U. S. Steel Corporation
Minnesota Ore Operations
P.O. Box 417
Mt. Iron, MN 55768

May 28, 2025

Minnesota Pollution Control Agency
Attn: Variance Request - 4th Floor
520 Lafayette Road N.
St. Paul, MN 55155-4194

To Whom it May Concern:

United States Steel Corporation (U. S. Steel) hereby submits the application enclosed requesting a variance from the Class 4A sulfate water quality standard for water used for production of wild rice (WUFPOWR) which Minnesota Pollution Control Authority (MPCA) has stated applies to Hay Lake. As an initial matter, U. S. Steel disagrees that the Class 4A sulfate water quality standard applies to Hay Lake. As it has stated in previous filings and communications, U. S. Steel does not believe that Hay Lake has been properly designated as a Class 4A water via a formal rulemaking, as required under the state's statutes.

This variance request is in addition to various other efforts – such as seeking a site-specific standard – that U. S. Steel has undertaken to ultimately find a path forward for sulfate. Reserving all rights with regard to U. S. Steel's opposition to Hay Lake's alleged designation, U. S. Steel is moving forward with this variance application for Hay Lake and for each surface discharge station in NPDES/SDS Permits No. MN0031879 and No. MN0055948 for the Keetac facility in accordance with Minnesota Rules (Minn. R.) 7000.7000, Minn. R. 7050.0190, Minn. R. 7050.0195, and Code of Federal Regulations, Chapter 40, Section 131.14 (40 CFR 131.14).

U. S. Steel seeks this variance on two bases. First, attainment of the sulfate Class 4A water quality standard at Hay Lake and for each of Keetac's discharge stations would be entirely economically infeasible due to the substantial economic hardship for U. S. Steel that full compliance with the discharge limitations would impose (Minn. R. 7000.7000, Subp. 2.E.). Such expenditures of funds for compliance with the sulfate water quality standards also runs in direct opposition to state law prohibiting MPCA from requiring permittees to expend money for design or implementation of sulfate treatment technologies or other forms of sulfate mitigation until MPCA amended the sulfate standard. Minn. Laws 2015, 1st Spec. Sess., Ch. 4, Art. 4, Sect. 136(a)(1)(i). Second, conformity with the sulfate water quality standards would likely be more detrimental to the environment because of significant air pollutant emissions that would be emitted to generate sufficient electricity to operate the requisite advanced wastewater treatment system, and because of the significant amount of waste that would be generated by the wastewater treatment process (Minn. R., part 7050.0190). U. S. Steel is also aware that MPCA is considering creating a multi-discharger variance. If/when that variance process is established, U. S. Steel would also like this package to be considered for that.

Please contact me if you have any questions on this application.

Sincerely,

Chrissy Bartovich Sr. Director - Environmental

Application for a Variance from the Class 4A Sulfate Water Quality Standard for Waters Used for Production of Wild Rice

NPDES/SDS Permit Nos. MN0055948 and No. MN0031879

Prepared for
United States Steel Corporation
Minnesota Ore Operations - Keetac

Prepared by
Barr Engineering Co.

May 2025

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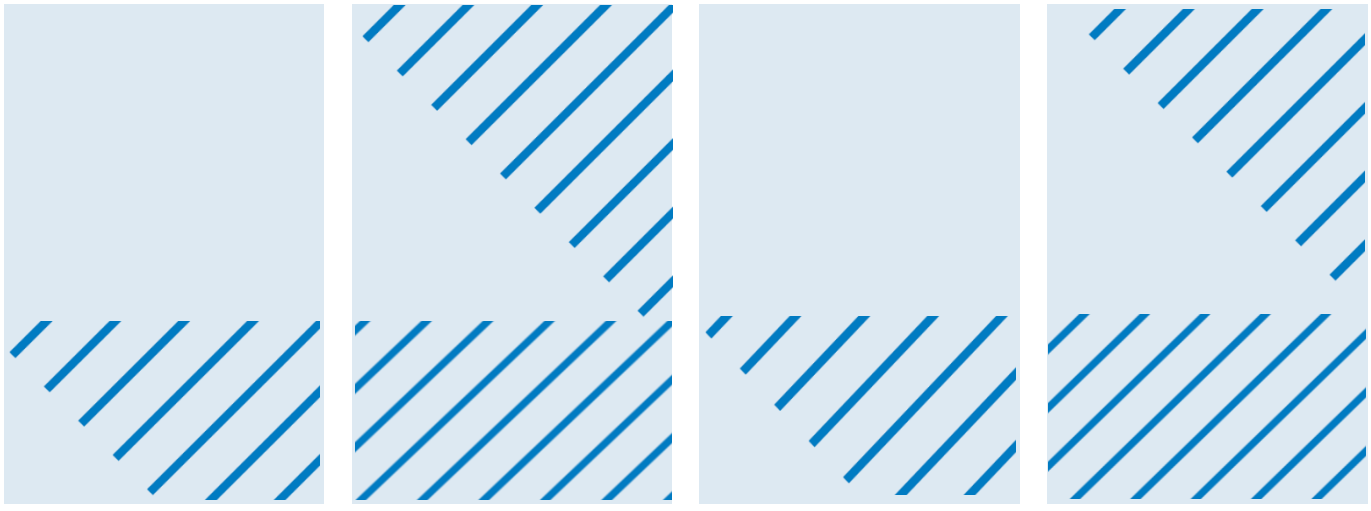

Application for a Variance from the Class 4A Sulfate Water Quality Standard for Waters Used for Production of Wild Rice

NPDES/SDS Permit Nos. MN0055948 and No. MN0031879

May 2025

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Abbreviations

AUID	Assessment Unit Identification
BEC	Boswell Energy Center
BF	Blast furnace
BGEPA	Bald and Golden Eagle Protection Act
CO2	Carbon Dioxide
CO2e	Carbon Dioxide equivalent
DMR	discharge monitoring report
DR	Direct Reduction
EAW	Environmental Assessment Worksheet
EPA	Environmental Protection Agency
EQB	Environmental Quality Board
GHG	Greenhouse Gas
IPaC	Information for Planning and Consultation
IRP	Integrated Resource Plan
MBTA	Migratory Bird Treaty Act
MGD	Million gallons per day
mg/L	milligram per liter
Minn. R.	Minnesota Rule
MNDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
MPUC	Minnesota Public Utilities Commission
MW	Megawatt
NF	Nanofiltration
NGCC	Natural gas combined cycle
NHIS	Natural Heritage Information System
NLEB	Northern Long-eared Bats
NPDES	National Pollutant Discharge Elimination System
SDS	State Disposal System
SMCL	secondary maximum contaminant level
SO4	sulfate
TBEL	Technology-based effluent limits
tpy	tons per year
TSS	total suspended solids
USFWS	U. S. Fish and Wildlife Service
U. S. Steel	United States Steel Corporation
WQS	Water Quality Standards
WTS	Water Treatment System
WUFPOWR	water used for production of wild rice

Executive Summary

The United States Steel Corporation (U. S. Steel) requests a variance from the Class 4A sulfate water quality standard (WQS) for water used for production of wild rice (WUFPOWR) applied to Hay Lake (Assessment Unit Identification (AUID) No. 31-0037-00). U. S. Steel is authorized to discharge wastewater and stormwater from numerous surface discharge stations permitted by the National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Permit Nos. MN0031879 and MN0055948 (collectively referred to as permits). Discharges from these surface discharge stations eventually flow to Hay Lake after meandering through approximately six miles of other waterbodies. As part of the proposed variance from the Class 4A sulfate WQS for WUFPOWR of 10 milligrams per liter (mg/L), U. S. Steel proposes the alternative interim sulfate discharge limitations shown in ES Table 1. Large Figure 1 provides an overview of the specific waterbody segments and locations of surface discharge stations included in this variance application.

ES Table 1 Proposed Interim Sulfate Discharge Limitations Based on Sulfate WQS Variance

Discharge Limitation Type[1]	SD 002	SD 003	SD 012	SD 001	SD 005	SD 009
Phase 1, Calendar Month Maximum (mg/L)	218.4	101.2	34.1	163.2	163.2	monitor

[1] The Phase 1 discharge limitations were derived by increasing the maximum recorded sulfate concentration from the past five years for each surface discharge station by 20%. For example, the Phase 1 sulfate limit for SD 002 = 182 x 20 % = 218.4 mg/L.

U. S. Steel is seeking variances for ten years. The basis for these requested variances is:

- Attainment of the sulfate WQS is economically infeasible due to the substantial economic hardship for U. S. Steel that full compliance with the discharge limitations would cause (Minnesota Rules [Minn. R.] 7000.7000, Subpart [Subp.] 2.E.), as outlined in Section 2.4.
- Strict conformity with the sulfate WQS may be detrimental to the environment due to the significant emissions of air pollutants required to generate the electricity to operate the advanced wastewater treatment system (Minn. R., part 7050.0190), as outlined in Section 2.7.3.1.

Detailed information on these requested variances is contained in the sections that follow.

The variance request is based on the draft permits, placed on pre-public notice on January 29, 2025, and the respective supporting fact sheets. The limits and requirements in the draft permits are subject to change in response to comments received during the public notice period. U. S. Steel reserves the right to modify this variance request pending issuance of the final permit.

MINNESOTA POLLUTION CONTROL AGENCY
520 Lafayette Road North
St. Paul, MN 55155-4194

Variance request form

NPDES/SDS Permit Program

National Pollutant Discharge Elimination System (NPDES)/
State Disposal System (SDS)

Doc Type: Permit Application

Instructions: The NPDES/ SDS Permit Program regulates wastewater discharges to land and surface waters. This form is required for all applicants seeking a variance from water quality standard, criteria, or water quality based effluent limit. Complete the form by typing or printing in black ink. Attach additional sheets as necessary.

For more information: Please contact Fawkes Char, Minnesota Pollution Control Agency (MPCA), at 651-757-2327 or fawkes.char@state.mn.us.

Applications that are submitted without an authorized signature and attachments will be returned. Please make a copy for your records. You may submit this along with a permit application packet as part of a reissuance or modification. If not, submit the completed request form and attachments *(including plans and specifications, if applicable)* electronically to wq.submittals.mpca@state.mn.us.

Minn. R. 7002.0253 requires billing for additional work required to issue or reissue permits that include a variance. An additional fee is applied once a variance is included in a permit and approved by U.S. Environmental Protection Agency (EPA). You will receive an invoice from the MPCA when the permit is placed on public notice. Currently, additional fees for variances are 35 points or $10,850. *Water Quality Application Fee Guidance* can be found on the MPCA website at https://www.pca.state.mn.us/business-with-us/water-permits-and-regulations.

