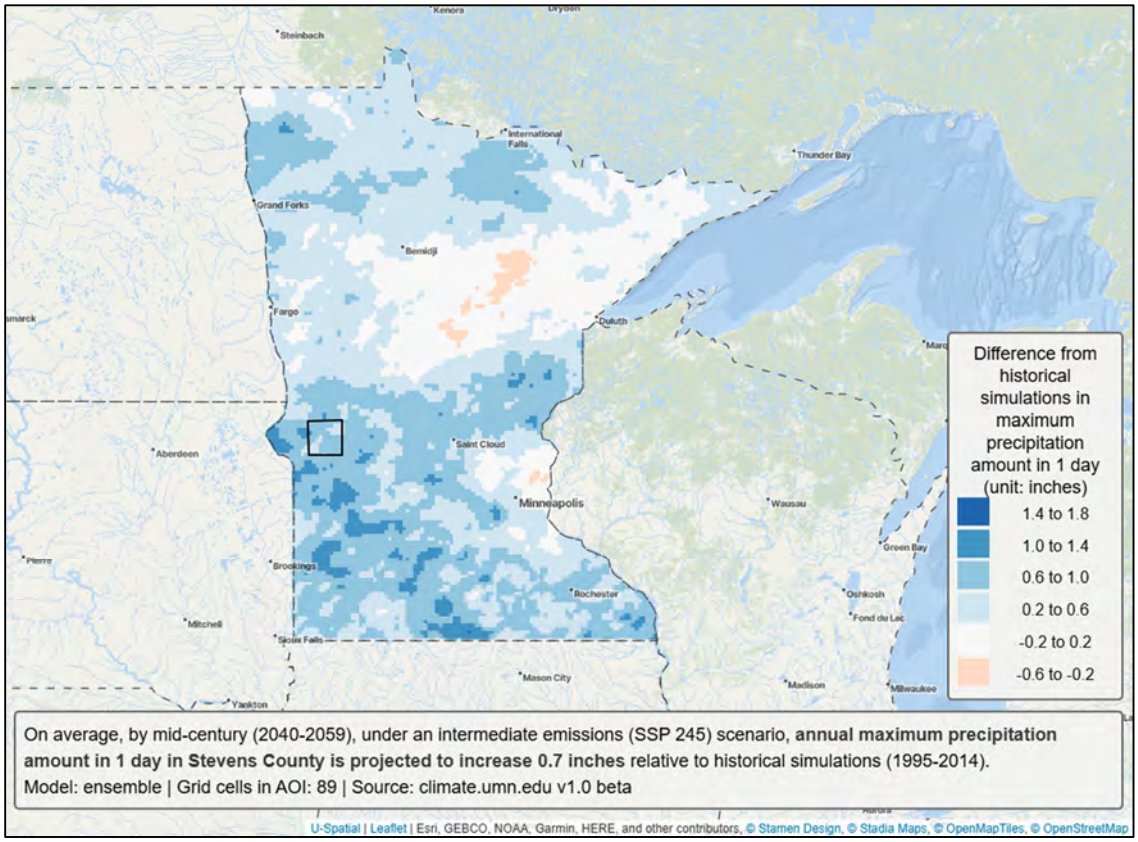


Figure 10: The max. amount of rain in 1 day in Stevens Co. is expected to increase by 0.7 inches

Increasing Risk of Heat Waves

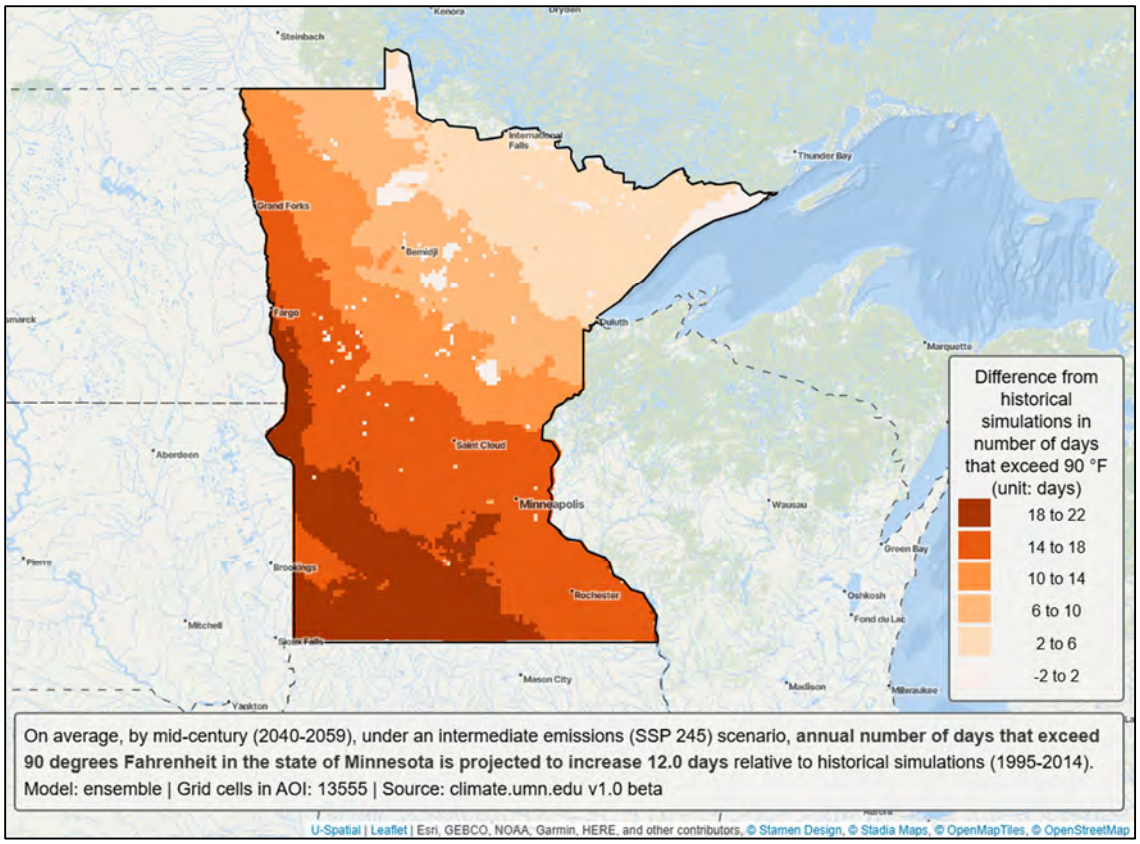


Figure 11: The number of days exceeding 90°F in Minnesota is expected to increase by 12 days

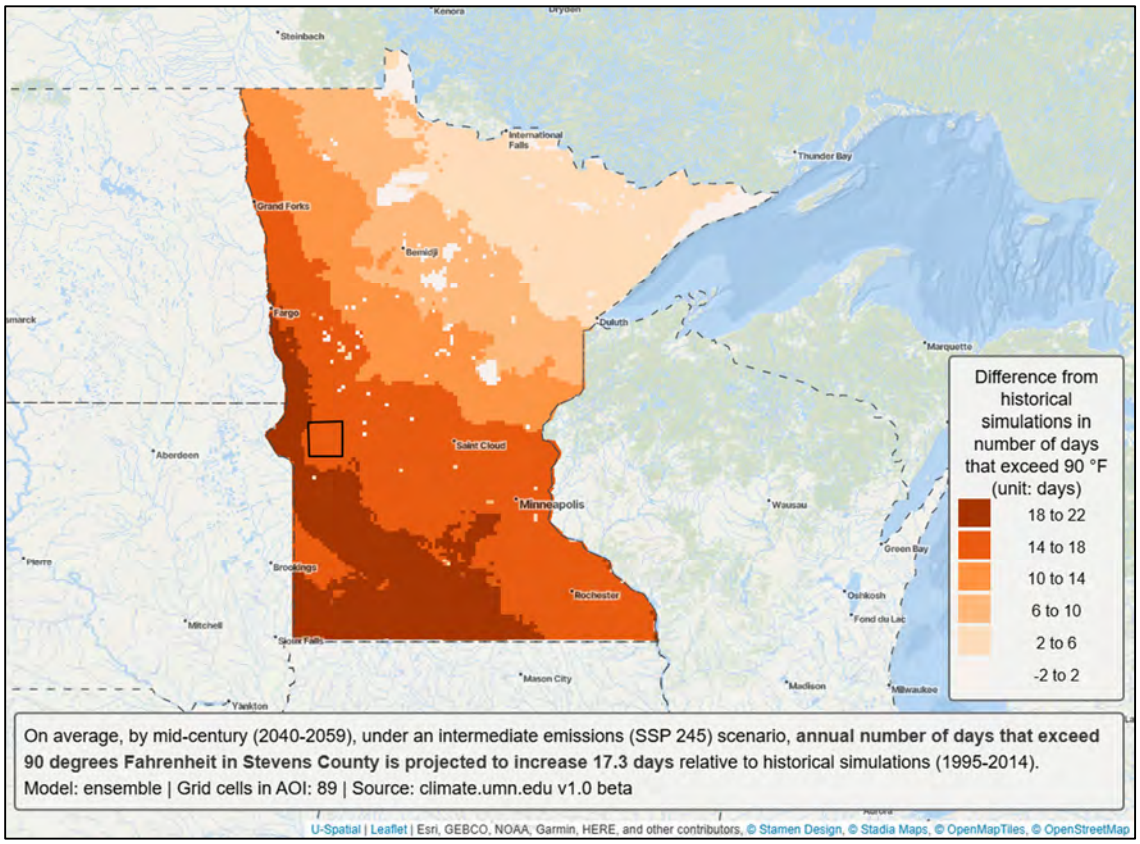


Figure 12: The number of days exceeding 90°F in Stevens Co. is expected to increase by 17.3 days

Increasing Risk of Drought

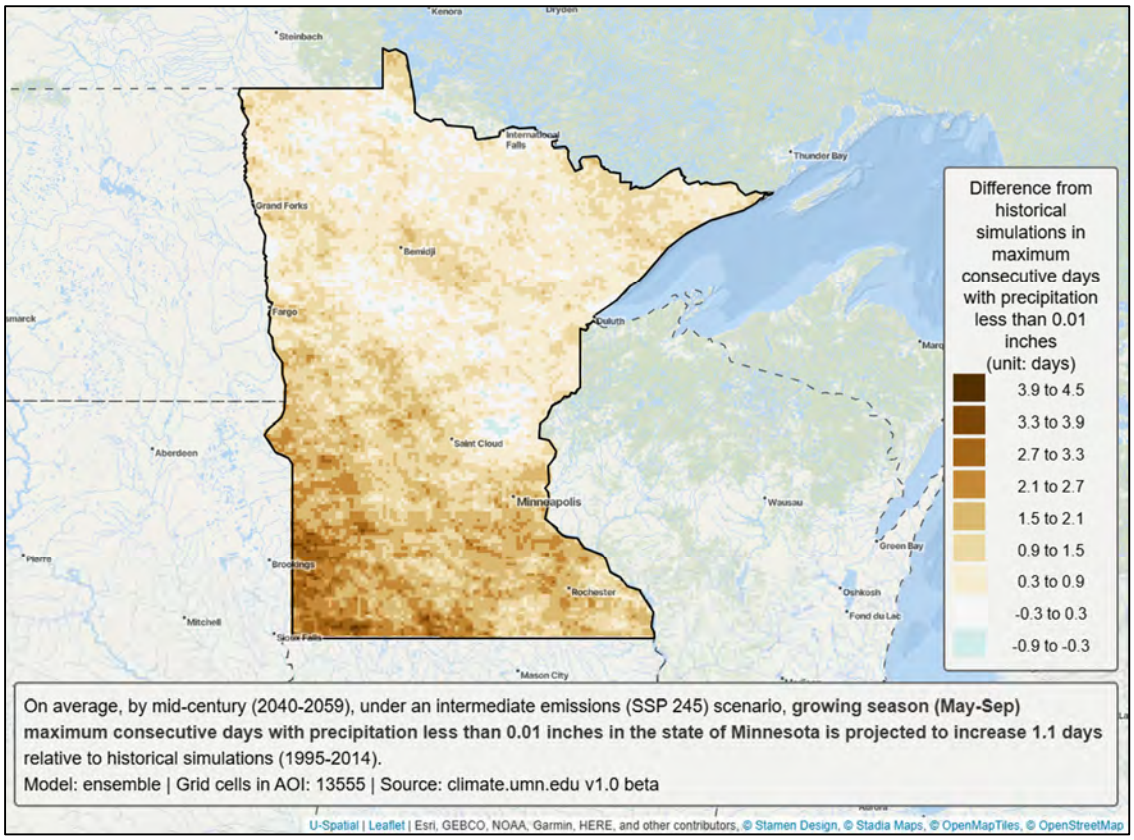


Figure 13: The maximum number of days without rain in MN is expected to increase by 1.1 days

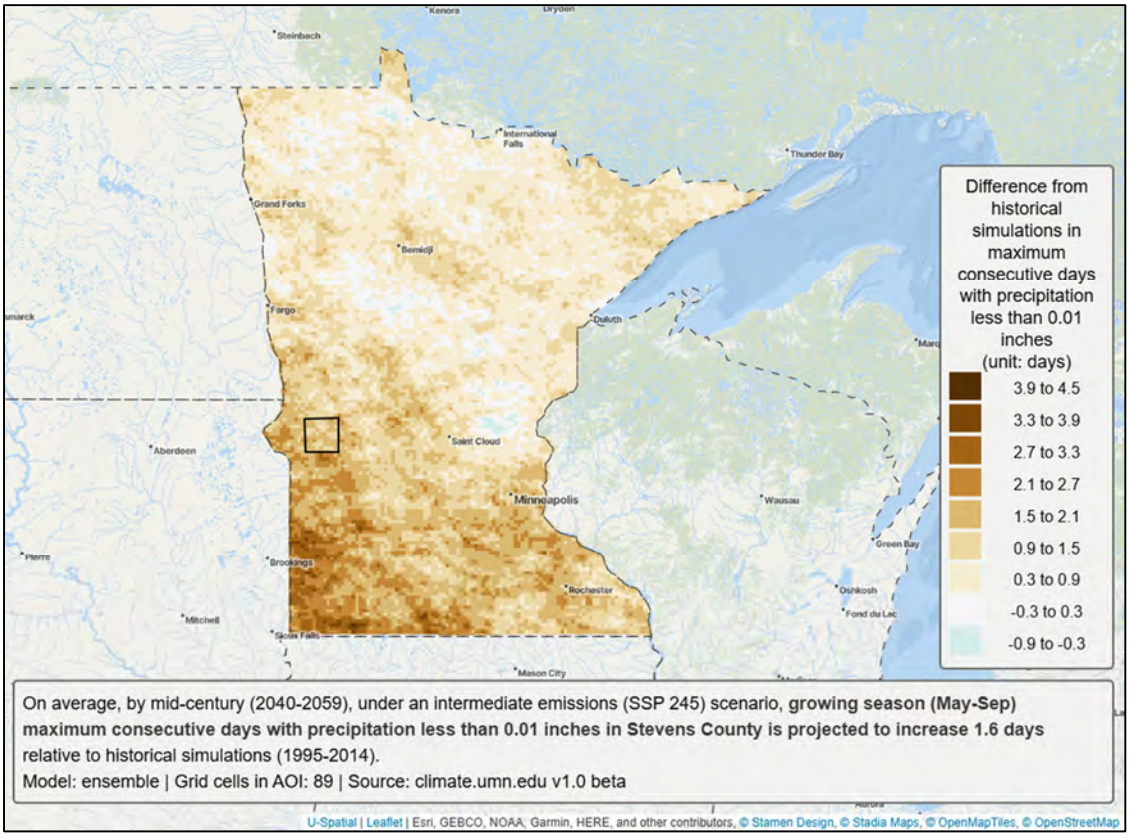


Figure 14: The max. number of days without rain in Stevens Co. is expected to increase by 1.6 days

Increasing Annual Rainfall

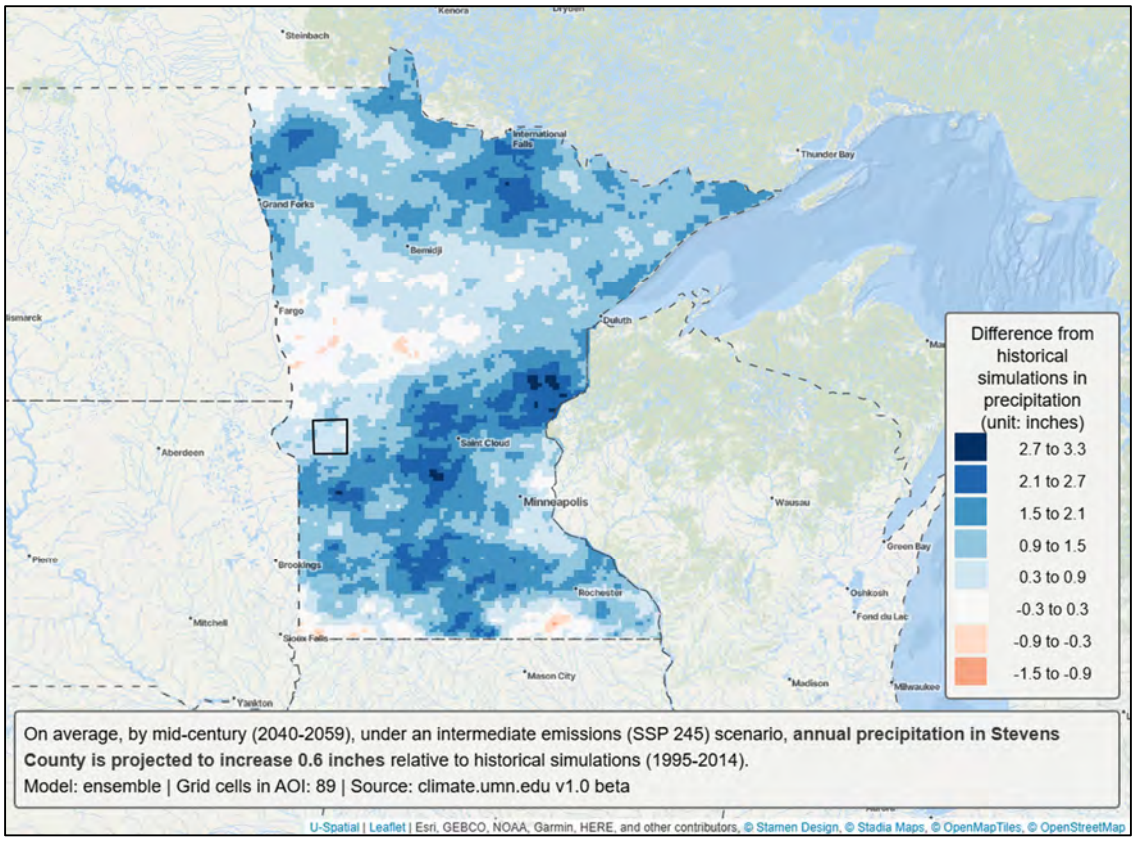


Figure 15: The annual rainfall in Stevens County is expected to increase by 0.6 inches

Land use changes Utilizing Data from EPA's U.S. GHG Emissions and Sinks 1990-2022 Report

Land use chage	Land Area (Acres)	Land Use Emissions or Reductions			
		Net CO2 Emissions Flux (metric tons CO2e)[1,3,4]	Total Area Land Use Changed in one year (hectares)[2]	Total Area Land Use Change (acres)[5]	Emissions (tons CO2e, negative value represents sink/removal of carbon) (short tons[6]/yr)
To Impervious Land Use[1]					
Wooded/Forest to Impervious Surface 2022		58,600,000	440,000	1,089,109	0.00
Cropland to Impervious Surface 2022	121.12	2,900,000	1,228,000	3,039,604	127.34
Wetland to Impervious Surface 2022		100,000	14,000	34,653	0.00
Grassland to Impervious Surface 2022		7,500,000	1,648,000	4,079,208	0.00
To Grassland[3]					
Cropland to grassland 2022	63.41	(12,500,000)	11,444,000	28,326,733	-30.84
Forest land to grassland 2022		46,800,000	3,894,000	9,638,614	0.00
Settlement (impervious land) to grassland 2022		(800,000)	93,000	230,198	0.00
Wetland to grassland 2022		100,000	134,000	331,683	0.00
To Cropland[4]					
grassland converted to cropland 2022		16,300,000	8,418,000	20,836,634	0.00
Forest land to cropland 2022		19,600,000	65,000	160,891	0.00
Settlement (impervious land) to cropland 2022		(100,000)	94,000	232,673	0.00
wetland to cropland 2022		400,000	75,000	185,644	0.00