Section I – Existing permit information

1. Permittee name: United States Steel Corporation
2. Facility name: U. S. Steel, Minnesota Ore Operations - Keetac
3. Permit number: MN0055948 and MN0031879 4. Permit expiration date (mm/dd/yyyy): 10/31/2016 (both permits)
5. Issuance data of last variance (if applicable): N/A
6. Has permit application been submitted? ☒ Yes ☐ No If yes, please provide date (mm/dd/yyyy): 3/4/2016 and 9/29/2023 (individual) and 2/28/2025 (combined)
7. What is the classification of your facility? ☐ A ☐ B ☐ C ☐ D N/A – not a wastewater treatment and collection system
8. Are there any plans to make changes to the facility within the next five years? ☐ Yes ☒ No
   If yes, please provide a list of all proposed changes to the facility below:

   There are no plans to change the facility operations. U. S. Steel is currently evaluating sulfate reduction alternatives in anticipation of a compliance schedule to achieve stringent sulfate discharge limitations derived from the Class 4A sulfate water quality standard, which is the subject of this variance request.

   Are there currently any unresolved enforcement issues with any other media (air, waste, etc.)? ☐ Yes ☒ No
   If yes, describe below:

9. Design flows of the existing and/or proposed facility:

	Existing (mgd)	**Proposed (mgd)** (if applicable)
Average wet weather design flow (AWW)	Flows for each surface discharge station are found in Section 2.2 in the application narrative.	No proposed change to flows.
Maximum Design Flow		
If available, please provide:		
Average annual design flow (AAD)		
Average dry weather design flow (ADW)		
Peak hourly wet weather flow (PHWW)		

mgd = million gallons per day

10. Attach a map indicating the receiving water location. See Large Figure 1, Large Figure 2, and Large Figure 3

11. Source of water supply:

    U. S. Steel uses water from reservoirs and reuses water from tailings basin as source water for industrial operations.

Section II – Variance Parameter Information

12. Parameter(s) for which the variance is sought. List all:

    Sulfate, Total (as SO4)

13. Identify the applicable rule or standard **from which** the variance is sought. Water quality standards can be found in Minn. R. 7050.0222, 7052.01000 and various subparts of 7053. For example, a variance could be requested from the Chloride standard to a Class 2B Water in Minn. R. 7050.0222, subp. 4:

    The variance is being sought from the Class 4A (Minn. R. 7050.0224, subp. 2) sulfate water quality standard (10 mg/L) for waters used in production for wild rice (WUFPOWR) and the sulfate discharge limitations derived from this water quality standard, proposed to be implementated in U. S. Steel permits as a daily maximum limit of 24 mg/L and a monthly averge limit of 14 mg/L.

14. Identify the applicable rule **under which** a variance is being sought. Examples include Minn. R. 7050.0190, 7052.0280, and 7053.0195. Using the same pollutant in #11 above, the chloride variance would be requested under Minn. R. 7050.0190:

    The variance is being requested under Minn. R. 7000.7000, Minn. R. 7050.0190, Minn. R. 7053.0195, and 40 CFR 131.14.

15. Include a statement of the nature and quantity of the materials being discharged currently. (Minn. R. 7000.7000, supb. 2, Item H, (1)) With this statement, attach the last five years of sampling data including:

    - Average, maximum, and minimum concentrations.
    - 50th percentile and 95th percentile (if applicable).
    - Sum total of the number of samples collected for each parameter over the last five years.

    Refer to Section 2.7.1 of the application narrative.

Section III – Source reduction or pollution minimization information

List primary sources of each parameter identified in #12. Include a general description of the materials handled or processed that are pertinent to the variance request. (Minn. R. 7000.7000, supb. 2, Item H, (1)). Provide a summary of source identification and source reduction efforts (e.g., industrial contributors, voluntary or statutory reduction programs).

16. Pollutant Minimization Plan Refer to Section 2.7 and Appendix A of the application narrative.

    - If you have not submitted a Pollutant Minimization Plan as part of your permit or application, please provide one.
    - If you have previously submitted a pollutant minimization plan, provide a date of when plan was last submitted, and update your actions and implementation progress, if not already completed.

    A Pollution Minimization Plan must include the following information:

    - What types of actions (e.g., pollution prevention, pre-treatment, or treatment) have you taken or could you take to reduce the parameter in the discharge?
    - For source reduction, pre-treatment, and treatment options not yet completed, what is a potential schedule for identifying and evaluating potential reduction, elimination, and prevention methods?
    - What types of waste materials or byproducts would be produced by source reduction steps and what would be the ultimate means of disposal of those wastes?

Use the following as guidelines or examples when preparing your Pollution Minimization Plan:

- Mercury Minimization Plan (Wastewater guide - wq-wwtp7-10) https://www.pca.state.mn.us/sites/default/files/wq-wwtp7-10.doc
- Mercury Minimization Plan (Stormwater checklist - wq-strm3-30) https://www.pca.state.mn.us/sites/default/files/wq-strm3-30.docx
- Phosphorus Management Plans (PMP) Guide - wq-wwtp9-06: https://www.pca.state.mn.us/sites/default/files/wq-wwtp9-06.doc
- EPA P2 webpage (http://www.epa.gov/p2/)
- Minnesota Technical Assistance Program University of Minnesota: http://www.mntap.umn.edu/
- MPCA's Preventing Waste and Pollution webpage: https://www.pca.state.mn.us/business-with-us/waste-and-pollution-prevention

Section IV – Treatment alternative(s) information

17. Indicate a reasonable expectation of the concentration of the pollutant for which the variance is being requested that will be discharged during the period of the proposed variance. (Minn. R. 7000.7000, supb. 2, Item H, (1))

    Refer to Section 2.3 and Section 2.7 of the application narrative.

18. Include the proposed method of control of the pollutant (Minn. R. 7000.7000, supb. 2, Item H, (1))

    Refer to Section 2.7 of the application narrative.

19. Indicate the steps to be taken during the period of the variance to reduce pollutant levels to the lowest limits practical. (Minn. R. 7000.7000, supb. 2, Item H, (2))

    Refer to Section 2.7 of the application narrative.

20. Include a statement of the alternatives to operation under the variance which have been considered. (Minn. R. 7000.7000, supb. 2, Item H, (4))

    Refer to Section 2.7 of the application narrative.

Section V – Seeking a variance due to substantial and widespread social and economic impacts

To be eligible for a variance, the applicant must demonstrate that attaining the water quality standard, criterion or effluent limit is not feasible because of one or more of the criterion listed in Federal Rule 40 CFR 131.10(g). The same criterion is listed in Minn. R. 7052.0280, subp. 3 and also in the next section of this request form, titled "Seeking a Variance due to Other Conditions."

In this section, MPCA's focus is on a variance request because more stringent controls than those required under sections 301(b) and 306 of the Clean Water Act would result in widespread economic or social impact [40 CFR 131.10(g)(6)].

Review MPCA's Water Quality Variance Guidance available at https://www.pca.state.mn.us/business-with-us/water-quality-variances. This document outlines various components needed to justify a variance using economic and social impacts. It also includes a link to *EPA's Interim Economic Guidance for Water Quality Standards*, which apply to both public and private entities. Another resource for Publicly Owned Treatment Works (POTWs) on how to assess financial capability is an EPA document entitled "Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule Development (Document No. 832-B-97-004), available on the EPA website at https://www.epa.gov/sites/default/files/2015-10/documents/csofc_0.pdf.

21. Indicate (in a concise statement) the effect on the establishment, maintenance, operation and expansion of business, commerce, trade, traffic, and other economic factors that may result from approval and from denial of the requested variance. (Minn. R. 7000.7000, supb. 2, Item H, (5))

    Refer to Section 2.4, Section 2.7.3, Section 2.7.4, and Section 2.7.5 of the application narrative.

22. If variance is sought based primarily on economic burden the following must be submitted:

    - Financial statements prepared or approved by a certified accountant.
    - Status of business, plant, system, or facility for each of the last three financial years.
    - Result of study to determine the capital cost of end-of-piper removal of the parameter for which the variance is sought, including capital and Operations and Maintenance (O&M) costs, solids/residual handling costs (if not considered in O&M), comparison to current costs and integrated management costs.
    - Effect on financial status if variance is not granted.

    The MPCA recommends you use the worksheets available in *EPA's Interim Economic Guidance for Water Quality Standards.* All EPA worksheets have been bundled together in this document located on the EPA's website found at http://water.epa.gov/scitech/swguidance/standards/economics/#worksheet. Economic requirements in #21 and 22 above can be fulfilled with the use of EPA's Worksheets.

    Refer to Section 2.4 of the application narrative.

Certification

Federal Regulations (40 CFR Part 122.22) and State Regulations (Minn. R. 7001.0060) require all permit applications to be signed as follows:

A. For a corporation: by a responsible corporate officer. For the purpose of this permit, a responsible corporate officer means: 1) a president, secretary, treasurer or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or 2) The manager of one or more manufacturing, production or operating facilities employing more than 250 persons or having a gross annual sales or expenditures exceeding 425 million, if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
B. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.
C. For a municipality, county or other political subdivision: by a principal executive officer or ranking elected official.
D. For a state, federal or other public agency/agents: by a commissioner, assistant or deputy commissioner; director, assistant or deputy director.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Printed name: Lukas Klemke Title: Plant Manager – Minnesota Ore Operations

Authorized signature: [signature] Date (mm/dd/yyyy): 05/29/2025

State tax ID#: 5738839 Federal tax ID#: 25-1897152

Seeking a variance due to other conditions under 40 CFR 131.10(g)

The remaining factors or justifications under which a variance may be requested are based on ambient receiving water conditions. At this time, the MPCA is not aware of any specific situation where these conditions would be applicable and does not foresee variances being requested based on these factors in the short term. However, if a situation developed where a variance could be considered under these conditions, the MPCA will work with EPA to determine a course of action. Below is a list of information that MPCA would likely request that the Permittee submit. Submittal requirements are subject to change based on the specific situation. Please consider the below a guide only and not the definitive information to be submitted.

Naturally occurring concentrations (e.g., background concentrations are high) [40 CFR 131.10(g)(1)]:

- Water quality assessment of all relevant parameters, biological assessment (as an indicator of water quality), appropriate reference conditions for comparison (if available), land usage/watershed characteristics, characterization of natural sources, water quality modeling (as necessary to confirm effects from natural pollutant sources), assessment of possible groundwater contamination from human activities as a source of surface water pollutant levels, and stream bank stability (including upstream stability if natural siltation is suspected).

- Upstream ambient data sufficient to adequately characterize pollutant concentrations and effluent data.
- Soil composition data, groundwater data, U.S. Geological Survey (USGS) analyses/reports, comparison to data collected from headwater streams, and analyses done by other states and an explanation of why they are relevant in this case.
- Source or sources of the pollutant and how the pollutant enters the facility discharge; how much of the pollutant in receiving water occurs naturally, how much is a result of permitted sources, and how much is from other sources.

Natural, ephemeral, intermittent or low-flow conditions or water levels [40 CFR 131.10(g)(2)]:

- Not supportable if the conditions may be compensated for by discharging sufficient volume of effluent to enable water quality standards, criteria, or effluent limits to be met without violating requirements of Minnesota Statutes ch. 103G. If Permittee is unable to discharge a sufficient volume of effluent to enable the limit to be met without violation of the state water conservations requirements, describe the basis for this decision.
- Volume and velocity of flow, depth, range of flow conditions (including highs and lows as well as more generally representative conditions not influenced by drought or recent precipitation), presence of pools within the water body channel, precipitation and snowmelt patterns, presence of riparian vegetation (as an indicator of pattern of flow and water levels), depth of the water table (to distinguish ephemeral from intermittent, if necessary), biological assessment (as necessary to confirm flow or water level limitation if physical evidence is unclear), recreational use safety and access, potential use by children.

Human-caused conditions or sources of pollution [40 CFR 131.10(g)(3)]:

- Data characterizing receiving water concentrations, sediment and tissue quality (as necessary), biological assessment (as an indicator of water quality), appropriate reference condition for comparison (if available), land use/watershed characteristics, characterization of human caused condition and its relationship to water quality and/or the use in question.
- For legacy pollutants, data, information and analyses describing the "life history" of the pollutant (e.g., how pollutant has entered into the environment and continues to cycle through and will not be removed from the environment in the near future because its sources are diffuse and not within the control of the discharger to address).
- Identification of currently available remedies and assessment of their potential efficacy and feasibility, demonstration of technology-based requirements and cost effective and reasonable BMPs (as appropriate), forecast of water quality conditions once implemented (e.g., using water quality modeling), and assessment of potential damage caused by potential remedies.
- Similar to the justification for significant and widespread economic and social impacts, the Permittee must show why they cannot meet the criteria end-of-pipe, including an evaluation of how much the pollutant is or can be removed by current treatment processes, and whether other alternatives are available that can partially or fully remove the pollutant to meet WQBELs (particularly if they are adding the pollutant through their processes).
- Describe how taking an alternative approach would have adverse environmental consequences (i.e., would cause more environmental damage to correct than to leave in place).
- Other alternatives include consideration of additional treatment, which could result in other environmental effects, such as potential disposal issues with waste generated from various treatment technologies (e.g., brines, spent resin), alternative water source issues (e.g., high levels of arsenic in groundwater), or high energy use (Collaborate with MPCA water and air staff – often, sources of electricity change over time, vary by nature of the grid, and have different impacts when released to water or air, so adjustments are necessary).

Dams, diversion or other types of hydrologic modifications [40 CFR 131.10(g)(4)]:

- Not supportable if feasible to restore the waterbody to its original condition or operate the modification in a way that would result in attainment of the water quality standard.
- Please consult with MPCA staff to discuss whether a use attainability analysis is more appropriate than a variance request.
- Water quality assessment for all relevant parameters, biological assessment (as an indicator of water quality), appropriate reference condition for comparison (if available), land usage/watershed characteristics, characterization of hydrologic modification and its relationship to water quality and/or the use in question, identification of currently available restoration and/or operation methods and assessment of their potential efficacy and feasibility, societal value of the hydrologic modification.

Physical conditions related to the natural features of a water body, such as lack of proper substrate cover, flow, depth, pools, riffles and the like, unrelated to chemical water quality, preclude attainment. [40 CFR 131.10(g)(5)]

- This condition is unrelated to chemical water quality. The physical features identified in this condition relate to the health of aquatic life, such as fish and aquatic invertebrates and related to Class 2 waters. Therefore, justification for this condition must be made on the attainment of aquatic life protection uses.
- Please consult with MPCA staff to discuss whether a use attainability analysis is more appropriate than a variance request.

- Physical habitat characterization of the water body, natural hydrologic patterns, sediment grain size, bathymetry, biological assessment, (as necessary to confirm physical habitat limitation if physical evidence is unclear).

1 Background

U. S. Steel submits this written application requesting a variance from the Class 4A sulfate WQS for WUFPOWR for Hay Lake (AUID 31-0037-00) and a sulfate discharge limitation variance for each surface discharge station in NPDES/SDS Permit Nos. MN0031879 and MN0055948 for the Keetac facility in accordance with Minnesota Rules (Minn. R.) 7000.7000, Minn. R. 7050.0190, Minn. R. 7050.0195, and Code of Federal Regulations, Chapter 40, Section 131.14 (40 CFR 131.14). This report provides the variance request information required by the regulations and the Minnesota Pollution Control Agency's (MPCA) Variance Request Form (wq-wwprm2-10b), which is supplied above. U. S. Steel specifically requests a variance from the default sulfate WQS of 10 milligrams per liter (mg/L). Subsequently, U. S. Steel requests that interim (Phase 1) sulfate discharge limitations proposed by the MPCA for the upcoming reissuance of the permit(s) be re-evaluated and updated based on the WQS variance.

The MPCA reissued the permits to U. S. Steel on November 15, 2011, with an expiration date of October 31, 2016. U. S. Steel submitted timely and complete permit reissuance applications for both permits to the MPCA on March 4, 2016. On September 29, 2023, U. S. Steel submitted permit reissuance application updates to provide current analytical data and application information, as requested by the MPCA, because considerable time had passed since the last reissuance application. On February 28, 2025, U. S. Steel submitted a permit reissuance application to combine the authorization to discharge from the separate areas, mine area and tailings basin area, under a single permit.

On January 29, 2025, the MPCA issued pre-public notice draft permits that contained interim sulfate discharge limitations (Phase 1) and final sulfate discharge limitations (Phase 2) for each surface discharge station in each permit. The Phase 2 sulfate discharge limitations were set at 14 mg/L as a calendar month average and 24 mg/L as a monthly average maximum, based on the Class 4A default sulfate WQS for WUFPOWR of 10 mg/L.[1] These Phase 2 sulfate discharge limitations are not achievable in the foreseeable future, the reasons for which are outlined in this report. Therefore, U. S. Steel is compelled to submit this variance application. Table 1 summarizes the Phase 1 discharge limitations to be implemented for the duration of the Class 4A sulfate WQS for WUFPOWR variance. The evidence presented herein demonstrates that U. S. Steel is eligible for a variance because:

- Technology-based controls are not feasible due to substantial and widespread economic and social impacts.
- The variance will not jeopardize endangered species or their habitat.
- The variance will not result in unreasonable risk to human health.
- The variance will not impair the existing Class 4A WUFPOWR use of Hay Lake.
- The variance will comply with antidegradation requirements.

[1] As stated in the cover letter, U. S. Steel disagrees that the Class 4A sulfate water quality standard applies to Hay Lake. As it has stated in previous filings and communication, U. S. Steel does not believe that Hay Lake has been properly designated as a Class 4A water via a formal rulemaking, as required under the state's statutes.

Table 1 Variance Request for Class 4A Sulfate WQS for WUFPOWR Applied to Hay Lake

Discharge Limitation Type[1]	SD 002	SD 003	SD 012	SD 001	SD 005	SD 009
Phase 1, Calendar Month Maximum (mg/L)	218.4	101.2	34.1	163.2	163.2	monitor

[1] The Phase 1 discharge limitations were derived by increasing the maximum recorded sulfate concentration from the past five years for each surface discharge station by 20%. For example, the Phase 1 sulfate limit for SD 002 = 182 x 20 % = 218.4 mg/L.

U. S. Steel has taken the following actions to study and/or reduce the impacts of sulfate levels in the surface discharges from the Keetac facility:

- U. S. Steel prepared a Pollutant Minimization Plan (Appendix A), a deliverable required by Minn. R. 7000.7000 Subp. 2. H. (2), which describes U. S. Steel's proposed plan for steps it intends to take during the variance period to study and reduce levels of sulfate discharged to the lowest limits practicable. The primary objective is to identify feasible technologies/alternatives for non-mechanical or mechanical treatment/mitigation to reduce the sulfate concentration to meet the final monthly maximum discharge limitations.

- Air Pollution Control Equipment (Section 2.7.3.1)

    - U. S. Steel has identified scrubber blowdown water as a source of sulfate to the tailings basin. It may contribute 10% to 20% of the sulfate loading to the tailings basin.

    - U. S. Steel is actively evaluating mercury air emission controls to comply with the Taconite Iron Ore Processing National Emission Standards for Hazardous Air Pollutants (Taconite NESHAP) as amended on January 31, 2024, and Minn. R. 7007.0502. U. S. Steel has considered dry particulate emission controls (i.e., baghouses or electrostatic precipitators) to replace the existing scrubbers to bolster mercury emissions reductions. While dry particulate controls would also prevent sulfate loading to process water from acid gas absorption, the associated costs are unreasonable.

    - U. S. Steel and the other taconite mines have filed petitions for reconsideration of the taconite NESHAP based on several technical and economic factors. U. S. Steel is awaiting a response from the EPA. Communications with the MPCA regarding compliance and requirements of Minn. R. 7007.0502 are ongoing.

- Preliminary Alternatives Identification Plan (Section 2.7.4)

    - A Preliminary Alternatives Identification Plan has been conducted to evaluate the CAPEX and OPEX costs to construct and operate wastewater treatment systems capable of meeting the effluent limits in the NPDES permits (Appendix B). Four similar treatment systems, one for each active surface discharge station, are under consideration and denoted as SD-002, SD-003, SD-005, and SD-012. Only the equipment size and/or number of modules will vary depending on the different flow rates established for each surface discharge station. The base water treatment system (WTS) will utilize nanofiltration (NF) membrane technology. The NF units are expected to separate over 95% of the feedwater sulfate into an NF reject stream. The treated water, NF permeate stream, will have a sulfate concentration lower than 14 mg/L.

    - While this study is limited to nanofiltration and a zero-liquid-discharge treatment system of the reject stream, U. S. Steel plans to explore the feasibility of other technologies for sulfate removal.

The remainder of this report presents the details of the variance application and is divided into the following sections:

- **Section 2** – Provides the information required under Minn. R. 7000.7000 for variance requests.
- **Section 3** – Demonstrates eligibility for a Class 4A WQS for WUFPOWR variance request under Minn. R. 7050.0190 and a sulfate discharge limitation variance under Minn. R. 7053.0195.
- **Section 4** – Provides the information required under 40 CFR 131.14 for variance requests.

2 Minnesota Rules, Part 7000.7000, subpart 2

Minn. R. 7000.7000 governs the procedure for the issuance of variances. This section provides the information required in subpart 2 of Minn. R. 7000.7000. Italicized text corresponds to the requirements of the rule (e.g., *A. The name and address of the applicant and the person who prepared the application* corresponds to subpart 2, item A of the rule).