96.51

1. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2022. Net Flux from Soil, Dead Organic Matter and Biomass Carbon Stock Change: Table 6-136 (value is for the Year 2022).
2. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2022. Land Use and Land-Use Change for the U.S. Managed Land Base for All 50 States.
3. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2022. Net Flux from Soil, Dead Organic Matter and Biomass Carbon Stock Change: Table 6-51 (value is for the Year 2022).
4. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2022. Net Flux from Soil, Dead Organic Matter and Biomass Carbon Stock Change: Table 6-40 (value is for the Year 2022).
5. 1 acre = 0.404 hectacre
6. Metric tons to short tons 1.102

	version 29-APR-2022	Barn, Basin Storage, and N_2O				Solid Storage CH_4				Total Emissions			
	List of Emission Sources (calcs below):												
	CH_4 - enteric fermentation				41,832				-				41,832
	CH_4 - barn and manure storage				9,956				853				10,809
	N_2O - barn and manure storage				2,957				-				2,957
	N_2O - manure land application				1,548				-				1,548
	Total CO2e				**56,292**				**853**				**57,146**
		Calves	**Heifers**	**Cows**	**Total**	**Calves**	**Heifers**	**Cows**	**Total**	**Calves**	**Heifers**	**Cows**	**Total**
	Total Head	-	-	11,000	11,000								11,000
	Animal units/head	0.2	0.7	1.4									
	Total animal units	-	-	15400.0	15,400.00								15,400.0
	CH_4 - enteric fermentation	**Calves**	**Heifers**	**Cows**	**Total**	**Calves**	**Heifers**	**Cows**	**Total**	**Calves**	**Heifers**	**Cows**	**Total**
A	animal inventory (head)	-	-	11,000									
B	kg CH_4/head/yr (EPA)	12.0	58.5	138.0									
C	conversion from kg to short tons	0.0011	0.0011	0.0011									
	tons CH_4 (A*B*C)	-	-	1,673.29	1,673.29								1,673
	tons CO_2-e	**-**	**-**	**41,832.29**	**41,832.29**								**41,832**
	CH_4 - barn and manure storage												
D	livestock (head)	-	-	11,000		-	-	11,000					
E	animal liveweight (kg/head)	122	408	454		122	408	454					
F	volatile solids (vs) production rate (kg VS/kg animal liveweight/yr)	2.81	3.07	4.10		2.81	3.07	4.10					
G	rate of CH_4 production (potential) (m^3 CH_4/kg VS)	0.17	0.17	0.24		0.17	0.17	0.24					
	fraction of VSS	0.493	0.493	0.493		0.507	0.507	0.507					
H	convert from m^3 to kgs (kg CH_4/m^3 CH_4)	0.622	0.622	0.622		0.622	0.622	0.622					
I	maximum potential CH_4 production (kg/yr) (D*E*F*G*H)	-	-	1,505,266		-	-	1,548,012					
J	methane conversion factor (MCF) (fraction of potential CH_4)	0.240	0.240	0.240		0.020	0.020	0.020					
K	CH_4 (metric tons/yr) (I*J)	-	-	361.26		-	-	30.96					
L	convert from metric tons to short tons	1.1023	1.1023	1.1023		1.1023	1.1023	1.1023					
M	CH_4 (short tons/yr) (K*L)	-	-	398.22	398.22	-	-	34.13	34.13				432
N	short tons/yr CO_2-e	-	-	9,955.53	**9,955.53**	-	-	853.19	**853.19**				**10,809**
	N_2O - barn and manure storage (direct)												
O	livestock (head)	-	-	11,000									
P	animal liveweight (kg/head)	122	408	454									
Q	excreted nitrogen (N) (kg N/kg animal liveweight/yr)	0.164	0.17	0.23									
R	emission factor from manure storage (kg N_2O-N/kg excreted N)	0.005	0.005	0.005									
S	Conversion factor for N to N_2O	1.571	1.571	1.571									
T	N_2O emissions (metric tons) (O*P*Q*R*S/1000)	-	-	9.00									
U	convert from metric tons to short tons	1.1023	1.1023	1.1023									
V	N_2O emissions (short tons) (T*U)	-	-	9.92	9.92								10
W	short tons/yr CO_2-e	**-**	**-**	**2,956.96**	**2,956.96**								**2,957**
	N_2O - manure land application (indirect)												
X	N remaining in manure used as fertilizer (kg N/yr) [(O+P+Q)*(1-R)]	-	-	1,139,954									
Y	N lost through runoff/leaching (%)	0.4%	0.4%	0.4%									
Z	N lost through volatilization (%)	26%	26%	26%									
ZZ	emission factor for runoff/leaching (kg N_2O-N/kg N lost)	0.0075	0.0075	0.0075									
AA	emission factor for volatilization (kg N_2O-N/kg N lost)	0.01	0.01	0.01									
AB	convert N to N2O	1.571	1.571	1.571									
AC	N_2O emissions (metric tons) [X*AB/1000*(Y*ZZ+Z*AA)]	-	-	4.71									
AD	convert from metric tons to short tons	1.1023	1.1023	1.1023									
AE	N_2O emissions (short tons) (AC*AD)	-	-	5.19	5.19								5
AF	short tons/yr CO_2-e	**-**	**-**	**1,547.58**	**1,547.58**								**1,548**

GHG Annual Operational

CO2 - Stationary		CH4 - Stationary		N2O - Stationary		GHG Totals
19,982	Gal LPG (Fuel Use In Physical Units)	19,982	Gal LPG (Fuel Use In Physical Units)	19,982	Gal LPG (Fuel Use In Physical Units)	
10.870	Gal/MMBtu (MMBtu per Physical Unit)	10.870	Gal/MMBtu (MMBtu per Physical Unit)	10.870	Gal/MMBtu (MMBtu per Physical Unit)	
61.710	61.71 kg/MMBtu Emission Factor 2023	3.000	3 g/mmBtu Emission Factor 2023	0.600	.6 g/mmBtu Emission Factor 2023	
0.00110231	kg to short ton (multiply by .00110231)	1.10231E-06	g to short ton (multiply by .001 then by .00110231)	1.10231E-06	g to short ton (multiply by .001 then by .00110231)	
1	GWP	25	GWP	298	GWP	
125.05		0.15		0.36		125.56 short tons
						113.91 metric tons

For stationary combustion sources emissions of CO2 — tons CO2 = fuel use in physical units * MMBtu per physical fuel unit * tons of CO2/MMbtu of fuel use
For stationary combustion sources emissions of CH4 — tons CO2-e = fuel use in physical units * MMBtu per physical fuel unit * tons of CH4/MMBtu of fuel use * GWP
For stationary combustion sources emissions of N2O — tons CO2-e = fuel use in physical units * MMBtu per physical fuel unit * tons of N2O/MMBtu of fuel use * GWP

CO2 - Mobile		CH4 - Mobile		N2O - Mobile		GHG Totals
140,083	Gal Diesel - Ag Equipment	140,083	Gal Diesel - Ag Equipment	140,083	Gal Diesel - Ag Equipment	
10.210	10.21 kg/MMBtu Emission Factor 2023	1.270	1.27 g/gal Emission Factor 2023	1.070	1.07 g/gal Emission Factor 2023	
0.00110231	kg to short ton (multiply by .00110231)	1.10231E-06	g to short ton (multiply by .001 then by .00110231)	1.10231E-06	g to short ton (multiply by .001 then by .00110231)	
1	GWP	25	GWP	298	GWP	
1,576.58		4.90		49.24		1,630.72 short tons
						1,479.36 metric tons

For mobile combustion sources emissions of CO2 — tons CO2 = fuel use in physical units *CO2 Emission Factor (kg CO2/physical unit of fuel use) * Conversion of kg to tons
For mobile combustion sources emissions of CH4 — tons CO2-e = Vehicle Miles Traveled (NA for Non-Road Vehicles) * CH4/N2O Emission Factor (g/mile) or (g/gal non-road) * Conversion of g to tons *
For mobile combustion sources emissions of N2O — tons CO2-e = Vehicle Miles Traveled (NA for Non-Road Vehicles) * CH4/N2O Emission Factor (g/mile) or (g/gal non-road)* Conversion of g to tons *

CO2 - Purchased Electricity		CH4 - Purchased Electricity		N2O - Purchased Electricity		GHG Totals
11,006,761	kWh	11,006,761	kWh	11,006,761	kWh	
11,006.761	mWh (kWh multplied by .001)	11,006.761	mWh (kWh multplied by .001)	11,006.761	mWh (kWh multplied by .001)	
995.800	995.8 lb/mWh (MROW 2023)	0.107	0.107 lb/mWh (MROW 2023)	0.015	0.015 lb/mWh (MROW 2023)	
0.0005000	lb to short ton (multiply by .0005)	0.0005000	lb to short ton (multiply by .0005)	0.0005000	lb to short ton (multiply by .0005)	
1	GWP	25	GWP	298	GWP	
5,480.27		14.72		24.60		5,519.59 short tons
						5,007.29 metric tons

For off-site purchased electricity — tons CO2-e = purchased electricity (MWh) * Emission Factor * GWP

GHG Construction

CO2 - Mobile Construction Equipment		CH4 - Mobile Construction Equipment		N2O - Mobile Construction Equipment		GHG Totals
165,669	Gal Diesel - Construction Equipment	165,669	Gal Diesel - Construction Equipment	165,669	Gal Diesel - Construction Equipment	
10.210	10.21 kg/MMBtu Emission Factor 2023	1.010	1.01 g/gal Emission Factor 2023	0.940	.94 g/gal Emission Factor 2023	
0.00110231	kg to short ton (multiply by .0110231)	1.10231E-06	g to short ton (multiply by .001 then by .00110231)	1.10231E-06	g to short ton (multiply by .001*.00110231)	
1	GWP	25	GWP	298	GWP	
1,864.54		4.61		51.16		1,920.30 short tons
						1,742.07 metric tons

For mobile combustion sources emissions of CO2 — tons CO2 = fuel use in physical units *CO2 Emission Factor (kg CO2/physical unit of fuel use) * Conversion of kg to tons
For mobile combustion sources emissions of CH4 — tons CO2-e = Vehicle Miles Traveled (NA for Non-Road Vehicles) * CH4/N2O Emission Factor (g/mile) or (g/gal non-road) * Conversion of g to tons * GWP
For mobile combustion sources emissions of N2O — tons CO2-e = Vehicle Miles Traveled (NA for Non-Road Vehicles) * CH4/N2O Emission Factor (g/mile) or (g/gal non-road)* Conversion of g to tons * GWP

Technical Memorandum

To: Lisa Nieland of Riverview, LLP
From: Charles Gantzer of Barr Engineering Co.
Subject: GHG Credit for Replacement of Anhydrous Ammonia
Date: July 31, 2025
Project: West River Dairy Expansion 23/75-1004.00 100 012

1 Summary

The proposed 11,000-head expansion of West River Dairy will generate manure that will be applied to cropland. The nitrogen component of this manure can be used as fertilizer replacing the application of anhydrous ammonia. The production of anhydrous ammonia by the Haber-Bosch process releases greenhouse gas (GHG) into the atmosphere. By replacing anhydrous ammonia with manure nitrogen, the GHG emissions associated with ammonia production are eliminated. When manure is used as fertilizer instead of anhydrous ammonia, a GHG credit can be applied.

Land-applied manure from the 11,000-head expansion of the West River Dairy will replace about 1,545 ton of anhydrous ammonia annually. The regional overall GHG emission factor for ammonia production by the Haber-Bosch process is about 5.85 ton CO_2/ton NH_3. Thus, the use of manure generated by the 11,000-head expansion as fertilizer will reduce GHG emissions by about 9,038 ton CO_2/year, because the corresponding mass of anhydrous ammonia is not generated by the Haber-Bosch process.

2 Haber-Bosch Production of Ammonia

The Haber-Bosch process is the dominant means for producing ammonia for agricultural fertilizer. Ammonia synthesis has two greenhouse gas components: (1) the release of carbon dioxide during the chemical reaction and (2) the released carbon dioxide associated with the electrical power requirement for driving the chemical process. The chemical process alone accounts for about 7.5 percent of the industrial CO_2 emissions for the USA.[1] The Haber-Bosch process has significant energy requirements. Ammonia production consumes 1-2 percent of the global electrical energy generation.[2] Recent Haber-Bosch production facilities require about 10.1 megawatt hours per ton NH_3 produced.[3]

The CO_2 released by the chemical reactor depends on the carbon feedstock used to produce the hydrogen required for the Haber-Bosch process. When natural gas is used as the carbon source, the CO_2 emission factor is about 1.2 ton CO_2 per ton NH_3 produced. With petroleum coke as the carbon feedstock,

[1] EPA. 2024. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022*. 4. Industrial Processes and Product Use, Table 4.1.

[2] Kyriakou V. *et al*. 2020. An electrochemical Haber-Bosch process. *Joule* 4: 142-158.

[3] Rouwenhorst K. H. R. and Lefferts L. 2020. Feasibility study of plasma-catalytic ammonia synthesis for energy storage applications. *Catalysts* 10(9): 999.

the emission factor increases to 3.52 ton CO_2 per ton NH_3 produced.[4] For this evaluation, natural gas is the assumed carbon source.

The CO_2 emission factor for the generation of the electrical power consumed by the Haber-Bosch process varies with the supplying power plants. For the Midwest Reliability Organization West (MROW) region which includes Minnesota, a representative emission factor region's power plants is 0.460 ton CO_2 per MWh.[5] With an energy consumption factor of 10.1 MWh/ton NH_3 produced,[6] the electrical-power emission factor for ammonia production by the Haber-Bosch is about 4.65 ton CO_2/ton NH_3 produced.

The sum of the CO_2 emission factors for the chemical process component (1.2 ton CO_2/ton NH_3) and for the electrical power component (4.65 ton CO_2/ton NH_3) is 5.85 ton CO_2/ton NH_3. The electrical-power CO_2 emission factor accounts for about four-fifths of the total CO_2 emission factor for the Haber-Bosch process.

3 Credit for Replacement of Anhydrous Ammonia

The proposed 11,000-head expansion of West River Dairy will generate manure that will be applied to cropland. The manure-nitrogen mass loading will replace the application of anhydrous ammonia. The calculated manure nitrogen used as fertilizer is about 1,545 ton NH_3/yr.[7] Considering the combined emission factor of 5.85 ton CO_2/ton NH_3 for the Haber-Bosch process, the use of manure from the West River Dairy expansion instead of anhydrous ammonia will result in a reduction in GHG emissions of about 9,038 ton CO_2/yr.

4 Conclusion

The use of manure from the West River Dairy expansion as a replacement for anhydrous ammonia will reduce CO_2 emissions by 9,038 ton/yr.

[4] EPA. 2022. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2020*. 4.5 Ammonia Production (CRF Source Category 2B1), page 4-32.

[5] EPA. 2025. *The Emissions & Generation Resource Integrated Database.* Power Profiler. https://www.epa.gov/egrid/power-profiler#/MROW

[6] Rouwenhorst K. H. R. and Lefferts L. 2020. Feasibility study of plasma-catalytic ammonia synthesis for energy storage applications. *Catalysts* 10(9): 999.

[7] EPA. 2024. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022*. Tables A-156, A-158, and A-164.

Attachment 22

Minnesota NPDES Individual Feedlot Permit Application

Submittal Information

Facility Name:	Riverview LLP - West River Dairy
Agency Interest ID:	88731
Permit ID:	NEW
Service Type:	Feedlot Permitting - NPDES Individual Permit Issuance
Transaction ID:	174980
Submitted On:	2025-12-12 07:14:37

Permit Application Selection

Do you want to reissue an existing permit?	No
Do you need to make a modification to your existing permit or Manure Management Plan (MMP)?	No
Does your facility exceed any federal large CAFO thresholds?	Yes
Does your facility discharge to US Waters?	No
Do you want to apply for NPDES Permit?	Yes

Application Readiness

Based on your previous answers, you are applying for a NPDES Individual Permit.

Are you constructing new or expanding an existing feedlot or manure storage area (MSA)?	Yes
Is the ultimate capacity of the feedlot 500 or more animal units, or will the MSA hold manure produced by 500 or more animal units?	Yes
Acres Disturbed	146.8
Is the facility Minnesota Agricultural Water Quality Certified?	No
Is the feedlot in a non-delegated county?	No

Acknowledgements

I have notified all government authorities and local zoning authorities about the proposed construction or expansion, in accordance with Minn. R. 7020.2000 subp. 5.

I acknowledge that this application is for a NPDES permit where construction activities will disturb one or more acres of land, and it will also serve as an application for the general Construction Stormwater (CSW) NPDES permit, as referenced in the feedlot NPDES permit, unless a separate application for CSW NPDES permit coverage has been made. I agree to comply with the requirements of the CSW NPDES permit.

Feedlot Information

Feedlot Name:	Riverview LLP - West River Dairy
Physical Address:	52755 280th St Morris MN 56267-3719
Mailing Address:	26406 470th Ave Morris MN 56267-5370
Location Description:	

Feedlot Location

Collection Method:	Digitized - MPCA internal map
Coordinate System:	Lat Long - decimal degrees
Latitude:	45.49505557
Longitude:	-96.00690812
Point of Reference:	General Location
County:	Stevens
Is the site located in Indian country?:	No
Parcel(s) County and ID:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	SE
Quarter 40:	SE
Quarter 10:	
Quarter 2.5:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	SE

Feedlot Location

Quarter 40:	SW
Quarter 10:	
Quarter 2.5:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	SE
Quarter 40:	NW
Quarter 10:	
Quarter 2.5:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	SE
Quarter 40:	NE
Quarter 10:	
Quarter 2.5:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	NE
Quarter 40:	NE
Quarter 10:	
Quarter 2.5:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	NE
Quarter 40:	NW
Quarter 10:	
Quarter 2.5:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	NE
Quarter 40:	SE
Quarter 10:	
Quarter 2.5:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	NE
Quarter 40:	SW
Quarter 10:	
Quarter 2.5:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	NW
Quarter 40:	NE
Quarter 10:	
Quarter 2.5:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	NW
Quarter 40:	NW
Quarter 10:	
Quarter 2.5:	
Township:	123
Range:	43W
Section:	1
Quarter 160:	NW
Quarter 40:	SE

Feedlot Location

Quarter 10:	
Quarter 2.5:	
Township:	143
Range:	43W
Section:	1
Quarter 160:	NW
Quarter 40:	SW
Quarter 10:	
Quarter 2.5:	

Contacts

Contact Name:	Damon Knobloch
Contact Type:	Feedlot Contact
Organization Name:	Riverview, LLP
Organization Type:	Private (Non-Government)
Address:	26406 470th Ave Morris MN 56267-5370
Email:	ben.hernandez@riverviewllp.com damon.knobloch@riverviewllp.com
Phone:	3203491272 3203925609

Contact Name:	
Contact Type:	Owner
Organization Name:	Riverview, LLP
Organization Type:	Private (Non-Government)
Address:	26406 470th Ave Morris MN 56267-5370
Email:	ben.hernandez@riverviewllp.com damon.knobloch@riverviewllp.com
Phone:	3203491272 3203925609

Contact Name:	Damon Knobloch
Contact Type:	Billing Contact
Organization Name:	Riverview, LLP
Organization Type:	Private (Non-Government)
Address:	26406 470th Ave Morris MN 56267-5370
Email:	ben.hernandez@riverviewllp.com damon.knobloch@riverviewllp.com
Phone:	3203491272 3203925609

Prevention Opportunities

You chose not to answer these optional questions.

Animal Holding & Numbers

Animal Holding Areas

Does the facility have pasture access?	No	
Are there animal holding areas at this facility?	Yes	
Is there a well within 1000 feet?	Yes	650 ft.

Total Confinement Barn	**Animal Type**	**Capacity**	**Animal Units**
Status: Active	Dairy Cattle >1000 lbs	1,055	1,477
Structure Name: Animal Holding Area (Facility #3)			
Length: 664 feet			
Width: 302 feet			
Coordinate System: Lat Long - decimal degrees			
Latitude: 45.49513			

Longitude: -96.00576
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Total Confinement Barn	**Animal Type**	**Capacity**	**Animal Units**
Status: Active	Dairy Cattle >1000 lbs	1,220	1,708

Structure Name: Animal Holding Area (Facility #6)
Length: 664 feet
Width: 164 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49431
Longitude: -96.00541
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Total Confinement Barn	**Animal Type**	**Capacity**	**Animal Units**
Status: Active	Dairy Cattle >1000 lbs	2,230	3,122

Structure Name: Animal Holding Area (Facility #2)
Length: 644 feet
Width: 244 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49577
Longitude: -96.00816
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Total Confinement Barn	**Animal Type**	**Capacity**	**Animal Units**
Status: Active	Dairy Cattle >1000 lbs	1,120	1,568

Structure Name: Animal Holding Area (Facility #1)
Length: 664 feet
Width: 122 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49599
Longitude: -96.00553
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Total Confinement Barn	**Animal Type**	**Capacity**	**Animal Units**
Status: Active	Dairy Cattle >1000 lbs	2,230	3,122

Structure Name: Animal Holding Area (Facilities #4 & #15)
Length: 664 feet
Width: 244 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49451
Longitude: -96.00828
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Milk Parlor-Holding Area
Status: Active
Structure Name: Milking Parlor (Facility #5)
Length: 300 feet
Width: 100 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49508
Longitude: -96.00803
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Total Confinement Barn	**Animal Type**	**Capacity**	**Animal Units**
Status: New	Dairy Cattle >1000 lbs	11,000	15,400

Structure Name: Animal Holding Area (Facility #201)
Length: 1,304 feet
Width: 692 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49537
Longitude: -96.00121
Collection Method: Digitized - MPCA online map

Reference Point: General Location

Milk Parlor-Holding Area
Status: New
Structure Name: Holding Pen (Facility #202)
Length: 281 feet
Width: 162 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49497
Longitude: -95.99854
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Milk Parlor-Holding Area
Status: New
Structure Name: Milking Parlor (Facility #203)
Length: 330 feet
Width: 240 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49429
Longitude: -95.99662
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Total Animal Headcount

Animal Type	Capacity	Units
Dairy Cattle >1000 lbs	18,855	26,397
Totals:	18,855	26,397

Manure Storage Areas

Are there manure storage or treatment areas at this feedlot?	Yes	
Is there a well within 1000 feet?	Yes	150 ft.