2.1 Applicant Information

The written application must contain:

A. The name and address of the applicant and the person who prepared the application.

This application was prepared by U. S. Steel with assistance from Barr Engineering Co. (Barr). The contact information for the authorized representative of U. S. Steel is listed below.

Ms. Chrissy Bartovich
Director - Environmental / Minnesota Ore Operations
United States Steel Corporation
P.O. Box 417
Mt. Iron, MN 55768

The written application must contain:

B. The signature of the applicant or authorized representative.

Chrissy Bartovich
Director – Environmental / Minnesota Ore Operations

5-29-25
Date

Lukas Klemke
Acting General Manager – Minnesota Ore Operations

05/29/2025
Date

2.2 Facility Description

The written application must contain:

C. A description, including the location, of the business, plant, system, or facility for which a variance is sought.

U. S. Steel operates the Keetac facility that includes a mining area and a tailings basin. These operations are described in detail in Sections 2.2.1 and 2.2.2.

2.2.1 Keetac Mining Area

The Keetac Mining Area is located near the city of Keewatin in St. Louis and Itasca Counties, Minnesota. Large Figure 1 depicts the site location and the facility's discharge and monitoring locations, and Large Figure 2 provides the facility's water balance and water flow diagram. The principal activity at this facility is open pit mining of taconite (Biwabik Iron Formation) for processing into taconite pellets. The facility comprises the Keetac plant area, all mine excavations, mining waste disposal areas, materials and

equipment storage areas, and wastewater disposal facilities. The facility produces blast furnace (BF) grade pellets and direct reduction (DR) grade pellets.

Four permitted surface water discharges are associated with the Mining Area (NPDES/SDS Permit No. MN0031879): SD 001, SD 002, SD 003, and SD 012.

SD 001 periodically discharges water treatment plant backwash wastewater from sand filters to Welcome Lake at a rate of less than 0.010 million gallons per day (MGD). The potable water supply treatment plant uses potassium permanganate and sodium hydroxide to remove iron and manganese from the water before it is distributed through the facility.

SD 002 discharges surface stormwater runoff and groundwater from the plant and stockpile areas, and decant from the tailings pipeline switching. Stormwater is pumped to a series of sedimentation basins (known as the Ten Settling Basin System) before being released through SD 002 at a rate of 2.56 MGD to Welcome Creek. Mine pit dewatering water and stormwater are occasionally used as process makeup water and/or recycled in other plant operations. In the current Mining Area Permit, sulfate limits that do not accurately reflect the actual sulfate load that enters any potential waters used for production of wild rice (WUFPWR) downstream of Keetac are incorrectly applied at outfall SD 002. Outfall SD 002, while it flows continuously, only intermittently discharges to the potential WUFPWR. U. S. Steel pumps water (recycle water) from Reservoir 6 back to plant operations for reuse. During periods of high demand and/or low water inventories in the tailings basin, outfall SD 005, covered under the Tailings Basin Permit, does not discharge. Welcome Creek, which contains the discharge from outfall SD 002, can intermittently flow to Reservoir 6 via Reservoir 2 North. This condition recycles water instead of discharging it off site through Reservoir 2 to a potential WUFPWR located downstream. It is during this condition that the current sulfate limits at outfall SD002 are incorrectly applied, which leads to double-counting sulfate when water is recycled. Note that Large Fig. 1 and Large Fig. 2 denote “SD0XX”, which is a proposed sulfate compliance point. SD 0XX is intended to replace the current sulfate limits at SD 002 and SD 005 to accurately measure the sulfate actually discharged to the downstream WUFPWR.

SD 003 discharges mine pit dewatering water, consisting of surface stormwater runoff and groundwater, from the Mesabi Chief Pit at 2.70 MGD to O’Brien Creek.

SD 012 discharges mine pit dewatering water, consisting of surface stormwater runoff and groundwater, from the Perry Pit at 1.77 MGD to O’Brien Creek. Stormwater runoff from surrounding surface strip mining and stockpiles also flows into the Perry Pit.

2.2.2 Keetac Tailings Basin

The Keetac Tailings Basin is located near the city of Keewatin in St. Louis and Itasca Counties, Minnesota. Large Figure 1 depicts the site location. The tailings basin receives all non-sewage wastewater, namely tailings slurry (taconite tailings and associated concentrator process wastewater) and treated wet scrubber blowdown water, from the facility and stormwater runoff from portions of the facility. The principal activity at this facility is the disposal of taconite tailings and related wastewater from the Keetac Plant.

There are three permitted surface water discharges and one surface water monitoring station associated with the Tailings Basin (NPDES/SDS Permit No. MN0055948): SD 001, SD 005, SD 009, and SW 001. Wastewater from the tailings basin is captured and treated by two ponds that operate in series, called Stage 2 Interior Pond and Stage 2 Exterior Pond. A stop-log decant tower structure discharges treated

wastewater from the Stage 2 Exterior Pond to Reservoir 6. Treated wastewater is temporarily stored in Reservoir 6 before being recycled back into the Keetac Plant for further ore processing. If the water levels in Reservoir 6 get high enough, discharge can occur through outfall SD 005 or siphon outfall SD 001, to Reservoir 2.

SD 001 discharges water from Reservoir 6 at a rate of 9.4 MGD to Reservoir 2 during abnormal conditions. This discharge occurs when the volume of water entering the reservoir exceeds the combined reuse rate and discharge rate through SD 005.

SD 005 discharges water from Reservoir 6 at a rate of 4.6 MGD to Reservoir 2 under normal conditions.

SD 009 is authorized to discharge mine pit dewatering water from the Sargent Pit to Reservoir 2; however, this outfall has not been established and there is no discharge.

SW 001 is a surface water monitoring station located at the weir outlet of Reservoir 2 to the O'Brien Diversion Ditch. SW 001 is not subject to discharge limitations.

2.3 Nature of the Variance

The written application must contain:

D. The nature of the variance sought, including an identification of the applicable rules or standards from which a variance is sought, the period of time for which it is sought, and the reasons relied upon by the applicant in requesting the variance

U. S. Steel requests a variance from the Class 4A sulfate WQS for WUFPOWR (Minn. R. 7050.0224) applied to Hay Lake (AUID 31-0037-00). Minn. R. 7000.0100, subp. 14 defines variance as "an exemption from the requirements of any rule or standard of the agency and which does not require compliance with the rule or standard for the duration of the authorization." The requested variance is an exemption from compliance with the Class 4A sulfate WQS for WUFPOWR of 10 mg/L.

Subsequently, U. S. Steel requests that MPCA re-evaluate sulfate discharge limitations to be included in Keetac facility's permit(s). MPCA's Guidance for Water Quality Standard Variances (May 2020, wq-wwprm2-10a) states that a variance must "include an achievable interim effluent limit for the pollutant of concern and a schedule of pollutant reduction activities intended to result in a discharge of the highest quality wastewater possible." Per the guidance, U. S. Steel proposes the interim sulfate discharge limitations listed in Table 2. These proposed values were calculated by adding a 20% safety factor to the maximum recorded sulfate concentration from the past five years for each surface discharge station. These values represent the highest quality wastewater consistently achievable concerning sulfate concentrations. U. S. Steel is confident that effluent will comply with these Phase 1 sulfate discharge limitations throughout the duration of the variance.

Table 2 Interim Sulfate Discharge Limitations

Discharge Limitation Type[1]	SD 002	SD 003	SD 012	SD 001	SD 005	SD 009
Phase 1, Calendar Month Maximum (mg/L)	218.4	101.2	34.1	163.2	163.2	monitor
Phase 1, Calendar Month Average (mg/L)	n/a	n/a	n/a	n/a	n/a	n/a

[1] The Phase 1 discharge limitations were derived by adding a 20% safety factor to the maximum recorded sulfate concentration from the past five years for each surface discharge station. For example, the Phase 1 sulfate limit for SD 002 = 182 mg/L x 1.2 = 218.4 mg/L.

U. S. Steel requests that the variances for the surface waters and surface discharge stations remain in place for ten years. This will allow U. S. Steel to collect additional data needed to assess water quality impacts and develop sustainable sulfate reduction alternatives.

The requested variance is based on the following:

- Attainment of the sulfate WQS is economically infeasible (Minn. R. 7000.7000, subp. 2.E.) as outlined in Section 2.4.
- Strict conformity with the sulfate WQS would be unreasonable, impractical, or not feasible under the circumstances (Minn. R. 7050.0190) as outlined in Section 2.7.3.1.

2.4 Economic Burden

The written application must contain:

E. If the applicant seeks a variance primarily on grounds of economic burden, financial statements prepared or approved by a certified public accountant, or other person acceptable to the agency, which shall fairly set forth the status of the business, plant, system, or facility for each of the three financial years immediately preceding the year of the application, and an analysis of the effect of such financial status if the variance is not granted (if the business, plant, system, or facility has not been in operation for this period, then the financial statements and analysis must be based on the most complete data available)

U. S. Steel is applying for the variance on the grounds of economic burden. The economic analysis demonstrates that full compliance with the Phase 2 sulfate discharge limitations will lead to substantial economic hardship.

To demonstrate why the proposed variance is justified based on economic hardships, U. S. Steel applied the methodologies contained in the U. S. Environmental Protection Agency's (EPA's) *Interim Economic Guidance for Water Quality Standards Workbook, March 1995* (reference (1)), which provides a widely recognized framework for analyzing economic factors and developing economic impacts associated with water quality standards.

The costs required to come into compliance with the draft permit conditions present a substantial economic hardship, notably one that others in the industry and within the state do not share. This is a severe hardship for a facility that must be globally competitive. As discussed further in Section 2.7.4, U. S. Steel has evaluated the feasibility and costs of installing and operating an advanced water treatment system for treating process water capable of achieving discharge sulfate concentrations that would result in compliance with the proposed sulfate limits.

Appendix C contains the EPA's spreadsheet associated with the *Interim Economic Guidance for Water Quality Standards Workbook, March 1995* (reference (1)). U. S. Steel-specific information from fiscal years 2022, 2023, and 2024 was analyzed using EPA's spreadsheet. This information demonstrates an unacceptable economic burden associated with the capital and operational costs of an advanced water treatment system required to meet the sulfate limits.

Following EPA's guidance and working through their worksheets on financial evaluation (Appendix C), U. S. Steel determined that the requirement to install treatment would have a significant negative financial impact on the company. The water treatment equipment necessary to meet the water quality standards is estimated to require approximately $595,000,000 in capital, with annual operating and maintenance costs of approximately $13,214,900. This does not include an escalator for the substantial increases in

electrical power for the additional 8.6 megawatts (MW) of power needed to operate the technology. These costs are introduced in the Preliminary Alternatives Identification Plan (Appendix B). As the work described in the Pollutant Minimization Plan (Appendix A) proceeds, more economical treatment alternatives may be identified, necessitating the requirement to reevaluate the worksheets and financial evaluation of this section and Appendix C.