LMSA - Earthen
Status: Active
Structure Name:Liquid Manure Storage Area (Facility #12)
Shape: Rectangle
Length: 600 feet
Width: 405 feet
Depth: 16 feet
Volume: 22,361,367 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49284
Longitude: -96.00852
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Stockpile-Permanent
Status: Active
Structure Name:Permanent Stockpile (Facility #13)
Shape: Rectangle
Length: 273 feet
Width: 131 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49378
Longitude: -96.00529
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Earthen
Status: Active
Structure Name:Covered Basin (Facility #18)
Shape: Rectangle
Length: 695 feet
Width: 375 feet

Depth: 18 feet
Volume: 20,830,941 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49319
Longitude: -96.01321
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Earthen
Status: Active
Structure Name:Liquid Manure Storage Area (Facility #9)
Shape: Rectangle
Length: 430 feet
Width: 400 feet
Depth: 16 feet
Volume: 15,372,238 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49279
Longitude: -96.01151
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Earthen
Status: Active
Structure Name:Liquid Manure Storage Area (Facility #10)
Shape: Rectangle
Length: 400 feet
Width: 150 feet
Depth: 13 feet
Volume: 3,442,440 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.4928
Longitude: -96.01036
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Concrete
Status: Active
Structure Name:Concrete Grit Box (Facility #19)
Shape: Rectangle
Length: 105 feet
Width: 105 feet
Depth: 8 feet
Volume: 660,000 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49801
Longitude: -96.00683
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Earthen
Status: Active
Structure Name:Liquid Manure Storage Area (Facility #11)
Shape: Rectangle
Length: 908 feet
Width: 405 feet
Depth: 16 feet
Volume: 39,212,509 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49285
Longitude: -96.00555
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Stockpile-Permanent
Status: Active
Structure Name:Separated Solids Building (Facility #17)

Shape: Rectangle
Length: 160 feet
Width: 80 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49387
Longitude: -96.00649
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Concrete
Status: Active
Structure Name:Day Pit (Facility #7)
Shape: Rectangle
Length: 51 feet
Width: 49 feet
Depth: 12 feet
Volume: 224,310 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49407
Longitude: -96.00704
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Concrete
Status: Active
Structure Name:Digester Tank (Facility #8)
Shape: Rectangle
Length: 308 feet
Width: 147 feet
Depth: 16 feet
Volume: 5,419,000 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49422
Longitude: -96.01074
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Earthen
Status: New
Structure Name:Liquid Manure Storage Area (Facility #101)
Shape: Rectangle
Length: 900 feet
Width: 560 feet
Depth: 21 feet
Volume: 58,672,434 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49369
Longitude: -96.00238
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Earthen
Status: New
Structure Name:Liquid Manure Storage Area (Facility #102)
Shape: Rectangle
Length: 900 feet
Width: 560 feet
Depth: 21 feet
Volume: 58,672,434 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49432
Longitude: -96.00161
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Earthen
Status: New

Structure Name:Liquid Manure Storage Area (Facility #106)
Shape: Rectangle
Length: 636 feet
Width: 826 feet
Depth: 11 feet
Volume: 30,816,149 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49547
Longitude: -96.00337
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Concrete
Status: New
Structure Name:Day Pit (Facility #104)
Shape: Circular
Diameter: 36 feet
Depth: 12 feet
Volume: 91,300 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49549
Longitude: -96.00265
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Concrete
Status: New
Structure Name:Gray Water Tank (Facility #103)
Shape: Rectangle
Length: 30 feet
Width: 30 feet
Depth: 16 feet
Volume: 107,700 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49541
Longitude: -96.00007
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Stockpile-Permanent
Status: New
Structure Name:Stacking Pad (Facility #105)
Shape: Rectangle
Length: 405 feet
Width: 285 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49723
Longitude: -96.00395
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Stockpile-Permanent
Status: New
Structure Name:Separator Building (Facility #204)
Shape: Rectangle
Length: 202 feet
Width: 150 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49742
Longitude: -96.00304
Collection Method: Digitized - MPCA online map
Reference Point: General Location

LMSA - Earthen
Status: New
Structure Name:Feed Pad Runoff Basin (Facility #304)
Shape: Rectangle

Length: 735 feet
Width: 155 feet
Depth: 9 feet
Volume: 3,272,997 gallons
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49789
Longitude: -96.00661
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Feed Storage Areas

Is feed at the facility stored in an outdoor pile or bunker? Yes

Feed Storage Area
Status: Active
Structure Name: Feed Pad (Facility #14)
Shape: Rectangle
Length: 1,400 feet
Width: 600 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49687
Longitude: -96.00824
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Feed Storage Area
Status: New
Structure Name: Feed Pad (Facility #206)
Shape: Rectangle
Length: 1,070 feet
Width: 630 feet
Coordinate System: Lat Long - decimal degrees
Latitude: 45.49765
Longitude: -96.00091
Collection Method: Digitized - MPCA online map
Reference Point: General Location

Mortality Management

Are animal mortalities composted in a manner that utilizes manure or litter as a part of the compost material? No

Air Emissions Plan

I will employ the following Air Emissions Plan. (This satisfies the requirements of Minn. Rule 7020.0505 supb4.B (1) Affirmed

List of facility components likely to generate significant odors and methods use to mitigate odors*

Animal holding areas

- Disperse/mix air with tree plantings
- Regular removal of manure
- Promptly clean up any spilled feed
- Use spray oil to reduce dust
- Treatment of escaping air with control technologies
- Higher oil and fat content in feed to reduce dust
- Eliminate manure buildup under gates, feeders, etc.
- Maintain exhaust fans and avoid manure and dust accumulation
- Maintain clean, dry floors to eliminate manure buildup
- I will consult the MPCA to identify changes that can be made to reduce odors

Manure storage areas

- Maintain crust on basin by using organic bedding
- Cover liquid manure storage area with straw
- Cover liquid manure storage area with synthetic cover
- Anaerobic digestion
- Notify neighbors of manure application periods and avoid holidays
- Disperse/mix air with tree plantings
- Add straw or other bedding material to reduce odor/emissions
- Treatment of escaping air with control technologies

- Separate solids with settling basin or liquid/solid separator
- Utilize a pit additive to break down solids
- Cover the solid manure stockpile
- Reduce length of time stockpile is maintained
- Solid manure composting
- I will consult the MPCA to identify changes that can be made to reduce odors

*In the event that continued odor complaints are validated, at least one of the practices identified above will be implemented pursuant to MPCA request/approval

Response to documented exceedances

If ambient air quality monitoring indicates an exceedance of the Hydrogen Sulfide Standard, the applicant will submit a report, at the MPCA's request, that provides documentation that one of the following will control the emissions.

Liquid manure storage areas

- Chemical additions
- Natural crusting
- Straw cover
- Synthetic cover (i.e., HDPE)
- Treatment of escaping air

Solid manure storage areas

- Synthetic cover
- Frequent manure removal
- Frequent land application
- Incineration
- Composting

The report must provide evidence that the technology will control the emissions, indicate when the technology will be installed and fully operational, and indicate what temporary measures will be taken to minimize emissions prior to installation. Alternatives may be approved at the discretion of the MPCA. The measures with the report will be immediately implemented upon MPCA approval.

Sensitive Areas

Is any part of the facility located within 1,000 feet of surface waters or tile intakes?	Yes
Surface Water Types:	
Is any part of the facility located within a delineated flood plain (100 year flood)?	No
Is any part of the facility located within designated shoreland?	No
Are there four or more sinkholes within 1,000 feet of the facility?	No
Is any part of the facility located within 300 feet of a known sinkhole?	No
Is any part of the facility located within 1,000 feet of any of the following types of wells?	No
-a community water supply well,	
-a well serving a public school as defined under Minn.Stat. 120A. 05,	
-a well serving a private school excluding home school sites	
-a well serving a licensed child care center where the well is vulnerable(Minn.R. 4720.5550, subp. 2)	

Environmental Review

Are you only applying for reissuance of an existing permit? (no construction projects, physical alteration, or operational changes to the facility or process)?	No
Are you required to prepare, are you preparing, or have you completed any of the following items for any responsible governmental unit (RGU) other than the MPCA (e.g. City, Township, County, State or Federal Agency) as part of this project? Environmental Assessment Worksheet(EAW), Environmental Impact Statement(EIS), Alternative Urban Areawide Review(AUAR), Federal Environmental Assessment(EA)	No
Has this project been petitioned for an environmental review?	No
Subp. 2 - Construction or expansion of a nuclear fuel or nuclear waste processing facility?	No
Subp. 3 - Construction of an electric power generating plant and associated facilities designed for or capable of operating at a capacity of 25 megawatts or more but less than 50 megawatts and for which an air permit from MPCA is required?	No
Subp. 4 - Construction of a new or expansion of an existing petroleum refinery?	No
Subp. 5A - Construction of a facility for the conversion of coal, peat, or other biomass sources to a gaseous, liquid, or solid fuel (this includes anaerobic digesters)?	No
Subp. 5B - Construction of a facility for the production of alcohol fuels?	No
Subp. 8A - Construction or expansion of a coal transfer facility?	No
Subp. 8B - Construction or expansion of a hazardous materials transfer facility?	No
Subp. 10A - Construction or expansion of a storage facility for coal?	No
Subp. 10B - Construction of a facility for the storage of hazardous materials?	No
Subp. 10C & Subp. 10D – Expansion of a facility for the storage of hazardous materials?	No
Subp. 10H- Construction or expansion of a facility that will store silica sand?	No
Subp. 13 - Construction or expansion of a paper or pulp processing facility?	No
Subp. 15 - Construction or modification of a stationary source of air emissions resulting in an increase in air emissions or greenhouse gases?	No
Subp. 16 - Construction or expansion of a hazardous waste disposal facility?	No
Subp. 17 - Construction or expansion of a mixed municipal solid waste disposal, transfer, energy recovery, or compost facility?	No
Subp. 18A & Subp. 18B - Expansion, modification or replacement of a municipal sewage collection system?	No
Subp. 18C - Expansion or reconstruction of an existing municipal or domestic wastewater treatment facility?	No
Subp. 18D - Construction of a new municipal or domestic wastewater treatment facility?	No
Subp. 18E - Expansion or modification of an existing industrial process wastewater treatment facility?	No
Subp. 18F - Construction of a new industrial process wastewater treatment facility?	No
Subp. 25 - Incineration of wastes containing Polychlorinated Biphenyls (PCBs)?	No
Subp. 29 - Construction or expansion of an animal feedlot facility?	Yes
Subp. 29.1 - Are you constructing an animal feedlot facility with a capacity of 1,000 animal units or more?	No
Subp. 29.2 - Are you expanding an animal feedlot by 1,000 animal units or more?	Yes
A - Has a previous phase of this project been conducted in the last 3 years?	No
B - Are you planning an expansion or another phase of this project within the next 3 years?	No
C - Do you have other existing facilities or proposed projects that may affect the same geographic area as this project?	No

Facility Monitoring

Is your facility required to perform groundwater, surface water or surface discharge monitoring?	No

Nutrient Management Plan

A copy of the NutrientManagementPlanfor2026-2027.pdf generated on 12/11/2025 12:19:56 PM is included in the submittal.

Attachments

Permit Application Documents:

Attachment Type	File Name	Document Date
Verification of Good Neighbor Notice	20250606 WRD Good Neighbor Notice.pdf	12/11/2025

Manure Storage Documents:

Attachment Type	File Name	Document Date
Construction Plans and Specifications	Project Manual - Stamped.pdf	12/8/2025

Other Documents:

Attachment Type	File Name	Document Date
Supporting Application Documents	Concrete Manure Storage Specs.pdf	12/11/2025
Supporting Application Documents	WRD Expansion Supplemental Application Materials.pdf	12/11/2025
Stormwater Pollution Prevention Plan (SWPPP)	WRD SWPPP.pdf	12/11/2025
Emergency Response Plan	20250606 WRD Emergency Response Plan.pdf	12/11/2025
Supporting Application Documents	Regarding Stocking Density of Facility 3.pdf	12/11/2025
Supporting Application Documents	Geo Report West River Dairy.pdf	12/11/2025

Certification

I hereby certify that the design, construction, and operation of the facility will be in accordance with this application and plans, specifications, reports, and related communications approved by the MPCA, and in accordance with applicable permit conditions or regulations/standards of the MPCA.I also certify under penalty of law that this document and all attachments were prepared under my direction or supervision and the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

The person that signs this application must be one of the following:
A. For a corporation, a principal executive officer of at least the level of vice president
B. For a partnership, a general partner
C. For a sole proprietorship, the proprietor

Name of Signing Party:	Brady Janzen
Username of Signing Party:	BradyJanzen
Challenge Question:	Where is your favorite place to visit?
Challenge Question Answer:	*****
Certification Date and Time:	12/11/2025 12:32:47 PM

Payment

NPDES Individual Issuance Application Fee	$1,860.00
Environmental Review Fee	$4,650.00
Total	$6,510.00

Bank Transaction Confirmation ID: MNPPCA000113700

Attachment 23

Manure Management Plan (MMP)

MINNESOTA POLLUTION CONTROL AGENCY
520 Lafayette Road N St Paul MN 55155-4194

Nutrient Management Plan for 2026-2027
Created: 12/26/2025 11:03:04 AM

Feedlot Information
Feedlot name: Riverview LLP - West River Dairy
Permit type: NPDES General
Permit ID: MNG440498
Registration ID: 149-98140

This is a Nutrient Management Plan for a NPDES permit type.
The facility does not have less than 300 animal units.
If any manure is transferred I will provide a Manure Transfer Tracking Form to each recipient.

Table of Contents

Manure Source Summary

Description	Primary animal Head count	Storage type	Date last analyzed	Amount applied	Amount remaining	Manure transferred
Facility 10 (Settling Pond)	Dairy Cattle - milk >1000 lbs Head count: 1	Liquid	10/09/2025	3,139,500 gal	0 gal	No
Facility 101 (Proposed West Lagoon)	Dairy Cattle - milk >1000 lbs Head count: 10,998	Liquid	10/09/2025	27,022,000 gal	21,978,000 gal	Yes
Facility 102 (Proposed East Lagoon)	Dairy Cattle - milk >1000 lbs Head count: 1	Liquid	10/09/2025	-- gal	49,000,000 gal	Yes
Facility 105 (Proposed Stacking Pad)	Dairy Cattle - milk >1000 lbs Head count: 1	Solid	09/12/2025	6,160 ton	4,840 ton	Yes
Facility 106 (Proposed Leachate Lagoon)	--	Liquid	09/10/2025	30,000,020.8 gal	0 gal	No
Facility 11 (East Lagoon)	Dairy Cattle - milk >1000 lbs Head count: 1	Liquid	09/18/2025	-- gal	36,133,500 gal	Yes
Facility 12 (Middle Lagoon)	Dairy Cattle - milk >1000 lbs Head count: 1	Liquid	09/18/2025	15,536,500 gal	0 gal	No
Facility 13 (Stacking Pad)	Dairy Cattle - milk >1000 lbs Head count: 1	Solid	09/12/2025	-- ton	5,500 ton	Yes
Facility 18 (Leachate)	--	Liquid	09/10/2025	18,350,000.5 gal	-0.5 gal	No
Facility 9 (West Lagoon)	Dairy Cattle - milk >1000 lbs Head count: 7,851	Liquid	10/09/2025	-- gal	15,000,000 gal	Yes

Manure source: Facility 10 (Settling Pond)

Source information

Type of manure: animal waste

	Animal	Average weight	Number of animals	Time in facility
Primary animal	Dairy Cattle - milk >1000 lbs	1,200 lbs	1	365 day/year

Storage information

Storage type	Capacity	Storage length
Liquid	3,442,440 gal	448 day

Application

Spreader type	Determine load volume or tonnage	Method of application rate calibration
Towed hose	Commercial applicator	Flow meter

Analysis

Sampling frequency	Sampling method	Basis for analysis	Date last analyzed
once per year	Well-agitated single sample	This year's sample	10/09/2025

Nutrient content

	Total nitrogen (N)	Inorganic nitrogen (N)	Organic nitrogen (N)	Total phosphorus (P2O5)	Total potassium (K20)
Expected	22 lb/1000gal	11 lb/1000gal	11 lb/1000gal	9.1 lb/1000gal	28 lb/1000gal

Annual generation

Estimated manure produced: 5,851.7 gal/yr

	Annual production	Manure received	Total nitrogen (N)	Annual inorganic nitrogen (N) produced	Annual organic nitrogen (N) produced	Annual phosphorus (P2O5) produced	Annual potassium (K20) produced
Anticipated	3,139,500 gal/yr	--	69,069 lb	34,535 lb	34,535 lb	28,569 lb	87,906 lb

Manure transfer plan

Manure is not transferred

Notes

Manure source: Facility 101 (Proposed West Lagoon)

Source information

Type of manure: animal waste

	Animal	Average weight	Number of animals	Time in facility
Primary animal	Dairy Cattle - milk >1000 lbs	1,200 lbs	10,998	365 day/year

Storage information

Storage type	Capacity	Storage length
Liquid	58,672,434 gal	448 day

Application

Spreader type	Determine load volume or tonnage	Method of application rate calibration
Towed hose	Commercial applicator	Flow meter

Analysis

Sampling frequency	Sampling method	Basis for analysis	Date last analyzed
once per year	Well-agitated single sample	This year's sample	10/09/2025

Nutrient content

	Total nitrogen (N)	Inorganic nitrogen (N)	Organic nitrogen (N)	Total phosphorus (P2O5)	Total potassium (K20)
Expected	23 lb/1000gal	13.8 lb/1000gal	9.2 lb/1000gal	9.1 lb/1000gal	26 lb/1000gal

Annual generation

Estimated manure produced: 64,356,776.6 gal/yr

	Annual production	Manure received	Total nitrogen (N)	Annual inorganic nitrogen (N) produced	Annual organic nitrogen (N) produced	Annual phosphorus (P2O5) produced	Annual potassium (K20) produced
Anticipated	49,000,000 gal/yr	--	1,127,000 lb	676,200 lb	450,800 lb	445,900 lb	1,274,000 lb

Manure transfer plan

	Amount transferred	Available transfer acres
Expected	21,978,000 gal	2,100 acre

Notes

Manure source: Facility 102 (Proposed East Lagoon)

Source information

Type of manure: animal waste

	Animal	Average weight	Number of animals	Time in facility
Primary animal	Dairy Cattle - milk >1000 lbs	1,200 lbs	1	365 day/year

Storage information

Storage type	Capacity	Storage length
Liquid	58,672,434 gal	448 day

Application

Spreader type	Determine load volume or tonnage	Method of application rate calibration
Towed hose	Commercial applicator	Flow meter

Analysis

Sampling frequency	Sampling method	Basis for analysis	Date last analyzed
once per year	Well-agitated single sample	This year's sample	10/09/2025

Nutrient content

	Total nitrogen (N)	Inorganic nitrogen (N)	Organic nitrogen (N)	Total phosphorus (P2O5)	Total potassium (K20)
Expected	23 lb/1000gal	13.8 lb/1000gal	9.2 lb/1000gal	9.1 lb/1000gal	26 lb/1000gal

Annual generation

Estimated manure produced: 5,851.7 gal/yr

	Annual production	Manure received	Total nitrogen (N)	Annual inorganic nitrogen (N) produced	Annual organic nitrogen (N) produced	Annual phosphorus (P2O5) produced	Annual potassium (K20) produced
Anticipated	49,000,000 gal/yr	--	1,127,000 lb	676,200 lb	450,800 lb	445,900 lb	1,274,000 lb

Manure transfer plan

	Amount transferred	Available transfer acres
Expected	49,000,000 gal	4,800 acre

Notes

Manure source: Facility 105 (Proposed Stacking Pad)

Source information

Type of manure: animal waste

	Animal	Average weight	Number of animals	Time in facility
Primary animal	Dairy Cattle - milk >1000 lbs	1,200 lbs	1	365 day/year

Storage information

Storage type	Capacity	Storage length
Solid	--	365 day

Application

Spreader type	Determine load volume or tonnage	Method of application rate calibration
Solids spreader	Commercial applicator	Loads applied per field

Analysis

Sampling frequency	Sampling method	Basis for analysis	Date last analyzed
once per year	Stockpile single sample	This year's sample	09/12/2025

Nutrient content

	Total nitrogen (N)	Inorganic nitrogen (N)	Organic nitrogen (N)	Total phosphorus (P2O5)	Total potassium (K20)
Expected	12 lb/ton	1.8 lb/ton	10.2 lb/ton	9.2 lb/ton	4.8 lb/ton