The interest rate for financing used in the calculations was 10.0% for 10 years. U. S. Steel will not be able to borrow this amount of capital from a bank at current interest rates for this type of investment. U. S. Steel will likely be required to issue bonds to finance an investment of this magnitude and level of risk; 10% is a realistic estimate of what investors will demand to assume this level of risk with their investment. This results in an annual cost of $105,166,000 for the water treatment equipment (Appendix C).

The substantial economic impacts analysis assesses the impact these costs will have on U. S. Steel. The impacts discussed are on the entire corporation, not just the Keetac facility. As described in the following subsections, four metrics are used in the assessment: profitability (a primary measure) and solvency, liquidity, and leverage (secondary measures). All four measures are considered jointly to assess the economic impacts likely to be incurred by implementing this technology.

2.4.1 Profitability

Based on the EPA guidance, the profitability test demonstrates a significant reduction in profits when the water treatment costs are factored in, which would decrease profits by 9% in 2024.

2.4.2 Solvency

In addition to the profitability test, EPA guidance was used to look at the secondary factors used in determining the substantial financial impacts of implementing the water treatment and how it relates to the company when financing capital, borrowing funds, and paying off debt.

Solvency is measured by the Beaver's ratio, which compares cash flow to total debt. The Beaver's Ratio for 2022, 2023, and 2024 are 0.83, 0.43, and 0.31, respectively. While these ratios do not indicate issues with the corporation's solvency, they are trending in a negative direction. They also do not reflect the impact of the proposed project on the Keetac facility directly.

2.4.3 Liquidity and Leverage

Liquidity is measured by the Current Ratios. A Current Ratio greater than two suggests a company can cover its short-term financial obligations. U. S. Steel's Current Ratios for 2022, 2023, and 2024 are 1.99, 1.76, and 1.55, respectively.

The amount of money a company can borrow can be influenced by the Debt-to-Equity Ratio. It suggests additional costs associated with the water treatment equipment would substantially increase the company's financial burden.

The financial analysis provided by the EPA's guidance demonstrates that achieving full compliance with the surface water quality standards would lead to substantial economic hardship to U. S. Steel.

2.4.4 Substantial and Widespread Social and Economic Factors

If the variance is denied, an analysis predicts that compliance with the water quality standards using the alternatives and technologies identified in Appendix B could lead to widespread adverse socioeconomic impacts in the geographic area surrounding the Keetac facility. Appendix C contains the Widespread Social and Economic Impact Inputs worksheet, from the EPA's Spreadsheet associated with the *Interim Economic Guidance for Water Quality Standards Workbook, March 1995* (reference (1)). Appendix C analyzes regional economic data to determine the Widespread Social and Economic Impact resulting from the denial of the requested variance.

For this analysis, the affected community is defined as the Iron Range surrounding the Keetac facility, and includes the communities of Buhl, Calumet, Chisholm, Hibbing, Keewatin, Marble, Nashwauk, and unincorporated areas in Itasca and St. Louis counties.

Based on U.S. Census 2022 American Community Survey 5-Year Estimates data (Selected Economic Characteristics Table DP03), the affected community has an unemployment rate of 5.26%, slightly below the national average of 5.3%, but well above the statewide average of 4.00%. Approximately 450 people are employed at Keetac. Thus the unemployment rate of the affected community could increase significantly if the variance were denied, making the installation of water treatment equipment necessary. Indirect impacts could drive this rate even higher. In addition to the unemployment rate, local tax revenues could also decrease, while the need for social services would climb. Based on the 2022 Minnesota City Finances audit report (reference (2)), the portion of the tax revenue from Itasca and St. Louis counties in the affected community is approximately $13,026,268. The proportionate spending on social services is estimated at $28,395,927 based on the population of the affected community and the 2020 average social services expenditure per capita in Itasca and St. Louis counties as listed in the Minnesota County Human Services Cost Report (reference (3)).

U. S. Steel pays approximately $16,955,000 per year in production tax to Minnesota, which then redistributes those dollars throughout the state to local school districts, communities, counties, etc. U. S. Steel is responsible for approximately 15% of the taconite taxes paid to Minnesota and is a substantial contributor to the State School Trust Fund (reference (4)).

U. S. Steel also supports many additional contractors and suppliers that live in the region, contributing to taxes and employment. According to the University of Minnesota Duluth Labovitz study, for every mining job an additional 1.25 jobs are supported in the region. Therefore, the approximate 450 jobs at the Keetac facility contribute to an additional 566 jobs in the region (reference (5)).

2.5 Technological Feasibility

The written application must contain:

F. If the applicant seeks a variance on grounds that compliance is not technologically feasible, a report from a registered professional engineer, or other person acceptable to the agency, stating fully the reasons why compliance is not technologically feasible

U. S. Steel is not seeking a variance on the grounds that compliance is not technologically feasible. While Section 2.7.4 discusses a Preliminary Alternatives Identification Plan, the technology described in the plan has never been implemented at the scale required to treat the volume of water generated by a taconite mining facility to the proposed Phase 2 sulfate discharge limitations.

2.6 Other Additional Information Required by a Rule or Standard

The written application must contain:

G. Other additional data or information that is required by an applicable agency rule or standard

Minn. R. 4410.4300 lists categories of projects for which an environmental assessment worksheet (EAW) must be prepared. Per subp. 18. F., constructing a new industrial process wastewater treatment facility of 200,000 gallons per day or more, triggers this requirement. The MPCA is the responsible governmental unit (RGU) for this category. The EAW process can add months to a project's schedule through the preparation and review of the EAW, public comments, and the decision-making process. If the RGU determines that an environmental impact statement (EIS) is required, years can be added to the project schedule. While the two processes can run concurrently, the environmental review process (EAW and EIS) must be completed before NPDES/SDS permits can be issued for a project. This process can add time to the project schedule that has not been accounted for in the compliance schedules proposed in the pre-public notice draft permits.

2.7 Other Relevant Data or Information

The written application must contain:

H. Any other relevant data or information that the board or the commissioner deems essential to a determination on the application, including but not limited to the following:

Sections 2.7.1 through 2.7.5 provide responses to the other relevant data or information items listed in the regulations.

2.7.1 General Description of Materials and Processes

(1) A general description of the materials handled or processed by the applicant that are pertinent to the subject application, and a statement of the nature and quantity of the materials being discharged, emitted, or disposed of, and that can reasonably be expected to be discharged, emitted, or disposed of during the period of the proposed variance, and proposed methods for the control of these materials;

A general description of the Keetac facility's processes is presented in Section 2.2. No operational changes or production increases are proposed at the facility.

The nature and quantity of the materials within the surface waters are represented by the existing effluent quality, as shown in Large Table 1. The table summarizes sulfate concentrations in each permitted surface discharge station from the past five years. These values were reported to the MPCA on routine discharge monitoring reports (DMR).

2.7.2 Proposed Plan during Variance Period

(2) A comprehensive proposed plan indicating the steps to be taken by the applicant during the period of the variance, even if the applicant is seeking a permanent variance, to reduce emission levels or discharges to the lowest limit practical;

U. S. Steel has prepared a pollutant minimization plan (Plan), as required by Minn. R. 7000.7000, subp. 2. H. (2.), which describes steps U. S. Steel intends to take during the variance period to study and reduce sulfate levels discharged to the lowest limits practicable. The primary objective of the Plan is to identify feasible technologies/alternatives for non-mechanical or mechanical treatment/mitigation to

reduce the concentration of sulfate to meet the final sulfate monthly maximum discharge limitations. Appendix A contains the Plan.

2.7.3 Variance Effects on Air, Water, and Land Resources

> ***(3) A concise statement of the effect upon the air, water, and land resources of the state and upon the public and other persons affected, including those residing in the area where the variance will take effect, which will result from board or commissioner approval of the requested variance;***

The effects of implementing the Class 4A sulfate WQS on air, water, and land resources for WUFPOWR variance are discussed in Section 2.7.3.1 through 2.7.3.3.

2.7.3.1 Air Impacts

As discussed further in Section 2.7.4, U. S. Steel has evaluated the feasibility and costs of installing and operating an advanced water treatment system for the treatment of process water that may be technically feasible for achieving discharge sulfate concentrations in compliance with the proposed sulfate limits. Technical issues aside, generating the electrical power required to operate such an advanced water treatment system would result in releasing significant amounts of greenhouse gases (GHG) and other pollutants. The environmental impact of those emissions compared to the benefit of complying with the Class 4A sulfate WQS for WUFPOWR means that strict conformance with sulfate discharge limitations derived from the Class 4A sulfate WQS for WUFPOWR may be detrimental from an overall environmental perspective.

The advanced water treatment system required for strict conformance with the standard, as described in Section 2.7.4, will require a significant amount of electrical energy to operate. The water treatment system necessary to treat the amount of process water for the Keetac facility is estimated to have an electrical power demand of nearly 8.6 MW. Table C-5 of Appendix D shows this is the equivalent of the annual electrical consumption of approximately 7,000 households.

The public electrical grid supplies electricity for the Keetac facility and other taconite facilities. Minnesota Power's Boswell Energy Center (BEC), in Cohasset, Minnesota, currently generates a combined 940 MW into the grid that is used to serve the Keetac facility. BEC Unit 4, a coal-fired generator, provides 585 MW. Under Minnesota Power's preferred plan, as submitted in its Integrated Resource Plan (IRP) to the Minnesota Public Utilities Commission (MPUC), BEC 4 is scheduled to cease coal operations by 2035. BEC 3, also a coal fired generator, provides 355 MW. Under the IRP, BEC Unit 3 is scheduled to cease coal operations by 2030 (reference (6)).

Electrical generation used to support an additional 8.6 MW of load would come from a variety of generation sources. In 2023, approximately half of the energy delivered to customers came from fossil fuels. Electricity required to operate the water treatment system will likely be generated from the combustion of coal at least until 2035. Electricity generated from the combustion of natural gas is likely to remain in use for many years.

Minnesota Power will need to complete a transmission system impact study to ensure that the impacts from the project are understood. If any transmission system upgrades are necessary as a result of the increased load level, they will be identified in the study and implemented in coordination with the Keetac facility's timing for the load addition. Appendix D contains emission calculations for the indirect emissions

attributable to the electrical power consumed by the water treatment system that will be required to strictly conform with the WQS in Minn. R. 7050.

Table 3 summarizes indirect GHG emissions using publicly available emission factors from BEC and emission factors for a modern gas-fired power plant from natural gas combined cycle (NGCC) peaking plants. To achieve compliance, indirect emissions from a total of three outlets will contribute to these secondary impacts.

Table 3 Comparison of Indirect GHG Emissions from Coal and Natural Gas-Fired Power Plants

GHG Emission	Coal Boiler (tpy) (CO_2e value)	NGCC (tpy) (CO_2e value)
CH_4	8.75 (244.87)	0.53 (14.78)
N_2O	1.27 (337.10)	0.05 (13.99)
CO_2	77,254.66 (77,254.66)	28,004.65 (28,004.65)
Total CO_2e [1]	77,837	28,033

[1] CO_2e, or CO_2 equivalent, is determined by multiplying the CH_4 (methane), N_2O (nitrous oxide), and CO_2 (carbon dioxide) emissions estimates by the respective Global Warming Potential, 100-Year Time Horizon factor and adding the results.

Therefore, any environmental benefits (speculative at best) of meeting the sulfate WQS must be considered alongside the significant secondary emissions that will be generated with the implementation of an advanced water treatment system. Under current federal and state rules for air emission permitting, indirect sources, such as off-site electricity generation, are not regulated at the site where the electrical energy is consumed.

The Minnesota Environmental Quality Board (EQB) revised item 18, Greenhouse Gas (GHG) Emissions/Carbon Footprint, of the Environmental Assessment Worksheet (EAW) in December 2022. The revisions added GHG quantification, assessment, and adaptation and resiliency requirements to item 18. The EQB published EAW climate guidance, *Developing a carbon footprint and incorporating climate adaptation and resilience*, in July of 2023 (reference (7)).[1]

If constructing or modifying a stationary source facility increases GHG generation by a combined 100,000 tons or more per year of carbon dioxide equivalent (CO_2e), after installation of air pollution control equipment, an EAW is required (reference (8)). The EQB has previously proposed changes to the EAW process, including additional review and approval of projects with GHG emissions that exceed 25,000 tons per year (tpy) CO_2e. Whether or not thresholds for GHG emissions change in the future, the process illustrates the significant impact of the emissions.

There is an increased public and societal sensitivity to carbon emissions. Minnesota has a goal of reducing carbon emissions. U. S. Steel has announced companywide carbon reduction goals and is leading the industry to reduce carbon emissions.

Other emissions and wastes generated by the wastewater treatment system include:

[1] The evaluation of air impacts was developed using the July 2023 version of EQB's EAW climate guidance, *Developing a carbon footprint and incorporating climate adaptation and resilience*. EQB has since published a revised version of the guidance dated June 2024; however, there do not appear to be any significant changes to the guidance that affect the evaluation.

- Sludge/solid waste will be generated by the process and will require off-site disposal at a landfill. Estimated amounts of sludge are approximately 58,700 tons per year (tpy), estimated at a 90% plant capacity factor.
- Table C-6 of Appendix D shows calculations for mobile source emissions associated with solid waste disposal. Mobile source emissions from trucks required to haul the sludge to the landfill are estimated to be approximately 300 tpy CO_2e.

Additional mobile source emissions will be attributable to transporting the reagents required to operate the water treatment system. While sources for these chemicals have not been identified, these indirect emissions need to be considered for a complete evaluation of the indirect environmental impacts from the advanced water treatment system.

2.7.3.2 Water Impacts

The water impacts from the requested variances can be expected to be similar to the current conditions in Hay Lake. Beneficial uses are not currently, nor anticipated to be, negatively impacted by the existing water quality of the waterbodies. Several studies have been conducted in Hay Lake to evaluate hydrologic conditions, wild rice presence, and wild rice density. The results of these studies are summarized in the site-specific standard and have shown abundant wild rice populations in most years. U. S. Steel conducted additional studies of downstream receiving waters in 2023 and 2024, consistent with the methods in the MPCA's 2023 Framework and 2017 and 2018 Methods. If necessary, studies will continue in subsequent years.

The studies point toward the significant influence water levels have on the condition of wild rice in Hay Lake. Beaver activity has proven to have a significant impact on water levels at Hay Lake. U. S. Steel has begun to control beaver activity in the vicinity of Hay Lake in order to optimize water levels to promote the growth of wild rice.

2.7.3.3 Land Resources Impacts

U. S. Steel is not seeking a variance from any discharge limitations other than those derived from the Class 4A sulfate WQS for WUFPOWR, Minn. R. 7050.0224 Subp. 2. U. S. Steel is not seeking variances for other Class 3 (Industrial), Class 4A (Irrigation), or Class 4B (livestock and wildlife) WQS. The proposed variance would allow for the continued discharge of existing water quality and is not expected to result in changes to the existing downstream habitat (see Section 3.1.1).

Increases in landfill capacity would be needed to address solid waste generated from sulfate treatment technologies. See Section 2.7.3.1 and Section 2.7.4 for more details on solid waste generation and disposal.

2.7.4 Proposed Alternatives

(4) A statement of the alternatives to the proposed operation under the variance which have been considered by the applicant; and

The draft public notice permits contain sulfate discharge limitations of 14 mg/L (monthly average) and 24 mg/L (daily max) that were derived from the Class 4A sulfate WQS for WUFPOWR of 10 mg/L. The MPCA proposed to implement compliance schedules related to these sulfate discharge limitations, which will require U. S. Steel to study, plan, design, construct, and initiate the operation of wastewater treatment infrastructure capable of achieving these limits. U. S. Steel has completed a broad review of potentially

applicable treatment technologies for reducing sulfate discharged from the facility. The applicability of these technologies to treat sulfate at the facility will be investigated further in the Alternatives Identification Plan. U. S. Steel is currently discussing the availability of pilot units with vendors.

Prior to commencement of design activities proposed in the compliance schedule, U. S. Steel completed a Preliminary Alternatives Identification Plan (Appendix B). Four treatment systems, one for each active surface discharge station, are under consideration and denoted as SD 002, SD 003, SD 005, and SD 012, and each treatment system will be similar. Only the equipment size and/or number of modules will vary depending on the different flow rates established for each surface discharge station. The base water treatment system (WTS) will utilize nanofiltration (NF) membrane technology. The NF units are expected to separate over 95% of the feedwater sulfate into an NF reject stream. The treated water, NF permeate stream, will have a sulfate concentration lower than 14 mg/L.

The NF reject stream will have a high concentration of sulfate and will undergo further treatment by a zero-liquid-discharge (ZLD) system to generate solid waste for landfill disposal. Lime will be used to soften the NF reject stream to precipitate calcium and magnesium salts. The softened water from the clarifier will be filtered with ultrafiltration (UF) units to remove suspended solids before processing with a reverse osmosis (RO) system to concentrate the salts into a RO reject stream. The RO permeate will be high-quality water with lower than 14 mg/L sulfate and will be discharged with the NF permeate. The RO reject stream will be mixed with soda ash before being processed by a bolt-on evaporator/crystallizer treatment system to ultimately generate sulfate (and other) salts. Sludge from the NF reject stream, pressed into filter cake, and sulfate salts are non-hazardous solids that are shipped off-site as solid waste for landfill disposal.

Appendix B contains the report Sulfate Water Treatment Preliminary Alternatives Identification Plan, Barr Engineering Co., April 30, 2025, which further describes the proposed treatment system and provides estimated capital and operating costs for the four treatment systems. The net present value of the combined capital and operational costs of the four proposed treatment systems is $814,298,000, with a -30%/+50% range of $600,000,000 to $1,300,000,000.

The proposed sulfate discharge limitations are intended to protect wild rice in Hay Lake. U. S. Steel's permits are among the first in Minnesota requiring a taconite facility to construct wastewater treatment infrastructure to achieve these discharge limitations. While the technology to achieve these WQS exists, it has never been implemented at the scale required to treat this volume of water to these levels of sulfate.

Based on previous studies and pilot testing, the proposed water treatment technology should be capable of consistently achieving these sulfate limits. While other treatment technologies are known, or are being studied and evaluated, to date none have proven to be economically capable of consistently meeting the sulfate discharge limitations required by U. S. Steel's permits at the current flow rates and concentrations. As the work described in the Pollutant Minimization Plan (Appendix A) proceeds, more economical treatment alternatives may be identified, necessitating the requirement to reevaluate this section and Appendix C.

Finally, requiring this level of treatment would result in other significant environmental impacts. Specifically, the large chemical usage and power requirements for this treatment system would create GHG emissions and other cross-media impacts, while the solid wastes generated would require additional landfill capacity. These are discussed in greater detail in Section 2.7.3.1.

2.7.5 Variance Effect on Economic Factors

(5) A concise statement of the effect on establishment, maintenance, operation, and expansion of business, commerce, trade, traffic, and other economic factors that may result from approval and from denial of the requested variance.

The economic analysis in Section 2.4 demonstrates that full compliance with the sulfate discharge limitations will lead to substantial economic hardship for U. S. Steel as well as negative impacts for the surrounding communities.

3 Minnesota Rules, Parts 7050.0190 and 7053.0195

Minn. R. 7050.0190 applies to variance requests from individual point source discharges to surface waters of the state for any water quality-based effluent limit based on a water quality standard of Minn. R., 7050 that is included in a permit. A variance under this part is a temporary change in a state WQS for a specified pollutant that reflects the highest attainable conditions for a permittee during the term of the variance. Minn. R. 7053.0195 applies to individual point source discharges to surface waters of the state seeking a temporary change in discharge effluent limit and states that the permittee must demonstrate eligibility and compliance with Minn. R. 7050.0190 before receiving a discharge limit variance. Sections 3.1 and 3.2 provide the information required in both regulations. As in Section 2, italicized text corresponds to the requirements of the rule.

3.1 Applicability

The following discussions demonstrate that U. S. Steel has met the conditions required by Minn. R. 7050.0190, Subp. 1, and is thus eligible for the variance.

3.1.1 Variance would not Jeopardize Endangered or Threatened Species

A. The variance would not jeopardize the continued existence of an endangered or threatened species listed under chapter 6134 or section 4 of the Endangered Species Act, United States Code, title 16, section 1533, or result in destruction or adverse modification of the species' critical habitat;

U. S. Steel is seeking a variance from limits based on the Class 4A sulfate WQS for WUFPOWR, Minn. R. 7050.0224, subp. 2. Granting the requested variances will not jeopardize the continued existence of an endangered or threatened species listed under chapter 6134 or section 4 of the Endangered Species Act, United States Code, title 16, section 1533, or result in the destruction or adverse modification of species' critical habitat. The discharge rates and water quality of all surface discharge stations are expected to remain consistent with past discharge rates and water quality; therefore, the proposed variance, which would allow for continued discharge of existing water quality, is not expected to result in changes to the existing downstream habitat.

3.1.1.1 Federally Listed Threatened and Endangered Species

Based on a review of the U. S. Fish and Wildlife Service's (USFWS) Information for Planning and Consultation (IPaC) database on December 4, 2024, three federally listed threatened and endangered species may be present within the Keetac facility (Table 4 and Appendix E). There is no designated critical habitat within the Keetac facility or flow paths of the discharges. The following subsections provide habitat information and any potential variance-related effects for each species.