Annual generation

Estimated manure produced: 17.7 ton/yr

	Annual production	Manure received	Total nitrogen (N)	Annual inorganic nitrogen (N) produced	Annual organic nitrogen (N) produced	Annual phosphorus (P2O5) produced	Annual potassium (K20) produced
Anticipated	11,000 ton/yr	--	132,000 lb	19,800 lb	112,200 lb	101,200 lb	52,800 lb

Manure transfer plan

	Amount transferred	Available transfer acres
Expected	4,840 ton	240 acre

Notes

Manure source: Facility 106 (Proposed Leachate Lagoon)

Source information
Type of manure: wastewater

Storage information

Storage type	Capacity	Storage length
Liquid	30,816,149 gal	448 day

Application

Spreader type	Determine load volume or tonnage	Method of application rate calibration
Towed hose	Commercial applicator	Flow meter

Analysis

Sampling frequency	Sampling method	Basis for analysis	Date last analyzed
once per year	Well-agitated single sample	This year's sample	09/10/2025

Nutrient content

	Total nitrogen (N)	Inorganic nitrogen (N)	Organic nitrogen (N)	Total phosphorus (P2O5)	Total potassium (K20)
Expected	1 lb/1000gal	0.6 lb/1000gal	0.4 lb/1000gal	0.2 lb/1000gal	1.7 lb/1000gal

Annual generation

	Annual production	Manure received	Total nitrogen (N)	Annual inorganic nitrogen (N) produced	Annual organic nitrogen (N) produced	Annual phosphorus (P2O5) produced	Annual potassium (K20) produced
Anticipated	30,000,020.8 gal/yr	--	30,000 lb	18,000 lb	12,000 lb	6,000 lb	51,000 lb

Manure transfer plan
Manure is not transferred

Notes

Manure source: Facility 11 (East Lagoon)

Source information

Type of manure: animal waste

	Animal	Average weight	Number of animals	Time in facility
Primary animal	Dairy Cattle - milk >1000 lbs	1,200 lbs	1	365 day/year

Storage information

Storage type	Capacity	Storage length
Liquid	39,212,509 gal	448 day

Application

Spreader type	Determine load volume or tonnage	Method of application rate calibration
Towed hose	Commercial applicator	Flow meter

Analysis

Sampling frequency	Sampling method	Basis for analysis	Date last analyzed
once per year	Well-agitated single sample	This year's sample	09/18/2025

Nutrient content

	Total nitrogen (N)	Inorganic nitrogen (N)	Organic nitrogen (N)	Total phosphorus (P2O5)	Total potassium (K20)
Expected	23 lb/1000gal	13.8 lb/1000gal	9.2 lb/1000gal	9.1 lb/1000gal	26 lb/1000gal

Annual generation

Estimated manure produced: 5,851.7 gal/yr

	Annual production	Manure received	Total nitrogen (N)	Annual inorganic nitrogen (N) produced	Annual organic nitrogen (N) produced	Annual phosphorus (P2O5) produced	Annual potassium (K20) produced
Anticipated	36,133,500 gal/yr	--	831,071 lb	498,642 lb	332,428 lb	328,815 lb	939,471 lb

Manure transfer plan

	Amount transferred	Available transfer acres
Expected	36,133,500 gal	3,600 acre

Notes

Manure source: Facility 12 (Middle Lagoon)

Source information

Type of manure: animal waste

	Animal	Average weight	Number of animals	Time in facility
Primary animal	Dairy Cattle - milk >1000 lbs	1,200 lbs	1	365 day/year

Storage information

Storage type	Capacity	Storage length
Liquid	22,361,367 gal	448 day

Application

Spreader type	Determine load volume or tonnage	Method of application rate calibration
Towed hose	Commercial applicator	Flow meter

Analysis

Sampling frequency	Sampling method	Basis for analysis	Date last analyzed
once per year	Well-agitated single sample	This year's sample	09/18/2025

Nutrient content

	Total nitrogen (N)	Inorganic nitrogen (N)	Organic nitrogen (N)	Total phosphorus (P2O5)	Total potassium (K20)
Expected	23 lb/1000gal	13.8 lb/1000gal	9.2 lb/1000gal	9.1 lb/1000gal	26 lb/1000gal

Annual generation

Estimated manure produced: 5,851.7 gal/yr

	Annual production	Manure received	Total nitrogen (N)	Annual inorganic nitrogen (N) produced	Annual organic nitrogen (N) produced	Annual phosphorus (P2O5) produced	Annual potassium (K20) produced
Anticipated	15,536,500 gal/yr	--	357,340 lb	214,404 lb	142,936 lb	141,382 lb	403,949 lb

Manure transfer plan

Manure is not transferred

Notes

Manure source: Facility 13 (Stacking Pad)

Source information

Type of manure: animal waste

	Animal	Average weight	Number of animals	Time in facility
Primary animal	Dairy Cattle - milk >1000 lbs	1,200 lbs	1	365 day/year

Storage information

Storage type	Capacity	Storage length
Solid	--	365 day

Application

Spreader type	Determine load volume or tonnage	Method of application rate calibration
Solids spreader	Commercial applicator	Loads applied per field

Analysis

Sampling frequency	Sampling method	Basis for analysis	Date last analyzed
once per year	Stockpile single sample	This year's sample	09/12/2025

Nutrient content

	Total nitrogen (N)	Inorganic nitrogen (N)	Organic nitrogen (N)	Total phosphorus (P2O5)	Total potassium (K20)
Expected	12 lb/ton	1.8 lb/ton	10.2 lb/ton	9.2 lb/ton	4.8 lb/ton

Annual generation

Estimated manure produced: 17.7 ton/yr

	Annual production	Manure received	Total nitrogen (N)	Annual inorganic nitrogen (N) produced	Annual organic nitrogen (N) produced	Annual phosphorus (P2O5) produced	Annual potassium (K20) produced
Anticipated	5,500 ton/yr	--	66,000 lb	9,900 lb	56,100 lb	50,600 lb	26,400 lb

Manure transfer plan

	Amount transferred	Available transfer acres
Expected	5,500 ton	300 acre

Notes

Manure source: Facility 18 (Leachate)

Source information
Type of manure: wastewater

Storage information

Storage type	Capacity	Storage length
Liquid	20,830,941 gal	448 day

Application

Spreader type	Determine load volume or tonnage	Method of application rate calibration
Towed hose	Commercial applicator	Flow meter

Analysis

Sampling frequency	Sampling method	Basis for analysis	Date last analyzed
once per year	Well-agitated single sample	This year's sample	09/10/2025

Nutrient content

	Total nitrogen (N)	Inorganic nitrogen (N)	Organic nitrogen (N)	Total phosphorus (P2O5)	Total potassium (K20)
Expected	1 lb/1000gal	0.6 lb/1000gal	0.4 lb/1000gal	0.2 lb/1000gal	1.7 lb/1000gal

Annual generation

	Annual production	Manure received	Total nitrogen (N)	Annual inorganic nitrogen (N) produced	Annual organic nitrogen (N) produced	Annual phosphorus (P2O5) produced	Annual potassium (K20) produced
Anticipated	18,350,000 gal/yr	--	18,350 lb	11,010 lb	7,340 lb	3,670 lb	31,195 lb

Manure transfer plan
Manure is not transferred

Notes

Manure source: Facility 9 (West Lagoon)

Source information

Type of manure: animal waste

	Animal	Average weight	Number of animals	Time in facility
Primary animal	Dairy Cattle - milk >1000 lbs	1,200 lbs	7,851	365 day/year

Storage information

Storage type	Capacity	Storage length
Liquid	15,372,238 gal	448 day

Application

Spreader type	Determine load volume or tonnage	Method of application rate calibration
Towed hose	Commercial applicator	Flow meter

Analysis

Sampling frequency	Sampling method	Basis for analysis	Date last analyzed
once per year	Well-agitated single sample	This year's sample	10/09/2025

Nutrient content

	Total nitrogen (N)	Inorganic nitrogen (N)	Organic nitrogen (N)	Total phosphorus (P2O5)	Total potassium (K20)
Expected	23 lb/1000gal	13.8 lb/1000gal	9.2 lb/1000gal	9.1 lb/1000gal	26 lb/1000gal

Annual generation

Estimated manure produced: 45,941,539.7 gal/yr

	Annual production	Manure received	Total nitrogen (N)	Annual inorganic nitrogen (N) produced	Annual organic nitrogen (N) produced	Annual phosphorus (P2O5) produced	Annual potassium (K20) produced
Anticipated	15,000,000 gal/yr	--	345,000 lb	207,000 lb	138,000 lb	136,500 lb	390,000 lb

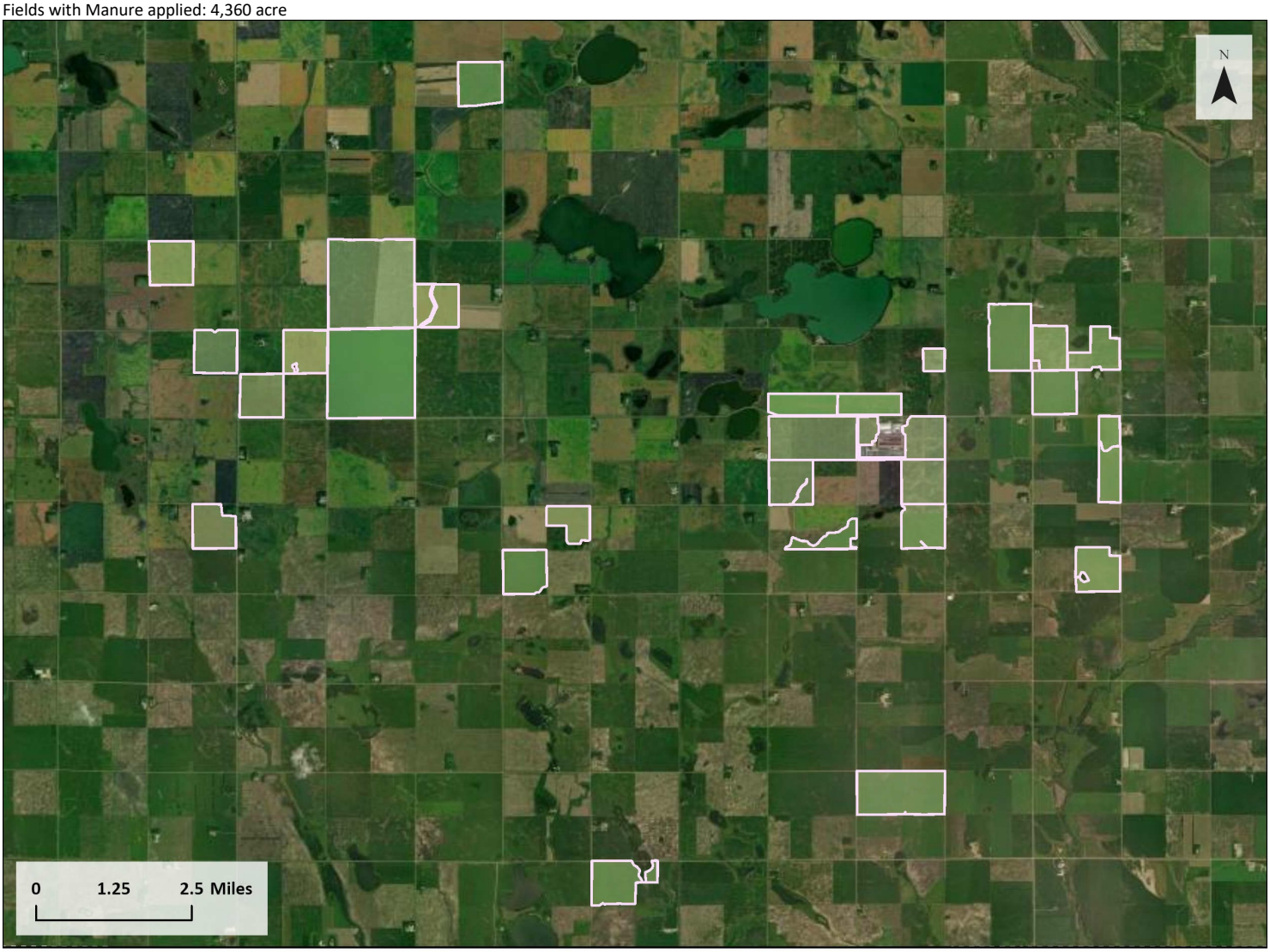
Manure transfer plan

	Amount transferred	Available transfer acres
Expected	15,000,000 gal	1,400 acre

Notes

Field Map Summary

Total Farmable Acreage: 5,240 acre
Fields with Manure applied: 4,360 acre



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Map legend

Drinking Water Features
- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features
- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain
- DFIRM, Modernized and Unmodernized Data

Water Bodies
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways
- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils
- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%
- less than 6%
- greater than 6%
- Field

See Sensitive Features Appendix for more information.

Field Summary

Total farmable acreage: 5,240

Field name/ID *over application	Crop grown	Crop most recently harvested	Manure application planned	Winter application	Sensitive features	Second year manure N credit (lb/ac)	Max N to apply after all credits (lb/ac)	Total N applied (lb/ac)	Year of most recent soil test Test method	P field average (ppm)	Max Phosphorus Allowable (lb/ac)
2009	Corn-Silage	Corn-Field	Yes	No	Yes	67	128	127	2022 Olsen	17	--
2011	Corn-Silage	Corn-Silage	Yes	No	No	64	131	127	2022 Olsen	18	--
2012	Corn-Silage	Corn-Silage	Yes	No	No	64	131	127	2022 Olsen	18	--
2020	Corn-Silage	Corn-Silage	Yes	No	Yes	--	195	190	2023 Olsen	32	--
2022	Alfalfa	Alfalfa	No	No	Yes	--	--	0	2022 Olsen	21	--
2029	Corn-Silage	Corn-Silage	Yes	No	Yes	68	127	127	2022 Olsen	24	--
2047	Corn-Silage	Corn-Silage	Yes	No	Yes	68	127	127	2022 Olsen	17	--
2054	Corn-Silage	Corn-Silage	Yes	No	Yes	76	119	115	2022 Olsen	27	--
2055	Corn-Silage	Corn-Silage	Yes	No	No	71	124	121	2022 Olsen	27	--
2056	Corn-Silage	Corn-Silage	No	No	Yes	65	130	0	2022 Olsen	50	--
2057	Alfalfa	Alfalfa	No	No	Yes	83	--	0	2024 Olsen	26	--
2058	Alfalfa	Alfalfa	No	No	Yes	136	--	0	2022 Olsen	9	--
2061	Alfalfa	Alfalfa	Yes	No	Yes	31	--	95	2025 Olsen	15	--
2064	Corn-Silage	Corn-Silage	Yes	No	Yes	66	129	127	2022 Olsen	24	--
2065	Corn-Silage	Corn-Silage	Yes	No	Yes	66	129	127	2022 Olsen	24	--
2068	Corn-Silage	Corn-Silage	Yes	No	Yes	--	195	190	2022 Olsen	16	--
2072	Corn-Silage	Corn-Silage	Yes	No	Yes	--	195	196	2022 Olsen	10	--
4000	Corn-Silage	Corn-Silage	Yes	No	Yes	--	195	190	2023 Olsen	11	--
4001	Corn-Silage	Corn-Field	Yes	No	Yes	--	195	190	2023	10	--

Field name/ID *over application	Crop grown	Crop most recently harvested	Manure application planned	Winter application	Sensitive features	Second year manure N credit (lb/ac)	Max N to apply after all credits (lb/ac)	Total N applied (lb/ac)	Year of most recent soil test Test method	P field average (ppm)	Max Phosphorus Allowable (lb/ac)
									Olsen		
4003	Corn-Silage	Soybeans	Yes	No	Yes	--	150	150	2023 Olsen	9	--
4004	Corn-Silage	Corn-Silage	Yes	No	Yes	--	80	72	2023 Olsen	9	--
4005	Corn-Silage	Soybeans	Yes	No	Yes	--	150	150	2023 Olsen	14	--
4007	Corn-Silage	Soybeans	Yes	No	Yes	--	150	150	2023 Olsen	9	--
4008	Corn-Silage	Corn-Silage	No	No	Yes	--	195	0	2023 Olsen	18	--
4012	Corn-Silage	Soybeans	Yes	No	Yes	--	150	150	2023 Olsen	9	--
4016	Corn-Silage	Soybeans	Yes	No	Yes	--	150	150	2023 Olsen	11	--
4018	Corn-Silage	Corn-Field	Yes	No	Yes	--	195	194	2024 Olsen	17	--
4019	Corn-Silage	Corn-Field	Yes	No	Yes	--	195	194	2023 Olsen	15	--
4023	Corn-Silage	Corn-Field	Yes	No	Yes	--	195	190	2023 Olsen	16	--

Field name/ID: 2009

Field group name:
Farmable acreage: 234
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Lake Tile Intake Non-Public Waters Wetland (uncultivated)	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	133 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil
A phosphorus application plan is not required.

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	17	Med/high (3% and greater)

Will manure be applied within 300 ft of any lake, stream, intermittent stream, public waters wetland, or un-bermed drainage ditch? No

Are average grid sample results less than or equal to 16 Olsen / 21 Bray within 300 ft of all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? No

Does a 50 ft (100 ft for lakes and streams) non-manured, permanent, grassed buffer exist along all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? Yes

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Field	Corn-Silage	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 10 (Settling Pond)	Dairy Cattle - milk >1000 lbs	24 lb/1000gal	12 lb/1000gal	12 lb/1000gal	11,195 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	67 lb/ac	--	128 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 234

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 10 (Settling Pond)	Injection - knife	11,500 gal/ac	127 lb/ac	84 lb/ac
Total nutrients from manure			127 lb/ac	84 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 127 lb/ac	Total phosphorus applied: 84 lb/ac
Nitrogen needs/removal: 128 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -1 lb/ac (deficit)	Balance: -11 lb/ac (deficit)

Notes
There are no notes.

Field name: 2009

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Map legend

- Township and range
- Section

Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Lake Tile Intake Non-Public Waters Wetland (uncultivated)

Field name/ID: 2011

Field group name:
Farmable acreage: 122
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
No sensitive features were identified.	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	117 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil
A phosphorus application plan is not required.

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	18	Med/high (3% and greater)

Will manure be applied within 300 ft of any lake, stream, intermittent stream, public waters wetland, or un-bermed drainage ditch? Yes

Are average grid sample results less than or equal to 16 Olsen / 21 Bray within 300 ft of all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? No

Does a 50 ft (100 ft for lakes and streams) non-manured, permanent, grassed buffer exist along all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? Yes

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Soybeans

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 12 (Middle Lagoon)	Dairy Cattle - milk >1000 lbs	24 lb/1000gal	12 lb/1000gal	12 lb/1000gal	10,593.2 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	64 lb/ac	--	131 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 122

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 12 (Middle Lagoon)	Injection - knife	11,000 gal/ac	127 lb/ac	80 lb/ac
Total nutrients from manure			127 lb/ac	80 lb/ac

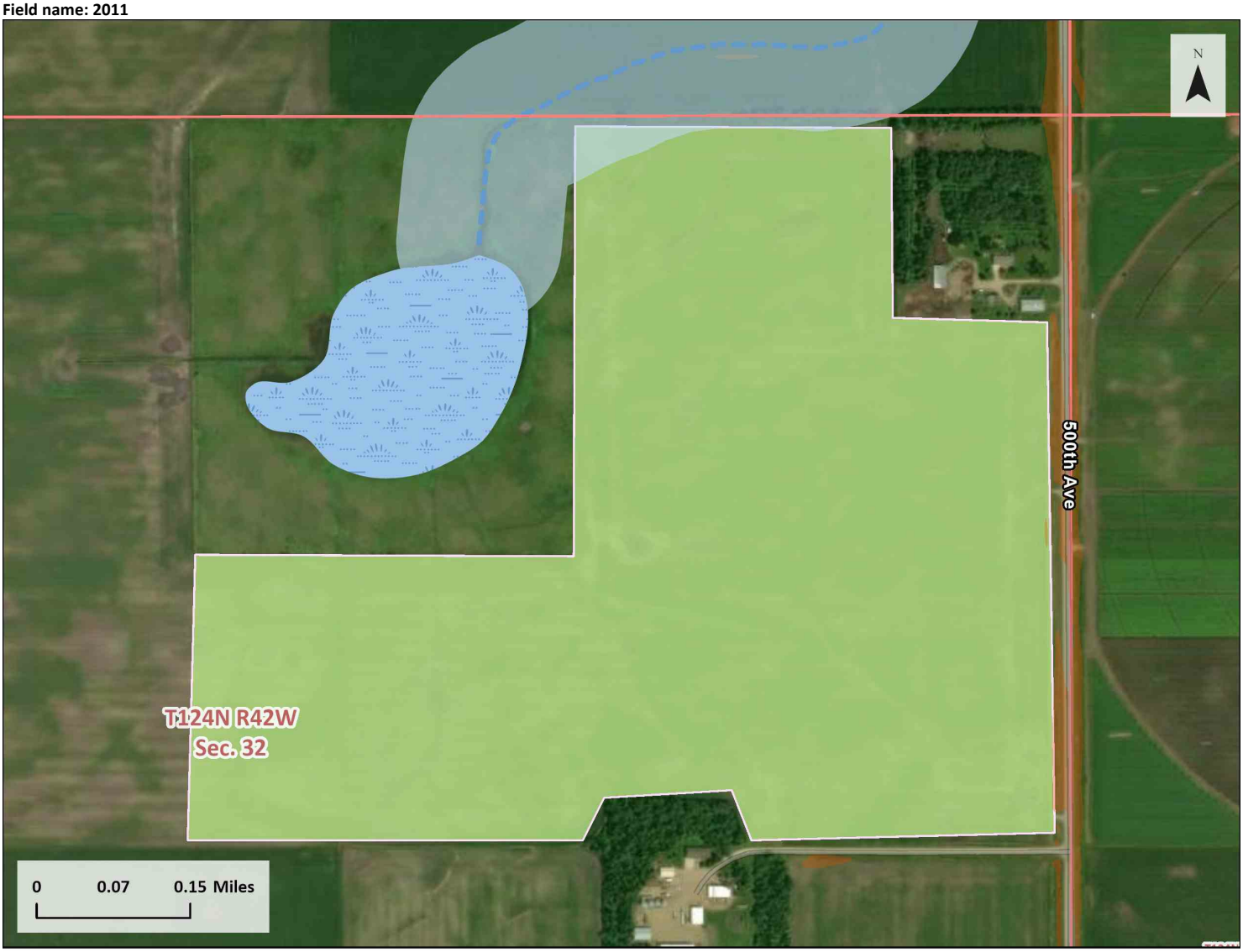
No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 127 lb/ac	Total phosphorus applied: 80 lb/ac
Nitrogen needs/removal: 131 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -4 lb/ac (deficit)	Balance: -15 lb/ac (deficit)

Notes
There are no notes.