Table 4 Federally Listed Threatened and Endangered Species Summary

Common Name	Scientific Name	Federal Status
Northern Long-eared Bat	*Myotis septentrionalis*	Endangered
Canada Lynx	*Lynx canadensis*	Threatened
Grey Wolf	*Canis lupus*	Threatened

Northern Long-eared Bat (*Myotis septentrionalis*)

Northern long-eared bats (NLEB) exhibit seasonal habitat preferences. During winter, they hibernate in caves and mines, known as hibernacula, seeking areas with constant temperatures, high humidity, and minimal air currents. Within these hibernacula, bats often occupy small crevices or cracks, often with only their noses and ears visible. In contrast, during spring, summer, and portions of the fall, these bats roost in various arboreal habitats, including tree cavities, crevices, and under loose bark. While they primarily utilize forested areas for roosting, foraging, and commuting between summer and winter habitats, they have also been observed roosting in structures such as barns and sheds. The Keetac facility contains suitable roosting habitat for NLEB.

The USFWS range-wide determination key was utilized to evaluate potential impacts to this species. Per that tool, there may be suitable NLEB habitat within the Keetac facility; however, no known bat hibernaculum is located within 0.5 miles of the tailings basin. Therefore, the requested variances would not be reasonably expected to jeopardize the continued existence of the NLEB.

Grey Wolf (*Canis lupus*) and Canada Lynx (*Lynx canadensis*)

Gray wolves and Canada lynx primarily inhabit forested areas, particularly those with a mix of deciduous and coniferous trees. They favor regions with abundant food sources, such as deer, elk, and smaller prey. Den sites are typically located in secluded areas. Both species often utilize natural dens, such as caves, rock crevices, or hollow logs. The specific location of den sites can vary depending on factors like prey availability and disturbance levels.

The operation of U. S. Steel's Keetac facility and proximity to the city of Keewatin bring a regular human presence to the area. Gray wolves and Canada lynx are not likely to utilize this area as a result, and the requested variances are not expected to result in landscape-level conversion that would affect these species, if present. Therefore, the requested variances would not be reasonably expected to jeopardize the continued existence of grey wolves and Canada lynx or result in the destruction or adverse modification of their habitat.

3.1.1.2 Migratory Birds and Eagles

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA), which prohibits the taking of any migratory bird, nest, or eggs of any such bird, except under the terms of a valid permit issued pursuant to federal regulations. Trees and shrubs located within the Keetac facility could be used by migratory birds as suitable nesting habitats. However, the requested variances would not be reasonably expected to jeopardize the continued existence of birds nesting within the Keetac facility.

Bald and golden eagles are protected under the MBTA and the Bald and Golden Eagle Protection Act (BGEPA), which prohibits the take of bald or golden eagle adults, juveniles, or chicks, including their nests, or eggs without a valid permit. Suitable nesting habitat for the bald eagle is located within the Keetac facility. However, the requested variances would not be reasonably expected to jeopardize the continued existence of nesting eagles within the Keetac facility.

3.1.1.3 State Listed Threatened and Endangered Species

Based on Barr's review of the Minnesota Department of Natural Resources (MDNR) Natural Heritage Information System (NHIS) database on December 4, 2024, records of seven state-listed threatened and endangered species were identified within one mile of the Facility (Table 5). However, no element

occurrences for these species were located within the Keetac facility and impacts to these species resulting from the dischargers are not anticipated. Therefore, the requested variances would not be reasonably expected to jeopardize the continued existence of these plant species or result in the destruction or adverse modification of their habitat.

Table 5 State Listed Threatened and Endangered Species Summary

Common Name	Scientific Name	Habitat Type	State Status
Slender Prairie Moonwort	*Botrychium campestre var. lineare lineare*	Upland	Endangered
Upswept Moonwort	*Botrychium ascendens*	Upland	Endangered
Blunt-Lobed Grapefern	*Sceptridium oneidense*	Wetland / Upland	Threatened
Case's Ladies' Tresses	*Spiranthes casei var. casei*	Upland	Threatened
Goblin Fern	*Botrychium mormo*	Upland	Threatened
Narrow Triangle Moonwort	*Botrychium angustisegmentum*	Upland	Threatened
Tubercled Rein Orchid	*Platanthera flava var. herbiola*	Wetland	Threatened

3.1.2 Standards are not Attained by CWA Sections 301(b) and 306

B. Standards will not be attained by implementing effluent limitations required under sections 301(b) and 306 of the Clean Water Act, United States Code, title 33, sections 1311(b) and 1316, and by the permittee implementing cost-effective and reasonable best management practices for nonpoint sources under the permittee's control as established under state authority; and

No applicable sulfate technology-based effluent limits (TBELs) required under sections 301(b) and 306 of the Clean Water Act, United States Code, title 33, sections 1311(b) and 1316 exist. The discharges at each surface discharge station are in compliance with applicable TBELs for other parameters (e.g., pH, total suspended solids (TSS), and dissolved iron), and this compliance has not resulted in the attainment of the sulfate WQS for which variance is proposed.

U. S. Steel does not control nonpoint sources which contribute to the concentrations of the sulfate in Hay Lake. Therefore, it is not possible to attain the sulfate WQS through implementation of cost-effective and reasonable best management practices for nonpoint sources.

3.1.3 Variance would not Remove an Existing Use

C. The variance would not remove an existing use.

As described previously, the discharge rate and water quality of each surface discharge station are expected to remain consistent with past discharge rates and water quality. Therefore, the proposed variance, which would allow for continued discharge of existing water quality, would not be expected to result in the removal of an existing use of the receiving waters.

The variance is specific to compliance with the Class 4A sulfate WQS for WUFPOWR, not the Class 4A use designation. As evidenced by the wild rice monitoring studies discussed in Section 2.7.3.2, the presence of wild rice has been observed in Hay Lake.

Additionally, as discussed in Section 2.7.3.3:

- Classes 3B, 3C, and 4A uses are not existing uses of Hay Lake, with the exception of the Class 4A sulfate WQS for WUFPOWR, and U. S. Steel is not requesting variances them, except for the Class 4A sulfate WQS for WUFPOWR.
- Class 4B uses for livestock watering and non-acclimated wildlife are not existing uses of Hay Lake, and thus, there are no such existing uses to be affected by the requested variance from Class 4B water quality standards. Class 4B uses for acclimated wildlife do currently exist, but such wildlife are current users of the water and thus are acclimated to the water quality. U. S. Steel is not requesting variances from Class 4B WQS.
- There are no existing Class 1B uses for drinking water of Hay Lake, and the requested variances will not result in negative impacts on Class 1B uses because the use for drinking water is non-existent. Impacts on wildlife are discussed in Section 3.1.1. U. S. Steel is not requesting variances from Class 1B WQS.
- No negative impacts to Classes 2A, 2B, 5, or 6 uses will occur as a result of the variances. U. S. Steel is not requesting variances from Class 2A, 2B, 5, or 6 water quality standards.

3.2 Conditions for Approval

The following discussions demonstrate U. S. Steel has met the conditions required by Minn. R. 7050.0190, subp. 4, and is thus eligible for the variance.

3.2.1 Demonstration that Attaining the Water Quality Standard is not Feasible

A. Demonstrate to the agency that attaining the water quality standard is not feasible because:

(1) Naturally occurring pollutant concentrations prevent attainment of the water quality standard;

(2) Natural, ephemeral, intermittent, or low-flow conditions or water levels prevent attainment of water quality standards, unless these conditions may be compensated for by discharging sufficient volume of effluent to enable water quality standards to be met without violating the water conservation requirements of Minnesota Statutes, chapter 103G;

(3) Human-caused conditions or sources of pollution prevent attainment of water quality standards, and the conditions or sources cannot be remedied or would cause more environmental damage to correct than to leave in place;

(4) Dams, diversions, or other types of hydrologic modifications preclude attainment of water quality standards, and it is not feasible to restore the water body to its original condition or to operate the modification in a way that would result in attainment of the water quality standard;

(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate cover, flow, depth, pools, riffles, and the like, unrelated to chemical water quality, preclude attainment of aquatic life protection uses; or

(6) Controls more stringent than those required under sections 301(b) and 306 of the Clean Water Act, United States Code, title 33, section 1311(b) and 1316, would result in substantial and widespread negative economic and social impacts;

In accordance with the conditions for approval in Minn. R. 7050.0190, subp. 4.A, Section 3.2.1.1 and 3.2.1.2 provide demonstration that attainment of the Class 4A sulfate WQS for WUFPOWR is not feasible because (1) implementation of controls more stringent than those required under sections 301(b) and 306 of the Clean Water Act, United States Code, title 33, section 1311(b) and 1316, would result in substantial

and widespread negative economic and social impacts and (2) human-caused conditions or sources of pollution prevent attainment of the WQS, and the conditions or sources cannot be remedied or would cause more environmental damage to correct than to leave in place.

The EPA uses 40 CFR 131.10(g) as its criteria for approving a variance. Refer to Section 4 for additional demonstration of the need for a WQS variance in accordance with the requirements of 40 CFR 131.14.

3.2.1.1 Substantial and Widespread Negative Economic and Social Impacts

Immediate sulfate WQS attainment is not feasible because the implementation of controls more stringent than those required under sections 301(b) and 306 of the Clean Water Act, United States Code, title 33, section 1311(b) and 1316 would result in substantial and widespread negative economic and social impacts, as discussed in Section 2.4.

3.2.1.2 Environmental Damage to Correct

Immediate sulfate WQS attainment is not feasible because human-caused conditions or sources of pollution prevent sulfate WQS attainment, and the conditions or sources cannot be remedied or would cause more environmental damage to correct than to leave in place, as discussed in Section 2.7.3.

3.2.2 Variance Conforms with parts 7050.0250 to 7050.0335

B. Show that the variance conforms with parts 7050.0250 and 7050.0335;

Minn. R. 7050.0250 to 7050.0335 are the antidegradation standards and apply to new or expanded discharges. The discharges for which this variance is requested are neither new nor expanded. Per Minn. R. 7050.0255, subp. 26.B.

> *"Application of new effluent limitations based on improved monitoring data or new water quality standards that are not a result of changes in loading or other causes of degradation within the existing capacity and processes authorized by an applicable control document is not considered a net increase in loading or other causes of degradation."*

U. S. Steel's permits currently authorize the discharge from surface discharge stations SD 001, SD 005, SD 009, SD 002, SD 003, and SD 012. These are not new or expanded surface discharge stations. Furthermore, none of the permitted discharges flow to outstanding resource value waters. This variance request stems from the MPCA's enforcement of the sulfate WQS for the production of wild rice that was previously not applied to Hay Lake, downstream the Facility.