Field name: 2011



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Map legend

- Township and range
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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
No sensitive features were identified.

Field name/ID: 2012

Field group name:
Farmable acreage: 120
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
No sensitive features were identified.	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	--	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	18	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Soybeans

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 12 (Middle Lagoon)	Dairy Cattle - milk >1000 lbs	24 lb/1000gal	12 lb/1000gal	12 lb/1000gal	10,593.2 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	64 lb/ac	--	131 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 112

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 12 (Middle Lagoon)	Injection - knife	11,000 gal/ac	127 lb/ac	80 lb/ac
Total nutrients from manure			127 lb/ac	80 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus

Nitrogen	Phosphorus
Total nitrogen applied: 127 lb/ac	Total phosphorus applied: 80 lb/ac
Nitrogen needs/removal: 131 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -4 lb/ac (deficit)	Balance: -15 lb/ac (deficit)

Notes
There are no notes.

Field name: 2012

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Map legend

- Township and range
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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
No sensitive features were identified.

Field name/ID: 2020

Field group name: Proposed Expansion
Farmable acreage: 154
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Well	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	--	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	32	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Corn-Silage

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	--	--	195 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 154

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 101 (Proposed West Lagoon)	Injection - knife	16,500 gal/ac	190 lb/ac	120 lb/ac
Total nutrients from manure			190 lb/ac	120 lb/ac

No fertilizer applied.

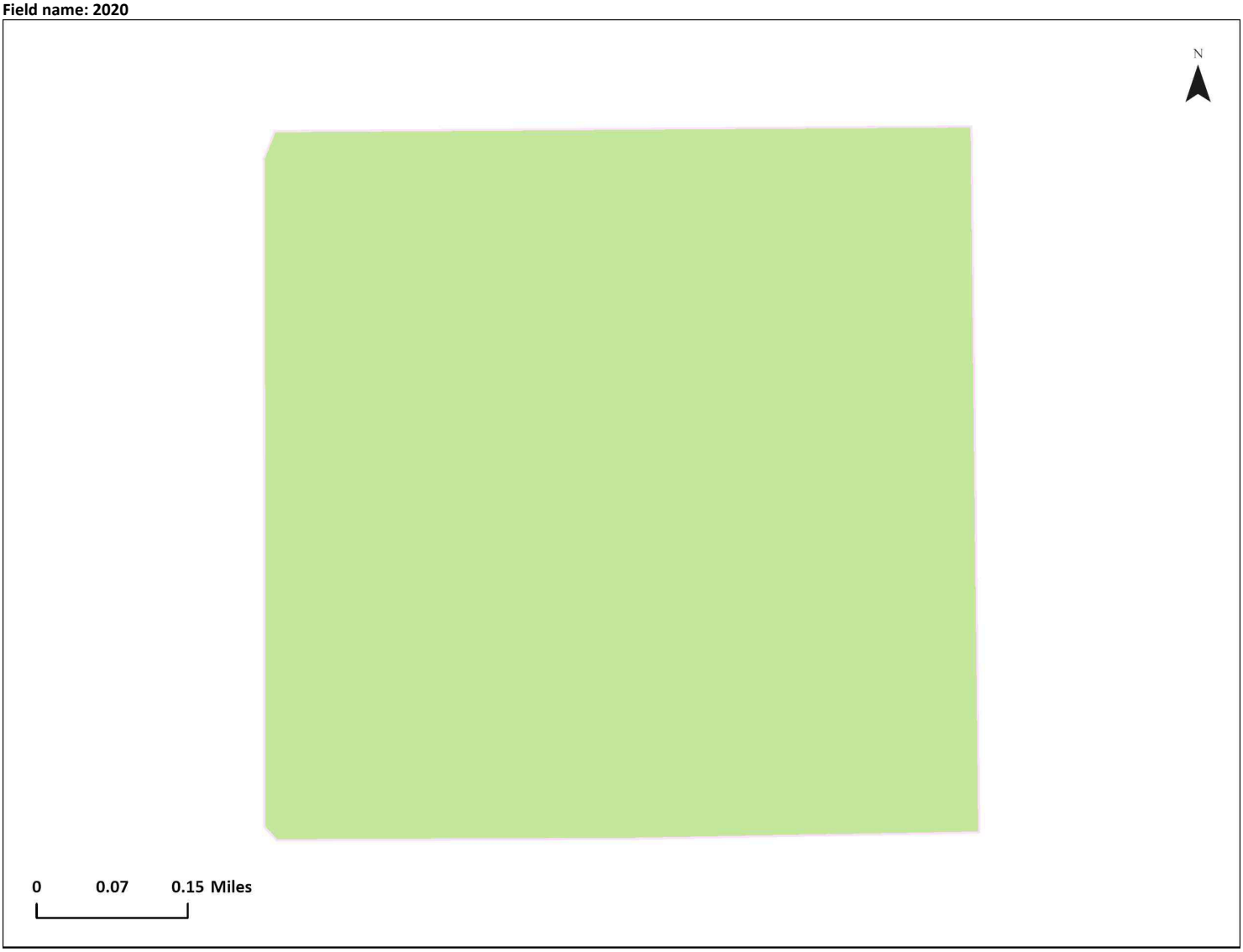
Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 190 lb/ac	Total phosphorus applied: 120 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 195 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -5 lb/ac (deficit)	Balance: 25 lb/ac (surplus)

Notes
There are no notes.

Field name: 2020



Basemap Credits:

Map legend

- Township and range
- Section

Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Well

Field name/ID: 2022

Field group name:
Farmable acreage: 147
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Intermittent Stream	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	0 feet	--	No	--	--

Planning

Irrigation
The field is not irrigated

Soil
A phosphorus application plan is not required.

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	21	Med/high (3% and greater)

Will manure be applied within 300 ft of any lake, stream, intermittent stream, public waters wetland, or un-bermed drainage ditch? No

Are average grid sample results less than or equal to 16 Olsen / 21 Bray within 300 ft of all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? No

Does a 50 ft (100 ft for lakes and streams) non-manured, permanent, grassed buffer exist along all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? No

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Alfalfa	7 ton	--	Alfalfa	Alfalfa	Alfalfa

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
--	--	--	--	--	357 lb/ac

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	76 lb/ac	--

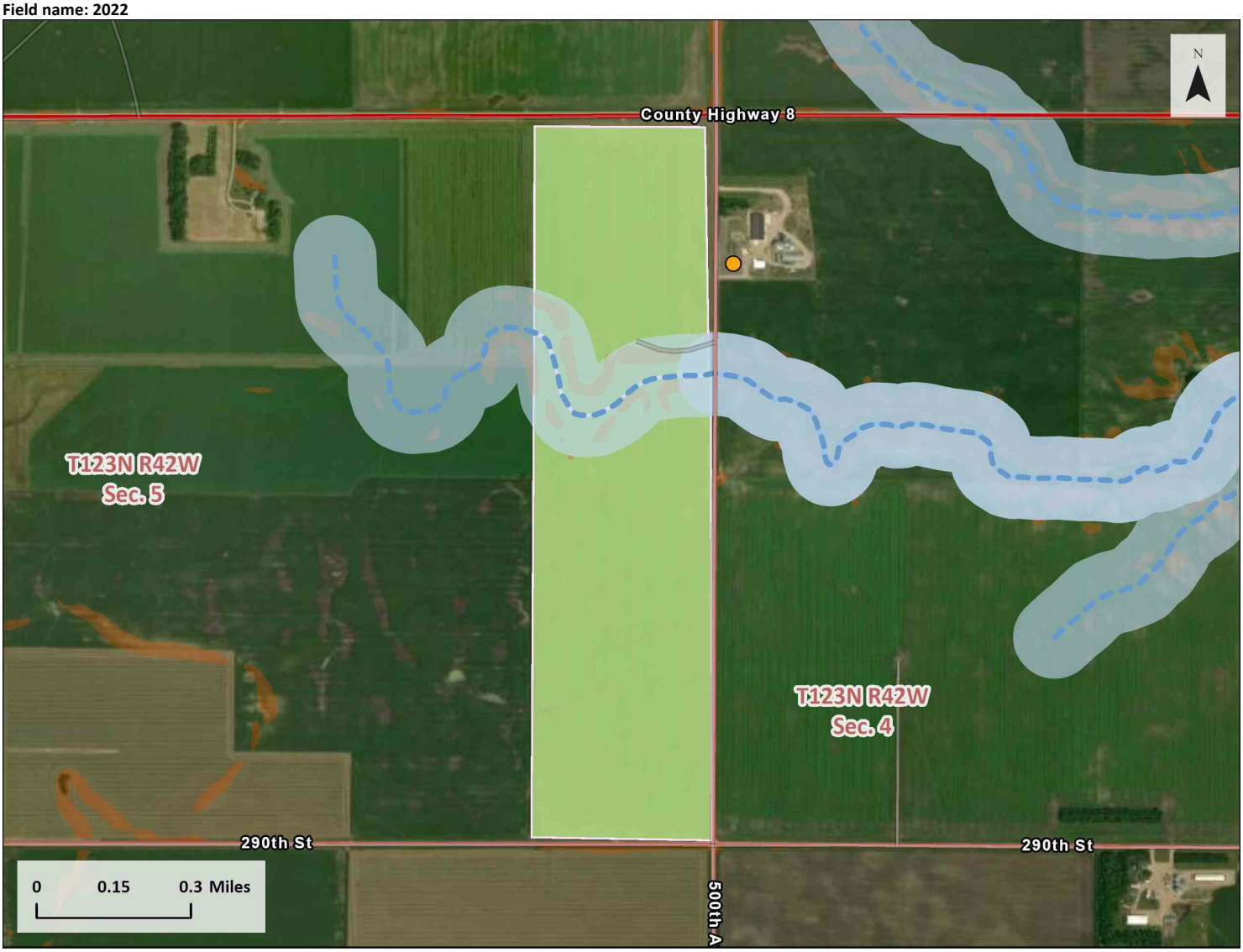
Nutrient application
Acreage after setback: 147

No manure applied.

No fertilizer applied.

Notes
There are no notes.

Field name: 2022



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Map legend

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Intermittent Stream

Field name/ID: 2029

Field group name:
Farmable acreage: 147
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Intermittent Stream Tile Intake Non-Public Waters Wetland (uncultivated)	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	30 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil
A phosphorus application plan is not required.

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	24	Med/high (3% and greater)

Will manure be applied within 300 ft of any lake, stream, intermittent stream, public waters wetland, or un-bermed drainage ditch? Yes

Are average grid sample results less than or equal to 16 Olsen / 21 Bray within 300 ft of all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? No

Does a 50 ft (100 ft for lakes and streams) non-manured, permanent, grassed buffer exist along all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? Yes

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 9 (West Lagoon)	Dairy Cattle - milk >1000 lbs	22 lb/1000gal	13.8 lb/1000gal	8.2 lb/1000gal	12,373 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	68 lb/ac	--	127 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 147

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 12 (Middle Lagoon)	Injection - knife	11,000 gal/ac	127 lb/ac	80 lb/ac
Total nutrients from manure			127 lb/ac	80 lb/ac

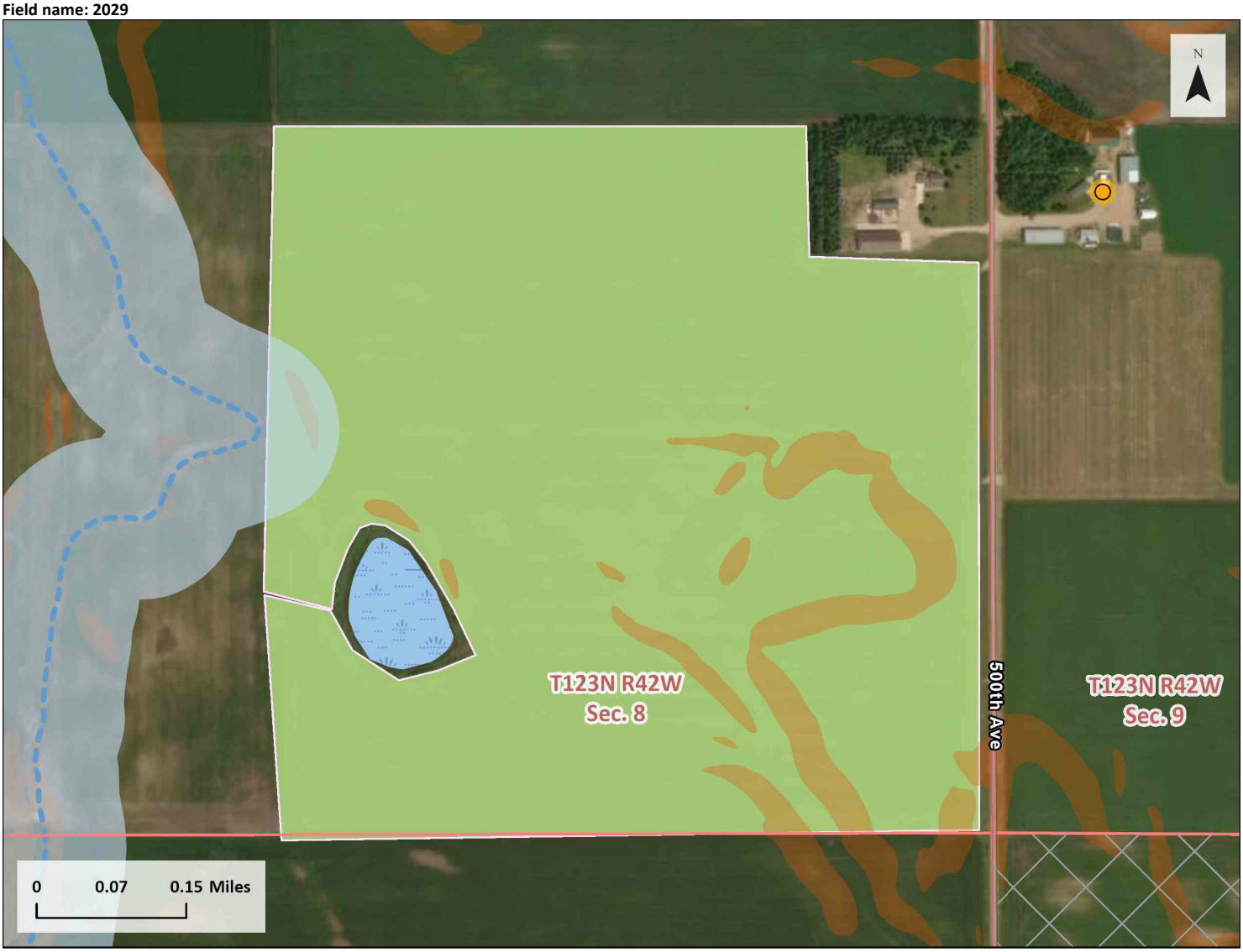
No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 127 lb/ac	Total phosphorus applied: 80 lb/ac
Nitrogen needs/removal: 127 lb/ac	Phosphorus removed: 95 lb/ac
Balance: 0 lb/ac	Balance: -15 lb/ac (deficit)

Notes
There are no notes.

Field name: 2029



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Map legend

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Intermittent Stream Tile Intake Non-Public Waters Wetland (uncultivated)

Field name/ID: 2047

Field group name:
Farmable acreage: 39
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	--	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	17	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 12 (Middle Lagoon)	Dairy Cattle - milk >1000 lbs	24 lb/1000gal	12 lb/1000gal	12 lb/1000gal	11,339 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	68 lb/ac	--	127 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 39

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 10 (Settling Pond)	Injection - knife	11,500 gal/ac	127 lb/ac	84 lb/ac
Total nutrients from manure			127 lb/ac	84 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 127 lb/ac	Total phosphorus applied: 84 lb/ac
Nitrogen needs/removal: 127 lb/ac	Phosphorus removed: 95 lb/ac
Balance: 0 lb/ac	Balance: -11 lb/ac (deficit)

Notes
There are no notes.

Field name: 2047

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Map legend

- Township and range
- Section

Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
Tile Intake

Field name/ID: 2054

Field group name:
Farmable acreage: 110
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Coarse-Textured Soil	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	--	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	27	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 12 (Middle Lagoon)	Dairy Cattle - milk >1000 lbs	24 lb/1000gal	12 lb/1000gal	12 lb/1000gal	12,616 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	76 lb/ac	--	119 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 110

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 12 (Middle Lagoon)	Injection - knife	10,000 gal/ac	115 lb/ac	73 lb/ac
Total nutrients from manure			115 lb/ac	73 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 115 lb/ac	Total phosphorus applied: 73 lb/ac
Nitrogen needs/removal: 119 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -4 lb/ac (deficit)	Balance: -22 lb/ac (deficit)

Notes
There are no notes.

Field name: 2054

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Map legend

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Coarse-Textured Soil

Field name/ID: 2055

Field group name:
Farmable acreage: 114
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
No sensitive features were identified.	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	135 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	27	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 9 (West Lagoon)	Dairy Cattle - milk >1000 lbs	22 lb/1000gal	13.8 lb/1000gal	8.2 lb/1000gal	12,920 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	71 lb/ac	--	124 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 114

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 12 (Middle Lagoon)	Injection - knife	10,500 gal/ac	121 lb/ac	76 lb/ac
Total nutrients from manure			121 lb/ac	76 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 121 lb/ac	Total phosphorus applied: 76 lb/ac
Nitrogen needs/removal: 124 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -3 lb/ac (deficit)	Balance: -19 lb/ac (deficit)

Notes
There are no notes.

Field name: 2055

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
No sensitive features were identified.

Field name/ID: 2056

Field group name:
Farmable acreage: 139
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	--	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	50	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 12 (Middle Lagoon)	Dairy Cattle - milk >1000 lbs	24 lb/1000gal	12 lb/1000gal	12 lb/1000gal	10,864.8 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	65 lb/ac	--	130 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 139

No manure applied.

No fertilizer applied.

Notes
No manure application planned for 26-27 pending construction timeline, this field will be used for the new facilities.

Field name: 2056

Basemap Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

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Drinking Water Features
- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features
- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain
- DFIRM, Modernized and Unmodernized Data

Water Bodies
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways
- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils
- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%
- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
Tile Intake

Field name/ID: 2057

Field group name:
Farmable acreage: 53
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	--	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2024	Olsen	26	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Alfalfa	7 ton	--	Alfalfa	Corn-Silage	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 12 (Middle Lagoon)	Dairy Cattle - milk >1000 lbs	24 lb/1000gal	12 lb/1000gal	12 lb/1000gal	13,781.7 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
--	--	83 lb/ac	--	--	274 lb/ac

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	76 lb/ac	--

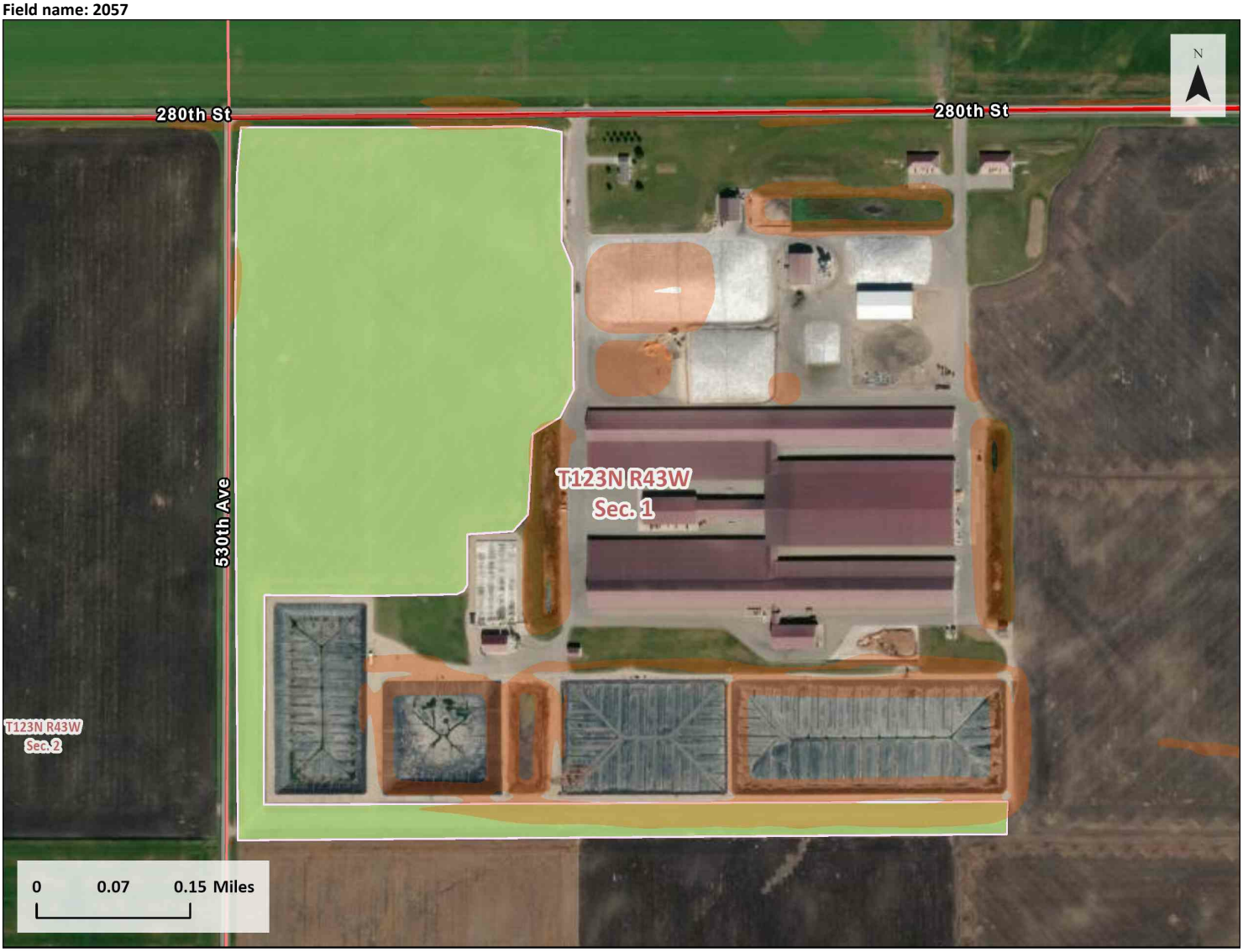
Nutrient application
Acreage after setback: 53

No manure applied.

No fertilizer applied.

Notes
There are no notes.

Field name: 2057



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Drinking Water Features
- Domestic Wells, Verified and Unverified Locations
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- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features
- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain
- DFIRM, Modernized and Unmodernized Data

Water Bodies
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways
- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils
- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%
- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
Tile Intake

Field name/ID: 2058

Field group name:
Farmable acreage: 310
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
Yes	554 feet	0%	Yes	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	9	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Alfalfa	7 ton	--	Alfalfa	Corn-Silage	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 9 (West Lagoon)	Dairy Cattle - milk >1000 lbs	22 lb/1000gal	13.8 lb/1000gal	8.2 lb/1000gal	15,763.6 gal/ac	Injection - knife
Facility 9 (West Lagoon)	Dairy Cattle - milk >1000 lbs	22 lb/1000gal	13.8 lb/1000gal	8.2 lb/1000gal	4,433.3 gal/ac	Broadcast - incorporation 4 days or later
Facility 9 (West Lagoon)	Dairy Cattle - milk >1000 lbs	22 lb/1000gal	13.8 lb/1000gal	8.2 lb/1000gal	4,544.1 gal/ac	Broadcast - incorporation 4 days or later

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
--	--	136 lb/ac	--	--	221 lb/ac

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
57 lb/ac	76 lb/ac	--

Nutrient application
Acreage after setback: 310

No manure applied.

No fertilizer applied.

Notes
There are no notes.

Field name: 2058

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
Tile Intake

Field name/ID: 2061

Field group name:
Farmable acreage: 155
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Intermittent Stream	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	1 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2025	Olsen	15	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Alfalfa	7 ton	--	Alfalfa	Alfalfa	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 18 (Leachate)	--	0.8 lb/1000gal	0.6 lb/1000gal	0.2 lb/1000gal	156,193.7 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
--	--	31 lb/ac	--	--	326 lb/ac

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
8 lb/ac	76 lb/ac	--

Nutrient application
Acreage after setback: 155

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 18 (Leachate)	Injection - knife	118,387.1 gal/ac	95 lb/ac	19 lb/ac
Total nutrients from manure			95 lb/ac	19 lb/ac

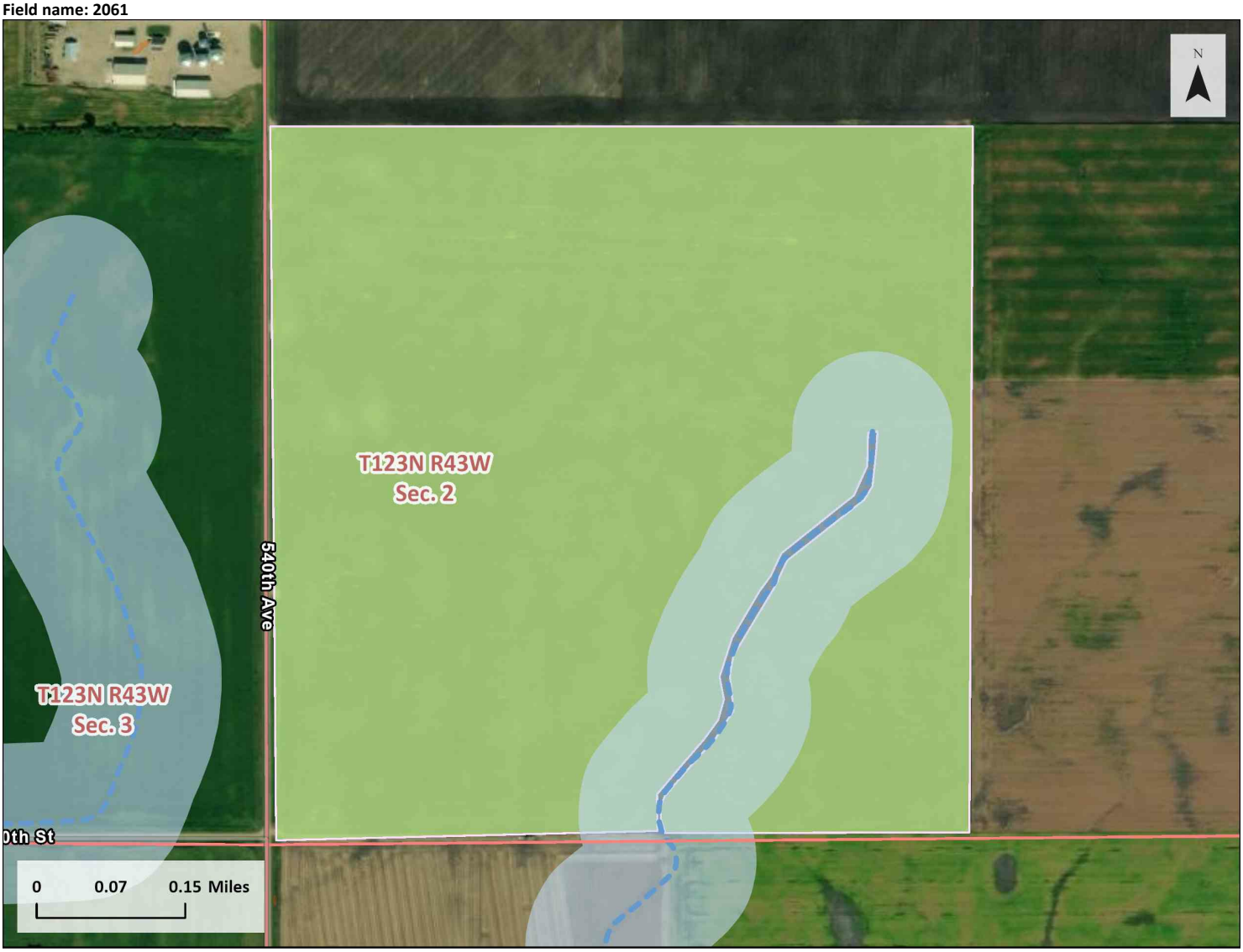
No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 95 lb/ac	Total phosphorus applied: 19 lb/ac
Nitrogen needs/removal: 326 lb/ac	Phosphorus removed: 76 lb/ac
Balance: -231 lb/ac (deficit)	Balance: -57 lb/ac (deficit)

Notes
155 acres takes into account intermittent stream acres that are not for manure application.

Field name: 2061



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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Intermittent Stream

Field name/ID: 2064

Field group name:
Farmable acreage: 156
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	65 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil
A phosphorus application plan is not required.

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	24	Med/high (3% and greater)

Will manure be applied within 300 ft of any lake, stream, intermittent stream, public waters wetland, or un-bermed drainage ditch? No

Are average grid sample results less than or equal to 16 Olsen / 21 Bray within 300 ft of all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? No

Does a 50 ft (100 ft for lakes and streams) non-manured, permanent, grassed buffer exist along all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? Yes

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 12 (Middle Lagoon)	Dairy Cattle - milk >1000 lbs	24 lb/1000gal	12 lb/1000gal	12 lb/1000gal	11,031 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	66 lb/ac weighted average	--	129 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application

Acreage after setback: 156

Split 1 - 85 acre

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 12 (Middle Lagoon)	Injection - knife	11,000 gal/ac	127 lb/ac	80 lb/ac
Total nutrients from manure			127 lb/ac	80 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 127 lb/ac	Total phosphorus applied: 80 lb/ac
Nitrogen needs/removal: 129 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -2 lb/ac (deficit)	Balance: -15 lb/ac (deficit)

Split 2 - 71 acre

No manure applied.

No fertilizer applied.

Notes
Only 85 acres will be applied once expansion is constructed. Some of the field area will have new facilities constructed in it.

Field name: 2064

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
Tile Intake

Field name/ID: 2065

Field group name:
Farmable acreage: 155
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Intermittent Stream Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	0 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil
A phosphorus application plan is not required.

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	24	Med/high (3% and greater)

Will manure be applied within 300 ft of any lake, stream, intermittent stream, public waters wetland, or un-bermed drainage ditch? Yes

Are average grid sample results less than or equal to 16 Olsen / 21 Bray within 300 ft of all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? Yes

Does a 50 ft (100 ft for lakes and streams) non-manured, permanent, grassed buffer exist along all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? No

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Corn-Silage

Past nutrient application

Manure source	Primary animal type	Manure source nitrogen	Manure source inorganic nitrogen	Manure source organic nitrogen	Application rate	Application method
Facility 12 (Middle Lagoon)	Dairy Cattle - milk >1000 lbs	24 lb/1000gal	12 lb/1000gal	12 lb/1000gal	11,031 gal/ac	Injection - knife

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	66 lb/ac	--	129 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 155

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 12 (Middle Lagoon)	Injection - knife	11,000 gal/ac	127 lb/ac	80 lb/ac
Total nutrients from manure			127 lb/ac	80 lb/ac

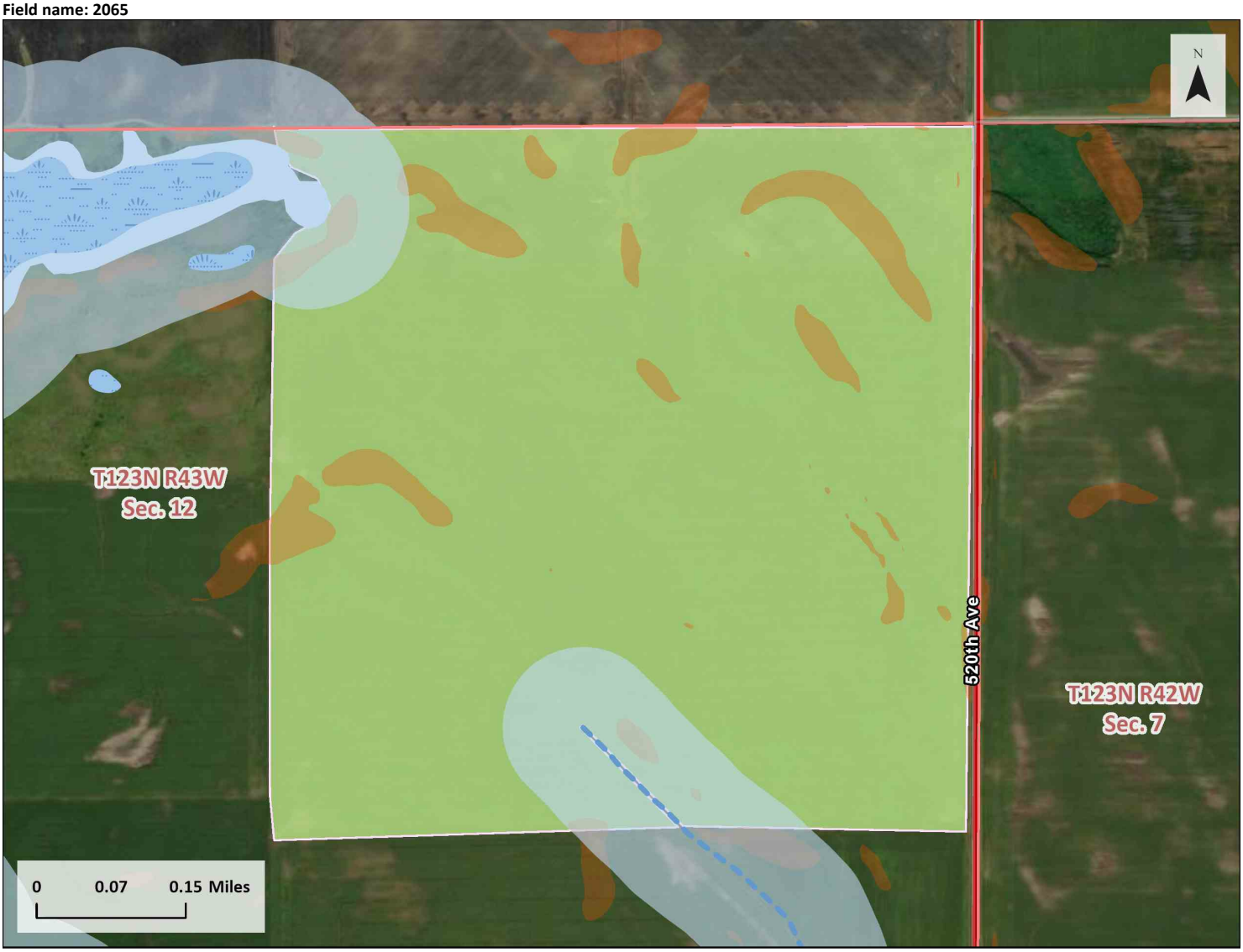
No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 127 lb/ac	Total phosphorus applied: 80 lb/ac
Nitrogen needs/removal: 129 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -2 lb/ac (deficit)	Balance: -15 lb/ac (deficit)

Notes
155 acres takes into account lost acres for intermittent stream

Field name: 2065



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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Intermittent Stream Tile Intake

Field name/ID: 2068

Field group name:
Farmable acreage: 69
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Drainage Ditch Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	0 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	16	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Corn-Silage

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	--	--	195 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 69

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 12 (Middle Lagoon)	Injection - knife	16,500 gal/ac	190 lb/ac	120 lb/ac
Total nutrients from manure			190 lb/ac	120 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 190 lb/ac	Total phosphorus applied: 120 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 195 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -5 lb/ac (deficit)	Balance: 25 lb/ac (surplus)

Notes
There are no notes.

Field name: 2068

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Map legend

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Drainage Ditch — Tile Intake

Field name/ID: 2072

Field group name:
Farmable acreage: 310
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Intermittent Stream Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	3 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2022	Olsen	10	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Corn-Silage	Corn-Silage

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	--	--	195 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
52 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 310

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 12 (Middle Lagoon)	Injection - knife	17,000 gal/ac	196 lb/ac	124 lb/ac
Total nutrients from manure			196 lb/ac	124 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 196 lb/ac	Total phosphorus applied: 124 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 195 lb/ac	Phosphorus removed: 95 lb/ac
Balance: 1 lb/ac (surplus)	Balance: 29 lb/ac (surplus)

Notes
310 acres takes into account intermittent stream

Field name: 2072

Basemap Credits: Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Intermittent Stream Tile Intake

Field name/ID: 4000

Field group name: Proposed Expansion
Farmable acreage: 150
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Drainage Ditch Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	54 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	11	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Soybeans	Corn-Field

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	--	--	195 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
43 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 150

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 101 (Proposed West Lagoon)	Injection - knife	16,500 gal/ac	190 lb/ac	120 lb/ac
Total nutrients from manure			190 lb/ac	120 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 190 lb/ac	Total phosphorus applied: 120 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 195 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -5 lb/ac (deficit)	Balance: 25 lb/ac (surplus)

Notes
There are no notes.

Field name: 4000

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Drainage Ditch — Tile Intake

Field name/ID: 4001

Field group name: Proposed Expansion
Farmable acreage: 620
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Drainage Ditch Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	0 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	10	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	--	Corn-Field	Soybeans	Corn-Silage

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	--	--	195 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
52 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 620

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 101 (Proposed West Lagoon)	Injection - knife	16,500 gal/ac	190 lb/ac	120 lb/ac
Total nutrients from manure			190 lb/ac	120 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 190 lb/ac	Total phosphorus applied: 120 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 195 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -5 lb/ac (deficit)	Balance: 25 lb/ac (surplus)

Notes
There are no notes.

Field name: 4001

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Drainage Ditch — Tile Intake

Field name/ID: 4003

Field group name: Proposed Expansion
Farmable acreage: 141
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Drainage Ditch Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	0 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	9	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Soybeans	Corn-Field	Soybeans

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
150 lb/ac	--	--	--	150 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
61 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 141

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 101 (Proposed West Lagoon)	Injection - knife	13,000 gal/ac	150 lb/ac	95 lb/ac
Total nutrients from manure			150 lb/ac	95 lb/ac

No fertilizer applied.

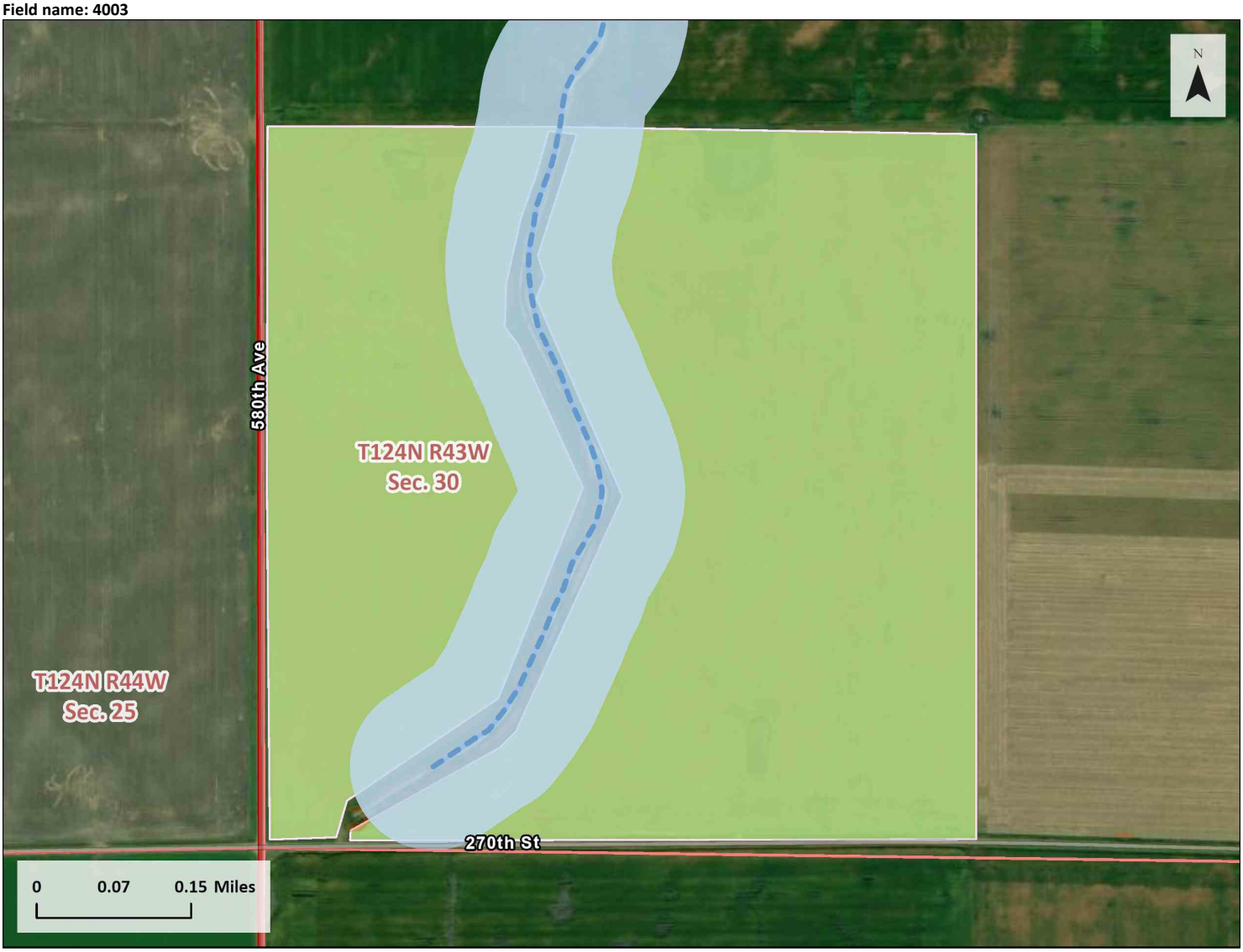
Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 150 lb/ac	Total phosphorus applied: 95 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 150 lb/ac	Phosphorus removed: 95 lb/ac
Balance: 0 lb/ac	Balance: 0 lb/ac

Notes
There are no notes.

Field name: 4003



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Map legend

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Drinking Water Features
- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features
- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain
- DFIRM, Modernized and Unmodernized Data

Water Bodies
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways
- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils
- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%
- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Drainage Ditch — Tile Intake

Field name/ID: 4004

Field group name: Proposed Expansion
Farmable acreage: 617
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	695 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	9	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Silage	Alfalfa	Alfalfa

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	115 lb/ac	--	--	80 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
61 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 617

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 106 (Proposed Leachate Lagoon)	Injection - knife	48,622.4 gal/ac	39 lb/ac	8 lb/ac
Total nutrients from manure			39 lb/ac	8 lb/ac

Fertilizer applied

Fertilizer brand	Fertilizer timing	Application rate	Nitrogen from fertilizer	Phosphorus from fertilizer	Potassium from fertilizer
Anhydrous Ammonia (82% N)	Starter	40 lb/ac	33 lb/ac	0 lb/ac	0 lb/ac
Total nutrients from fertilizer			33 lb/ac	0 lb/ac	0 lb/ac

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 72 lb/ac	Total phosphorus applied: 8 lb/ac
Nitrogen needs/removal: 80 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -8 lb/ac (deficit)	Balance: -87 lb/ac (deficit)

Notes
There are no notes.

Field name: 4004

Basemap Credits: Earthstar Geographics, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Map legend

- Township and range
- Section

Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
Tile Intake

Field name/ID: 4005

Field group name: Proposed Expansion
Farmable acreage: 152
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Tile Intake Non-Public Waters Wetland (uncultivated)	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	--	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	14	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Soybeans	Corn-Silage	Soybeans

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
150 lb/ac	--	--	--	150 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
17 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 152

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 101 (Proposed West Lagoon)	Injection - knife	13,000 gal/ac	150 lb/ac	95 lb/ac
Total nutrients from manure			150 lb/ac	95 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 150 lb/ac	Total phosphorus applied: 95 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 150 lb/ac	Phosphorus removed: 95 lb/ac
Balance: 0 lb/ac	Balance: 0 lb/ac

Notes
There are no notes.

Field name: 4005

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Map legend

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Tile Intake Non-Public Waters Wetland (uncultivated)

Field name/ID: 4007

Field group name: Proposed Expansion
Farmable acreage: 142
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Intermittent Stream Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	0 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	9	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Soybeans	Corn-Field	Soybeans

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
150 lb/ac	--	--	--	150 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
61 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 142

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 101 (Proposed West Lagoon)	Injection - knife	13,000 gal/ac	150 lb/ac	95 lb/ac
Total nutrients from manure			150 lb/ac	95 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 150 lb/ac	Total phosphorus applied: 95 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 150 lb/ac	Phosphorus removed: 95 lb/ac
Balance: 0 lb/ac	Balance: 0 lb/ac

Notes
There are no notes.

Field name: 4007

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Map legend

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Intermittent Stream Tile Intake

Field name/ID: 4008

Field group name: Proposed Expansion
Farmable acreage: 152
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Well Non-Public Waters Wetland (uncultivated)	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	110 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	18	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	--	Corn-Silage	Soybeans	Corn-Field

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	--	--	195 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 152

No manure applied.

No fertilizer applied.

Notes
There are no notes.

Field name: 4008

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Map legend

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Well Non-Public Waters Wetland (uncultivated)

Field name/ID: 4012

Field group name: Proposed Expansion
Farmable acreage: 101
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	942 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	9	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Soybeans	Corn-Field	Soybeans

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
150 lb/ac	--	--	--	150 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
61 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 101

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 101 (Proposed West Lagoon)	Injection - knife	13,000 gal/ac	150 lb/ac	95 lb/ac
Total nutrients from manure			150 lb/ac	95 lb/ac

No fertilizer applied.

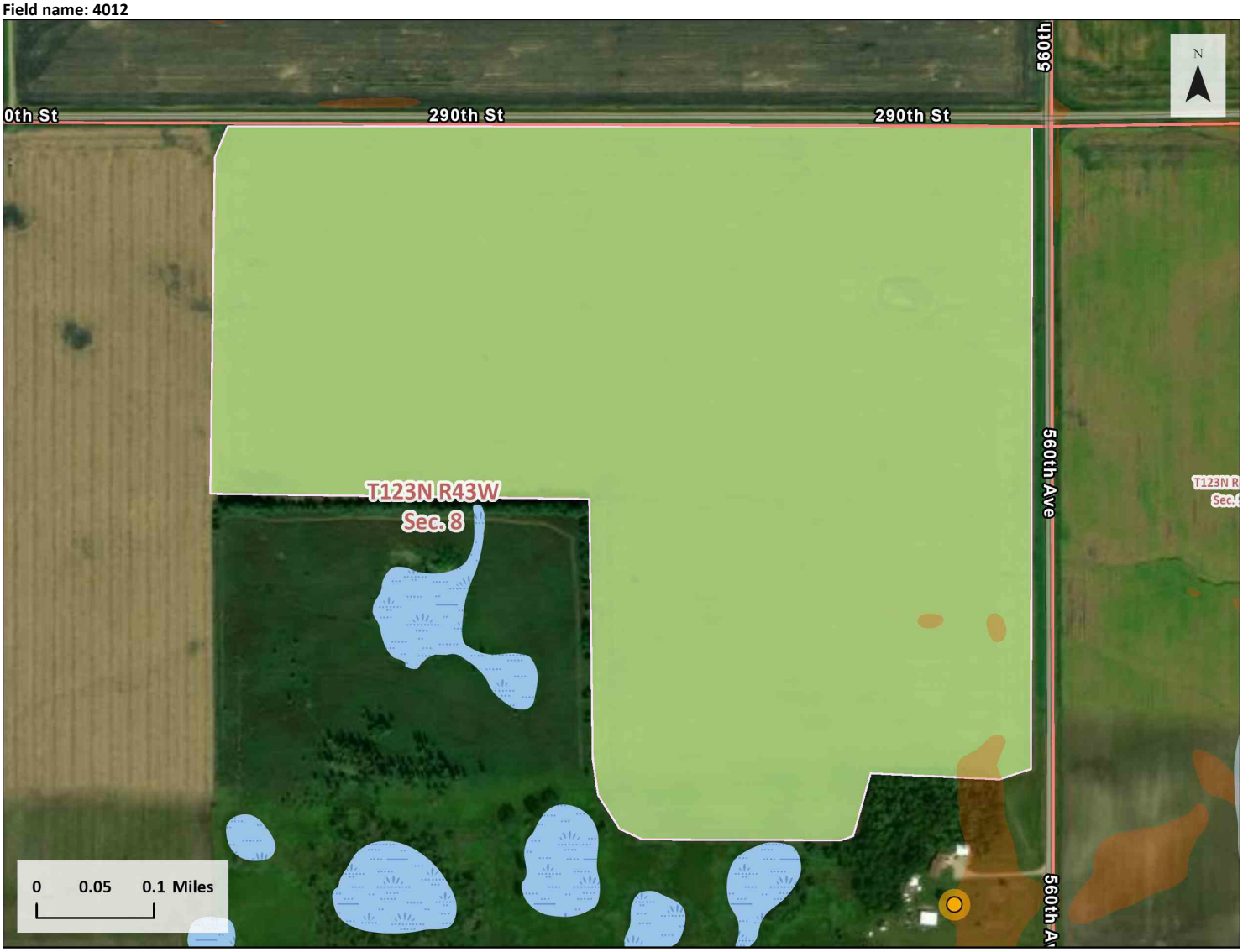
Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 150 lb/ac	Total phosphorus applied: 95 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 150 lb/ac	Phosphorus removed: 95 lb/ac
Balance: 0 lb/ac	Balance: 0 lb/ac

Notes
There are no notes.

Field name: 4012



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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
Tile Intake

Field name/ID: 4016

Field group name: Proposed Expansion
Farmable acreage: 149
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Drainage Ditch Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	65 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	11	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Soybeans	Corn-Field	Corn-Silage

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
150 lb/ac	--	--	--	150 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
43 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 149

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 101 (Proposed West Lagoon)	Injection - knife	13,000 gal/ac	150 lb/ac	95 lb/ac
Total nutrients from manure			150 lb/ac	95 lb/ac

No fertilizer applied.

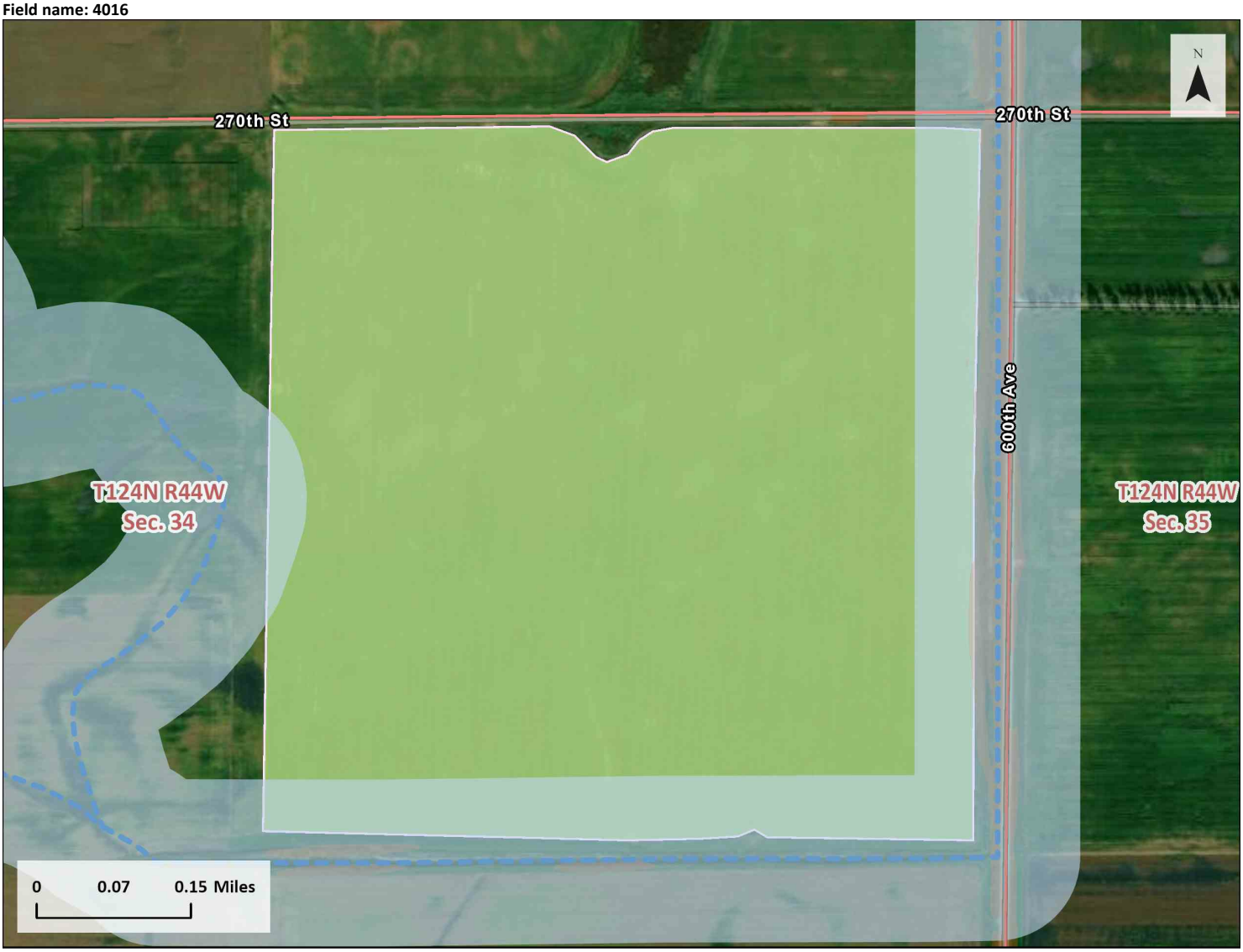
Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 150 lb/ac	Total phosphorus applied: 95 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 150 lb/ac	Phosphorus removed: 95 lb/ac
Balance: 0 lb/ac	Balance: 0 lb/ac

Notes
There are no notes.

Field name: 4016



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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Drainage Ditch — Tile Intake

Field name/ID: 4018

Field group name: Proposed Expansion
Farmable acreage: 152
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Drainage Ditch Well Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	127 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil
A phosphorus application plan is not required.

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2024	Olsen	17	Med/high (3% and greater)

Will manure be applied within 300 ft of any lake, stream, intermittent stream, public waters wetland, or un-bermed drainage ditch? No

Are average grid sample results less than or equal to 16 Olsen / 21 Bray within 300 ft of all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? No

Does a 50 ft (100 ft for lakes and streams) non-manured, permanent, grassed buffer exist along all lakes, streams, intermittent streams, public waters wetlands, or un-bermed drainage ditches? No

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Field	Corn-Silage	Soybeans

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	--	--	195 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 152

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 105 (Proposed Stacking Pad)	Broadcast - incorporation 12 hours to 4 days	20 ton/ac	96 lb/ac	147 lb/ac

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Total nutrients from manure			96 lb/ac	147 lb/ac

Fertilizer applied

Fertilizer brand	Fertilizer timing	Application rate	Nitrogen from fertilizer	Phosphorus from fertilizer	Potassium from fertilizer
Anhydrous Ammonia (82% N)	Starter	120 lb/ac	98 lb/ac	0 lb/ac	0 lb/ac
Total nutrients from fertilizer			98 lb/ac	0 lb/ac	0 lb/ac

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 194 lb/ac	Total phosphorus applied: 147 lb/ac
Nitrogen needs/removal: 195 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -1 lb/ac (deficit)	Balance: 52 lb/ac (surplus)

Notes
There are no notes.

Field name: 4018

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Drinking Water Features
- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features
- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain
- DFIRM, Modernized and Unmodernized Data

Water Bodies
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways
- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils
- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%
- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Drainage Ditch — Well ● Tile Intake

Field name/ID: 4019

Field group name: Proposed Expansion
Farmable acreage: 156
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Tile Intake	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	--	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	15	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Field	Soybeans	Corn-Field

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	--	--	195 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
8 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 156

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 105 (Proposed Stacking Pad)	Broadcast - incorporation 12 hours to 4 days	20 ton/ac	96 lb/ac	147 lb/ac
Total nutrients from manure			96 lb/ac	147 lb/ac

Fertilizer applied

Fertilizer brand	Fertilizer timing	Application rate	Nitrogen from fertilizer	Phosphorus from fertilizer	Potassium from fertilizer
Anhydrous Ammonia (82% N)	Starter	120 lb/ac	98 lb/ac	0 lb/ac	0 lb/ac
Total nutrients from fertilizer			98 lb/ac	0 lb/ac	0 lb/ac

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 194 lb/ac	Total phosphorus applied: 147 lb/ac
Nitrogen needs/removal: 195 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -1 lb/ac (deficit)	Balance: 52 lb/ac (surplus)

Notes
There are no notes.

Field name: 4019

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Map legend

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)
Tile Intake

Field name/ID: 4023

Field group name: Proposed Expansion
Farmable acreage: 174
Irrigated: No

Methodology information

Sensitive features See Sensitive Feature Appendix for management techniques	Planned manure application timing	Planned application methods	Crops grown
Intermittent Stream Public Waters Wetland (over 10 acres) Non-Public Waters Wetland (uncultivated)	September October 1-14 October 15-31 November	Broadcast - incorporation 12 hours to 4 days Broadcast - incorporation 4 days or later Broadcast - incorporation within 12 hours Injection - knife	Alfalfa Corn-Field Corn-Silage Corn-Sweet Edible Beans Hay-Legume-Grass Oats Potatoes Rye Soybeans Sugarbeets Wheat

Winter application

Application w/in 1000 ft of water	Shortest distance to water	Field slope	Emergency application site	Snow-manure application site	MN Phosphorus Index result
--	0 feet	--	No	No	--

Planning

Irrigation
The field is not irrigated

Soil

Year of most recent soil test	Test method	Phosphorus (P) field average (ppm)	Organic matter level
2023	Olsen	16	Med/high (3% and greater)

Crop info

Crop grown to utilize nutrients	Yield	Cover crop	Crop recently harvested	Crop grown 2 years ago	Crop grown 3 years ago
Corn-Silage	25 ton	Barley	Corn-Field	Soybeans	Corn-Silage

Past nutrient application
No manure applied

Nutrient recommendations/credits
Nitrogen

Max nitrogen recommendation	Min legume-nitrogen credit	Nitrogen credit from manure	Nitrogen credit from irrigation	Max N to apply	Nitrogen removal
195 lb/ac	--	--	--	195 lb/ac	--

Phosphorus

Phosphorus needs	Phosphorus removal	Maximum phosphorus allowable
0 lb/ac	95 lb/ac	--

Nutrient application
Acreage after setback: 174

Manure applied

Manure source	Application method	Application rate	Nitrogen from manure	Phosphorus from manure
Facility 101 (Proposed West Lagoon)	Injection - knife	16,500 gal/ac	190 lb/ac	120 lb/ac
Total nutrients from manure			190 lb/ac	120 lb/ac

No fertilizer applied.

Total nutrients applied

Nitrogen	Phosphorus
Total nitrogen applied: 190 lb/ac	Total phosphorus applied: 120 lb/ac

Nitrogen	Phosphorus
Nitrogen needs/removal: 195 lb/ac	Phosphorus removed: 95 lb/ac
Balance: -5 lb/ac (deficit)	Balance: 25 lb/ac (surplus)

Notes
There are no notes.

Field name: 4023

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Map legend

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Drinking Water Features

- Domestic Wells, Verified and Unverified Locations
- Drinking Water Supply Management Areas
- Domestic Well Buffers, Verified and Unverified Locations

Groundwater Features

- Karst Sinkholes
- Springs
- Karst Sinkhole Buffers
- Vulnerable Groundwater Area

Floodplain

- DFIRM, Modernized and Unmodernized Data

Water Bodies

- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands
- NWI (Class 3, 4, 5) and Public Water Inventory, Wetlands Buffer
- Public Water Inventory, Lakes
- Public Water Inventory, Lakes Buffer

Water Ways

- NHD, Intermittent Streams
- NHD, Intermittent Stream Buffers
- NHD and Public Drainage Systems, Ditches
- NHD and Public Drainage Systems, Ditch Buffers
- Public Water Inventory Streams
- Public Water Inventory, Stream Buffers

Soils

- Coarse Textured Soils
- Shallow Bedrock Soils

Slope greater than 6%

- less than 6%
- greater than 6%
- Field

Sensitive features (See Sensitive Features Appendix for more information.)

Intermittent Stream Public Waters Wetland (over 10 acres) Non-Public Waters Wetland (uncultivated)

End Materials

If you transfer manure you must provide the Manure Transfer Tracking form to each manure recipient. Create this form from the Nutrient Management Tool report feature.

Methodology Nutrient Information

Nitrogen (N) Management

- Based on the crop rotation, nutrient application rates will not exceed the N needs/removal of the crops as derived from the most recent MN Extension Service (MES) publications and MPCA fact sheets "Manure Nitrogen Rates For Corn Production (wq-f8-18)" and "Manure Management For Corn On Irrigated Sandy Soils (wq-f8-52)"
  - Any deviation will follow the standards allowed in Minn. Rule 7020.2225, subp. 3(A)(2) and any issued permit.
- Manure application rates will be calculated using the following factors:
  - N needs for non-legumes and N removal for legumes
  - Actual manure analysis test results, when available (most recent or historical average)
  - Soil test results (where applicable)
  - First year N availability will be based on MES guidance
  - If applicable, N credits for previous crops and/or manure applications will be accounted for according to MES guidance.
  - If applicable, N credits from irrigation will be accounted for in the calculations.
  - If applicable, any fertilizer N applied will be accounted for in the calculations.
- Feedlot permits may have additional restrictions for N application.

Phosphorus (P) Management

- In the instances described below, the rate and frequency of manure applications must not allow soil P build-up over any 6 year period.
  - Soil test levels exceed 150 Bray or 120 Olsen
  - Soil test levels exceed 75 Bray or 60 Olsen and the field is within 300 feet of an open tile intake
  - Soil test levels exceed 21 Bray or 16 Olsen and the field is within 300 feet of a lake, stream, intermittent stream, drainage ditch without protective berms, or public waters wetland
- Manure application rates will be calculated using the following factors:
  - Crop P needs and removal rates will be based on the most recent MN Extension Service (MES) publications
  - Actual manure analysis test results, when available (most recent or historical average)
  - Soil test results (where applicable)
  - An availability factor of 80 percent
  - If applicable, any fertilizer P will be accounted for in the calculations
  - P application for the previous 5 years will be used to determine the maximum amount to apply in the 6th year to avoid P build-up.
- Feedlot permits may have additional restrictions for P application.

Soil Erosion Conservation Measures

All winter application fields and all fields at NPDES permitted sites – You are required to employ one or more soil erosion conservation measures.

- Establish grassed waterways
- Contour stripcropping
- No-Till cropping
- Terracing
- Meet tolerable soil erosion rates ("T") as defined by NRCS
- Use rotations that include other than row crops (alfalfa, grass, etc)
- Chisel or disk tillage with residue
- Field edge buffers
- Contour buffer strip
- Sediment control basin
- Plant a cover crop on bare ground

Mortality Management

- Rendering BMPs
  - Kept in an animal-proof, enclosed area
  - At least 200 feet from a neighbor's buildings
  - Picked up within 72 hours (7 days if refrigerated to less than 45 degrees)
- Composting BMPs
  - Built on an impervious, weight-bearing pad that is large enough to allow equipment to maneuver. Note: Class V gravel material is not considered to be impervious.
  - Covered with a roof to prevent excessive moisture on the composting material, but if sawdust or other water-repelling material is used as the bulking agent, a roof may not be necessary.
  - Built of non-resistant material that is strong enough to withstand the force exerted by equipment.
  - Large enough to handle each day’s normal mortality through the endpoint of the composting which consists of a minimum of two (2) heat cycles.
- Burial BMPs
  - Stay 5 feet above seasonal high water table.
  - Stay 1000 feet away from lakes and 300 feet away from rivers, streams, ditches, etc.
  - Be covered immediately with enough soil to keep scavengers out (three feet is sufficient)
  - Not be placed in sandy or gravelly soil types.
  - Maintain at least 10 feet vertical separation between dead animals and bedrock.
- Incineration BMPs

- Capable of producing emissions not to exceed 20 percent opacity.
- Fitted with an afterburner that maintains flue gasses at 1,200 degrees Fahrenheit for at least 0.3 seconds.
- Ash from the incinerator must be handled in such a manner as to prevent particulate matter from becoming airborne.

- Other methods
  - As approved by BAH and MPCA

Timing Information

Fall
The MPCA encourages the use of the following BMPs to mitigate potential nitrate leaching from manure applied during the fall.

- Cover crops
- Delaying application until soil temps are 50°F or less
- Nitrogen stabilizing agent/product

NPDES permit requirements
From September 1 to September 30

- All manure applications must use one of the following BMPs:
  - Cover crop or other crop planted within 14 days of application
  - Application to an actively growing crop expected to utilize the N applied

From October 1 to October 14

- Manure applications in vulnerable groundwater areas must use one of the following BMPs:
  - Until 2026 follow the requirements for non-vulnerable groundwater areas
  - Starting in 2026 follow the requirements for September application
- Manure applications in non-vulnerable groundwater areas must use one of the following BMPs:
  - Soil temps are 50°F or less for 2 consecutive days
  - Use a nitrapyrin-based nitrogen stabilizing agent/product at the recommended rate
  - Use one of the BMPs for September application
  - Split application with no more than 50% of N applied October 1 - 14

From October 15 to October 31 (starting in 2027)

- Manure applications in vulnerable groundwater areas must use one of the following BMPs:
  - Use one of the BMPs for September application
  - Soil temps are 50°F or less for 2 consecutive days and a perennial crop is grown 2 out of 5 years
  - For liquid manure - Soil temps are 50°F or less for 2 consecutive days and a nitrapyrin-based nitrogen stabilizing agent/product is added at the recommended rate
  - For solid manure - Soil temps are 50°F or less for 2 consecutive days and a split application with no more than 50% of N applied October 15 – 31.
- Manure applications in non-vulnerable groundwater areas are encouraged, but not required, to utilize nitrogen BMPs.

From November 1 to November 30 (starting in 2027)

- Liquid manure applications in vulnerable groundwater areas are required to use one of the following BMPs:
  - Use one of the BMPs for September application
  - A perennial crop is grown 2 out of 5 years
  - A nitrapyrin-based nitrogen stabilizing agent/product at the recommended rate
- Solid manure applications in vulnerable groundwater areas are encouraged, but not required, to utilize nitrogen BMPs.
- Manure applications in non-vulnerable groundwater areas are encouraged, but not required, to utilize nitrogen BMPs.

SDS permit requirements
From September 1 to September 30

- All manure applications must use one of the following BMPs:
  - Cover crop or other crop planted within 14 days of application
  - Application to an actively growing crop expected to utilize the N applied

From October 1 to October 14

- Manure applications in vulnerable groundwater areas must follow the requirements for September application
- Manure applications in non-vulnerable groundwater areas must use one of the following BMPs:
  - Soil temps are 50°F or less for 2 consecutive days
  - Use a nitrapyrin-based nitrogen stabilizing agent/product at the recommended rate
  - Use one of the BMPs for September application
  - Split application with no more than 50% of N applied October 1 - 14

From October 15 to October 31 (starting in 2027)

- Manure applications in vulnerable groundwater areas must use one of the following BMPs:
  - Use one of the BMPs for September application
  - Soil temps are 50°F or less for 2 consecutive days and a perennial crop is grown 2 out of 5 years
  - For liquid manure - Soil temps are 50°F or less for 2 consecutive days and a nitrapyrin-based nitrogen stabilizing agent/product is added at the recommended rate
  - For solid manure - Soil temps are 50°F or less for 2 consecutive days and a split application with no more than 50% of N applied October 15 – 31.
- Manure applications in non-vulnerable groundwater areas are encouraged, but not required, to utilize nitrogen BMPs.

From November 1 to November 30 (starting in 2027)

- Liquid manure applications in vulnerable groundwater areas are required to use one of the following BMPs:
  - Use one of the BMPs for September application
  - A perennial crop is grown 2 out of 5 years
  - A nitrapyrin-based nitrogen stabilizing agent/product at the recommended rate
- Solid manure applications in vulnerable groundwater areas are encouraged, but not required, to utilize nitrogen BMPs.
- Manure applications in non-vulnerable groundwater areas are encouraged, but not required, to utilize nitrogen BMPs.

Land Application Site Inspection Frequency

All manure applications:

- At least once each day manure is applied to the field
- At the end of manure application to the field

When manure is not injected or incorporated:

- Within 24 hours of any ½ inch or greater rainfall within 14 days of application

Sensitive Feature Appendix

Sensitive feature	Definition	Management techniques For each sensitive feature, one of the listed techniques will be used to provide protection to this sensitive feature, as required in Minnesota Rules and/or permit conditions.
Lake	Lakes are identified on the DNR protected waters maps. They are generally bodies of water over 25 acres.	1. Observe a 25 ft non-manured setback, inject or incorporate within 24 hours and prior to rainfall within 300 ft, and avoid long term soil phosphorus build-up 2. 100 ft wide grassed buffer. 3. 100 ft setback with at least 16.5 ft as grassed buffer.
Tile Intake	Tile Intakes are direct conduits from the ground surface to waters of the state. This includes open intakes, blind inlets, rock inlets, and side inlets through berms along drainage ditches.	1. Observe a 25 ft non-manured setback, inject or incorporate within 24 hours and prior to rainfall within 300 ft, and avoid long term soil phosphorus build-up. 2. 35 ft wide grassed buffer. 3. 100 ft setback with at least 16.5 ft as grassed buffer.
Non-Public Waters Wetland (uncultivated)	Transitional land between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. Only included non-farmed wetlands.	1. Observe a non-manured setback. 2. Maintain a grass buffer. 3. Incorporate manure near the wetland. 4. Prevent long term soil P buildup. 5. Utilize soil conservation practices.
Well	Includes active wells or inactive unsealed wells whether or not they are used for human consumption.	1. 50 ft setback - minimum (100 ft if NPDES or SDS permitted)
Intermittent Stream	Intermittent streams typically only flow after a major storm event or snowmelt. They are denoted by dashed lines on USGS topo maps, even if they are farmed through. Some road ditches are mapped and considered an intermittent stream.	1. Observe a 25 ft non-manured setback, inject or incorporate within 24 hours and prior to rainfall within 300 ft, and avoid long term soil phosphorus build-up. 2. 50 ft wide grassed buffer. 3. 100 ft setback with at least 16.5 ft as grassed buffer.
Coarse-Textured Soil	1/3 or more of the field area has a soil type (at the surface, or within 3 ft of the surface) that ends in "sand". Soil types considered to be coarse-textured include: sand, loamy sand, loamy coarse sand, loamy very fine sand, fine sand, loamy fine sand, coarse sand, or very fine sand.	1. Follow the BMPS for vulnerable groundwater areas included in the NPDES or SDS permit (required if NPDES or SDS permitted). 2. Delay fall application until soil temperatures are less than 50°F. 3. Use nitrogen BMPs recommended by U of MN.
Drainage Ditch	A constructed waterway, public or private, used to convey (ie. drain) surface water runoff or tile drainage from farm fields or other low areas on the landscape. This includes drainage ditches that are bermed to prevent direct surface runoff.	1. Observe a 25 ft non-manured setback, inject or incorporate within 24 hours and prior to rainfall within 300 ft, and avoid long term soil phosphorus build-up. 2. 50 ft wide grassed buffer. 3. 100 ft setback with at least 16.5 ft as grassed buffer. 4. Berm that prohibits runoff from entering the ditch.
Public Waters Wetland (over 10 acres)	Public waters wetlands are identified on the DNR protected waters maps (typically over 10 acres).	1. Observe a 25 ft non-manured setback, inject or incorporate within 24 hours and prior to rainfall within 300 ft, and avoid long term soil phosphorus build-up. 2. 50 ft wide grassed buffer. 3. 100 ft setback with at least 16.5 ft as grassed buffer.

Attachment 24

Engineer Project Run-Off Hydrology Report

SETTJE
Agri-Services & Engineering, Inc.

15460 NW 48th St. | Raymond, NE 68428
P 402. 783. 2100 F 402. 783. 2104

Reference: Environmental Assessment Worksheet
West River Dairy Expansion
N ½ and SE ¼ of Sec. 1, T-123N, R-43W
Stevens County, MN

Overall hydrology for the site will largely remain unchanged from pre-construction to post-construction. Post-construction, there will be 20 acres removed from the watershed, since the feed pad and manure stacking pad areas must be contained in the manure containment system. Aside from the feed pad and manure stacking pad areas, most remaining acres within the project footprint will have a higher runoff volume going from lower runoff row-crop agricultural ground (pre-construction) to higher runoff rock/concrete/roof/LLDPE surfacing (post-construction). In general, the resulting net difference in water to the watershed will be minimal when accounting for the removed acres from the watershed and the higher runoff volume areas. For the clean stormwater runoff from the proposed dairy, the runoff shall first be collected in one of the stormwater basins on site, before management pumps the collected runoff back to the existing watershed at a controlled rate. Sections of drain tile and drain tile intakes located under the project footprint shall be removed out of necessity. Drain tile trunk lines shall be relocated as necessary to not impact the flow/release of other drainage areas connected to the trunk line. Impacts to any other existing ditches or drainage courses shall be minimal to none. Water released from the proposed stormwater basins shall be released to the same discharge point as water would flow prior to construction to have minimal impact to downstream recipients of the water.

The stormwater containment system and related piping shall be inspected regularly to ensure proper functioning. After each rain event, management shall inspect the stormwater basins to ensure the captured stormwater is free of waste before activating a lift station pump to lower the stormwater basin levels and discharge the stormwater to its natural drainage course. The proposed stormwater basins at the dairy are designed to hold much more than the required 25-year, 24-hour rain event that falls within their drainage area, and thus there is no concern of clean water impacting other areas of the site.

As addressed earlier, changes to volume routed into the watershed will be minimal when accounting for the 20 acres of feed pad and manure stacking pad removed from the watershed, and the other remaining areas within the project footprint holding a higher runoff value. The velocity of the release of the water from the stormwater basins shall be slower than pre-construction, due to the slow release of water from the site using a lift station pump that operates at 3,400 GPM.

To calculate runoff from the site, the SCS Curve Number Method was used to calculate total runoff pre-construction and post-construction. The total area to be disturbed as part of the dairy expansion includes 175 acres of existing row-crop agricultural ground. The annual precipitation of 26.71 inches was derived from NOAA High Plains Regional Climate Center and was used for the calculations. Running calculations on the pre-construction agricultural ground yielded approximately 117 million gallons of runoff annually. Post-construction, we figured 102.1 acres of impervious areas, 45.3 acres of grass areas, and 7.6 acres of stormwater basin surface areas. This yields 155 acres of total disturbed area (20 acres have been removed from the watershed due to the feed pad and stacking pad runoff being routed into the manure containment system and not the clean water containment system). Running calculations on the post-construction dairy yielded approximately 106 million gallons of runoff annually, or roughly 11 million gallons less than pre-construction conditions.

RUSLE2 models were performed for pre-construction and post-construction analysis. The site will be transitioning from row-crop agricultural ground to a combination of rock/concrete/roof/LLDPE/grass areas post-construction. All runoff ends up in stormwater basins prior to site discharge, thus RUSLE2 was performed for perennial grass landscaping only. Erosion pre-construction is 0.41 tons/acre/year and post-construction erosion shows erosion to be 0.05 tons/acre/year. However, post-construction erosion will be much less than these calculated figures due to impervious acres not being factored in. RUSLE2 models are attached after this report for reference.

Site Runoff Calculations (Pre-Construction)

Facility Information

Facility Name: West River Dairy
County: Stevens
Structure Name: Site Runoff (Pre-Construction)

Annual Precipitation, *P365 (in) 26.71

*NOAA High Plains Regional Climate Center

Annual Storm Water Runoff (SCS Curve Number Method):

Drainage Area Type	Area, A (acres)	Curve Number, CN	Potential Max. Retension, S = (1000/CN)-10	Initial Abstraction, Ia = 0.2*S	Runoff, Q365 (in) = (P365-I_a)^2)/((P365-I_a)+S)	Storm Runoff, V25 = A * Q365 (acre inches)
Impervious Areas	0.0	98				
Row Crop, Straight Row	175.0	85	1.76	0.35	24.70	4323.04
Grass Areas	0.0	70				
Stormwater Basin Areas	0.0	100				
					Total (acre-in)	**4323.04**
					Total (acre ft)	**360.25**
					Total (gallons)	**117,380,943**
					Total (cubic ft)	**15,692,639**

Site Runoff Calculations (Post-Construction)

Facility Information

Facility Name: West River Dairy
County: Stevens
Structure Name: Site Runoff (Post-Construction)

Annual Precipitation, *P365 (in) 26.71

*NOAA High Plains Regional Climate Center

Annual Storm Water Runoff (SCS Curve Number Method):

Drainage Area Type	Area, A (acres)	Curve Number, CN	Potential Max. Retension, S = (1000/CN)-10	Initial Abstraction, Ia = 0.2*S	Runoff, Q365 (in) = $(P365-I_a)^2/((P365-I_a)+S)$	Storm Runoff, V25 = A * Q365 (acre inches)
Impervious Areas	102.1	98	0.20	0.04	26.47	2702.25
Row Crop, Straight Row	0.0	85				
Grass Areas	45.3	70	4.29	0.86	22.18	1004.60
Stormwater Basin Areas	7.6	100	0.00	0.00	26.71	203.00
					Total (acre-in)	**3909.84**
					Total (acre ft)	**325.82**
					Total (gallons)	**106,161,537**
					Total (cubic ft)	**14,192,719**

RUSLE2 Profile Erosion Calculation Record

Info: West River Dairy - Soil Type J108A

File: profiles\MN_Zone1

Inputs:
Location: USA\Minnesota\Stevens County
Soil: SSURGO\Stevens County, Minnesota\J108A Aazdahl-Balaton clay loams, 0 to 2 percent slopes\Aazdahl Clay loam 45%
Slope length (horiz): 150 ft
Avg. slope steepness: 2.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 01\c.Other Local Mgt Records\MN_cont.corn_w/covercrop	vegetations\Rye, winter cover	pounds	6000.0
managements\CMZ 01\c.Other Local Mgt Records\MN_cont.corn_w/covercrop	vegetations\Corn, silage	tons	25.000
managements\CMZ 01\c.Other Local Mgt Records\MN_cont.corn_w/covercrop	vegetations\Rye, winter cover	pounds	6000.0
managements\CMZ 01\c.Other Local Mgt Records\MN_cont.corn_w/covercrop	vegetations\Corn, silage	tons	25.000
managements\CMZ 01\c.Other Local Mgt Records\MN_cont.corn_w/covercrop	vegetations\Rye, winter cover	pounds	6000.0
managements\CMZ 01\c.Other Local Mgt Records\MN_cont.corn_w/covercrop	vegetations\Corn, silage	tons	25.000
managements\CMZ 01\c.Other Local Mgt Records\MN_cont.corn_w/covercrop	vegetations\Rye, winter cover	pounds	6000.0
managements\CMZ 01\c.Other Local Mgt Records\MN_cont.corn_w/covercrop	vegetations\Corn, silage	tons	25.000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 0.41 t/ac/yr
Detachment on slope: 0.41 t/ac/yr
Soil loss for cons. plan: 0.41 t/ac/yr
Sediment delivery: 0.41 t/ac/yr

Crit. slope length: 150 ft
Surf. cover after planting: -- %

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/1/24	Manure injector, liquid high disturb.30 inch		53
10/1/24	Drill or air seeder, hoe/chisel openers 12-15 in spac.	Rye, winter cover	53

4/17/25	Cultivator, rotary		35
4/24/25	Sprayer, pre-emergence		34
5/1/25	Planter, double disk opnr	Corn, silage	33
6/17/25	Sprayer, post emergence		50
9/1/25	Harvest, silage		79
10/1/25	Manure injector, liquid high disturb.30 inch		53
10/1/25	Drill or air seeder, hoe/chisel openers 12-15 in spac.	Rye, winter cover	53
4/17/26	Cultivator, rotary		35
4/24/26	Sprayer, pre-emergence		34
5/1/26	Planter, double disk opnr	Corn, silage	33
6/17/26	Sprayer, post emergence		50
9/1/26	Harvest, silage		79
10/1/26	Manure injector, liquid high disturb.30 inch		53
10/1/26	Drill or air seeder, hoe/chisel openers 12-15 in spac.	Rye, winter cover	53
4/17/27	Cultivator, rotary		35
4/24/27	Sprayer, pre-emergence		34
5/1/27	Planter, double disk opnr	Corn, silage	33
6/17/27	Sprayer, post emergence		50
9/1/27	Harvest, silage		79
10/1/27	Manure injector, liquid high disturb.30 inch		53
10/1/27	Drill or air seeder, hoe/chisel openers 12-15 in spac.	Rye, winter cover	53
4/17/28	Cultivator, rotary		35
4/24/28	Sprayer, pre-emergence		34
5/1/28	Planter, double disk opnr	Corn, silage	33
6/17/28	Sprayer, post emergence		50
9/1/28	Harvest, silage		79

RUSLE2 Profile Erosion Calculation Record

Info: West River Dairy - Post Construction (exposed soil areas)

File: profiles\CornSoybeansZone1

Inputs:
Location: USA\Minnesota\Stevens County
Soil: SSURGO\Stevens County, Minnesota\J108A Aazdahl-Balaton clay loams, 0 to 2 percent slopes\Aazdahl Clay loam 45%
Slope length (horiz): 150 ft
Avg. slope steepness: 2.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 01\c.Other Local Mgt Records\Tall Fescue, mowed road right of way leave forage	vegetations\New Forages\North Central\Tall Fescue, North Central	lb	5131.6

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 0.050 t/ac/yr
Detachment on slope: 0.050 t/ac/yr
Soil loss for cons. plan: 0.050 t/ac/yr
Sediment delivery: 0.050 t/ac/yr

Crit. slope length: 150 ft
Surf. cover after planting: 47 %

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
3/15/26	Begin growth	New Forages\North Central\Tall Fescue, North Central	47
5/1/26	Mow pasture or road right of way leave forage		50
6/1/26	Mow pasture or road right of way leave forage		57
7/1/26	Mow pasture or road right of way leave forage		60
8/1/26	Mow pasture or road right of way leave forage		56
9/1/26	Mow pasture or road right of way leave forage		51