3.2.3 Characterization of Risk to Human Health and the Environment

C. Characterize the extent of any increased risk to human health and the environment associated with granting the variance, such that the agency is able to conclude that any increased risk is consistent with the protection of the public health, safety, and welfare; and

Granting the requested variance will not increase risk to human health and the environment. The Class 4A sulfate WQS for WUFPOWR is not based on human health criteria. The EPA has developed secondary drinking water standards. These non-mandatory WQS were established to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor. These constituents are not considered to present a risk to human health at the secondary maximum

contaminant level (SMCL). The SMCL for sulfate is 250 mg/L; water with sulfate levels above this SMCL may taste salty. Sulfate concentrations from all surface discharge stations are below the sulfate SMCL.

Risks to the environment are discussed in Section 3.1.

3.2.4 Determination of Water Quality Currently Attained

D. Show sufficient information to allow the agency to determine the water quality currently attained and the interim numeric effluent conditions that reflect the highest attainable conditions for a permittee during the term of the variance.

Large Table 1 presents DMR data for each surface discharge station from the past five years. Refer to Section 2.7.1 for additional details about effluent quality.

These data were used to derive the highest attainable interim sulfate discharge limitations. Refer to Section 2.3 for more information.

4 Federal Variance Regulation, 40 CFR 131.14

WQS variances are subject to federal regulation 40 CFR 131.14 and must be reviewed and approved by the EPA. The cited federal regulation outlines the application requirements for WQS variances. MPCA adopted the same requirements in state regulations; thus, the information required by federal regulation has been supplied above. To provide a thorough and complete variance request, U. S. Steel maintained the format of this application narrative by providing the federal regulation in italicized text, followed by U. S. Steel's response.

4.1 Applicability

(a) Applicability

(1) A WQS variance may be adopted for a permittee(s) or water body/waterbody segment(s), but only applies to the permittee(s) or water body/waterbody segment(s) specified in the WQS variance.

(2) Where a State adopts a WQS variance, the State must retain, in its standards, the underlying designated use and criterion addressed by the WQS variance, unless the State adopts and EPA approves a revision to the underlying designated use and criterion consistent with §§ 131.10 and 131.11. All other applicable standards not specifically addressed by the WQS variance remain applicable.

(3) A WQS variance, once adopted by the State and approved by EPA, shall be the applicable standard for purposes of the Act under § 131.21(d) through (e), for the following limited purposes. An approved WQS variance applies for the purposes of developing NPDES permit limits and requirements under 301(b)(1)(C), where appropriate, consistent with paragraph (a)(1) of this section. States and other certifying entities may also use an approved WQS variance when issuing certifications under section 401 of the Act.

(4) A State may not adopt WQS variances if the designated use and criterion addressed by the WQS variance can be achieved by implementing technology-based effluent limits required under sections 301(b) and 306 of the Act.

U. S. Steel has demonstrated the applicability of the Class 4A sulfate WQS for WUFPOWR variance in the preceding sections; therefore it is eligible for the requested variance.

4.2 Requirement for Submission to EPA

The following subsections address the requirements for a WQS variance request outlined in 40 CFR 131.14(b)(1).

4.2.1 Identification of Parameters and Waterbody Segments

(i) Identification of the pollutant(s) or water quality parameter(s), and the water body/waterbody segment(s) to which the WQS variance applies. Discharger(s)-specific WQS variances must also identify the permittee(s) subject to the WQS variance.

U. S. Steel requests a variance from the Class 4A sulfate WQS for WUFPOWR applied to Hay Lake. Refer to Section 2.3 for more details on the nature of the variance.

4.2.2 Highest Attainable Criterion or Effluent Condition

(ii) The requirements that apply throughout the term of the WQS variance. The requirements shall represent the highest attainable condition of the water body or waterbody segment applicable

throughout the term of the WQS variance based on the documentation required in (b)(2) of this section. The requirements shall not result in any lowering of the currently attained ambient water quality, unless a WQS variance is necessary for restoration activities, consistent with paragraph (b)(2)(i)(A)(2) of this section. The State must specify the highest attainable condition of the water body or waterbody segment as a quantifiable expression that is one of the following:

(A) For discharger(s)-specific WQS variances:

(1) The highest attainable interim criterion; or

(2) The interim effluent condition that reflects the greatest pollutant reduction achievable; or

(3) If no additional feasible pollutant control technology can be identified, the interim criterion or interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant control technologies installed at the time the State adopts the WQS variance, and the adoption and implementation of a Pollutant Minimization Program.

(iii) A statement providing that the requirements of the WQS variance are either the highest attainable condition identified at the time of the adoption of the WQS variance, or the highest attainable condition later identified during any reevaluation consistent with paragraph (b)(1)(v) of this section, whichever is more stringent.

The Class 4A sulfate WQS for WUFPOWR is 10 mg/L. Based on MPCA calculations, this produces sulfate discharge limitations of 14 mg/L as a monthly average and 24 mg/L as a daily maximum. U. S. Steel has demonstrated in Section 2 and Section 3 that compliance with these sulfate discharge limitations is not attainable. Therefore, U. S. Steel proposes using interim sulfate discharge limitations that represent the highest attainable effluent conditions for each surface discharge station for the duration of the variance.

The existing sulfate effluent conditions presented in Section 2.3 were based on past discharge performance. These values can be consistently achieved and will not impact the Class 4A designated use for WUFPOWR because water quality conditions will not degrade. Existing effluent quality will be maintained; therefore, existing water quality in Hay Lake will be maintained, barring changing environmental conditions beyond U. S. Steel's control.

Furthermore, U. S. Steel plans to continue evaluating sulfate reduction alternatives to incrementally reduce concentrations of sulfate discharge for the duration of the variance. This effort will satisfy the requirement to implement pollution minimization strategies in conjunction with interim sulfate discharge limitations.

4.2.3 Term of the WQS Variance

(iv) The term of the WQS variance, expressed as an interval of time from the date of EPA approval or a specific date. The term of the WQS variance must only be as long as necessary to achieve the highest attainable condition and consistent with the demonstration provided in paragraph (b)(2) of this section. The State may adopt a subsequent WQS variance consistent with this section.

U. S. Steel requests that the variance be effective for ten years. Refer to Section 2.3 for more information.

4.2.4 Re-evaluation of Highest Attainable Condition and WQS Variance

(v) For a WQS variance with a term greater than five years, a specified frequency to reevaluate the highest attainable condition using all existing and readily available information and a provision

specifying how the State intends to obtain public input on the reevaluation. Such reevaluations must occur no less frequently than every five years after EPA approval of the WQS variance and the results of such reevaluation must be submitted to EPA within 30 days of completion of the reevaluation.

(vi) A provision that the WQS variance will no longer be the applicable water quality standard for purposes of the Act if the State does not conduct a reevaluation consistent with the frequency specified in the WQS variance or the results are not submitted to EPA as required by (b)(i)(v) of this section.

The highest attainable condition and the WQS variance for sulfate will be re-evaluated every five years or once per permit cycle, whichever is shorter. Ideally, the re-evaluation will occur concurrently with the permit reissuance application.

U. S. Steel will continue to monitor sulfate at each of the permitted surface discharge stations and will submit the data to the MPCA via routine DMRs. This data will also be incorporated into the permit reissuance applications, which typically occur every five years.

The Class 4A sulfate WQS for WUFPOWR variance request will be updated and submitted alongside the subsequent permit reissuance application.

4.3 Supporting Documentation for Variance

Sections 4.3.1 through 4.3.3 address the requirements for supporting documentation for a WQS variance request outlined in 40 CFR 131.14(b)(2).

4.3.1 40 CFR 313.10(g) Factors

(i) Documentation demonstrating the need for a WQS variance

A. For a WQS variance to a use specified in section 101(a)(2) of the Act or a sub-category of such a use, the State must demonstrate that attaining the designated use and criterion is not feasible throughout the term of the WQS variance because:

(1) One of the factors listed in §131.10(g) is met; or

(2) Actions necessary to facilitate lake, wetland, or stream restoration through dam removal or other significant reconfiguration activities preclude attainment of the designated use and criterion while the actions are being implemented.

B. For a WQS variance to a non-101(a)(2) use, the State must submit documentation justifying how its consideration of the use and value of the water for those uses listed in § 131.10(a) appropriately supports the WQS variance and term. A demonstration consistent with paragraph (b)(2)(i)(A) of this section may be used to satisfy this requirement.

The following two factors are used in this demonstration:

- 40 CFR 131.10(g)(6): Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.
- 40 CFR 131.10(g)(3): Human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.

Refer to Section 2.4, Section 2.7.3, and Section 2.7.4 for documentation demonstrating the need for the variance based on these two factors.

4.3.2 Documentation Demonstrating Variance Term

(ii) Documentation demonstrating that the term of the WQS variance is only as long as necessary to achieve the highest attainable condition. Such documentation must justify the term of the WQS variance by describing the pollutant control activities to achieve the highest attainable condition, including those activities identified through a Pollutant Minimization Program, which serve as milestones for the WQS variance.

U. S. Steel requests that the variances for the surface waters and surface discharge stations remain in place for ten years. This will allow U. S. Steel to collect additional data needed to assess water quality impacts and develop sustainable sulfate reduction alternatives.

Refer to Section 2.7 for details on sulfate conditions, efforts to identify sources of sulfate, and activities performed and planned to be performed to reduce sulfate concentrations in discharges from the Facility. Section 2.7.2 provides a summary of a sulfate treatment/mitigation alternatives evaluation. U. S. Steel's sulfate treatment/mitigation alternatives evaluation efforts align with the federal expectation for a "Pollutant Minimization Program."

4.3.3 Waterbody

(iii) In addition to paragraphs (b)(2)(i) and (ii) of this section, for a WQS variance that applies to a water body or waterbody segment:

(A) Identification and documentation of any cost-effective and reasonable best management practices for nonpoint source controls related to the pollutant(s) or water quality parameter(s) and water body or waterbody segment(s) specified in the WQS variance that could be implemented to make progress towards attaining the underlying designated use and criterion.

(B) Any subsequent WQS variance for a water body or waterbody segment must include documentation of whether and to what extent best management practices for nonpoint source controls were implemented to address the pollutant(s) or water quality parameter(s) subject to the WQS variance and the water quality progress achieved.

U. S. Steel does not control any potential nonpoint sources of sulfate being released to Hay Lake. Refer to Section 3.1.2 for additional information.

4.4 WQS Variance Implementation

(c) Implementing WQS variances in NPDES permits. A WQS variance serves as the applicable water quality standard for implementing NPDES permitting requirements pursuant to § 122.44(d) of this chapter for the term of the WQS variance. Any limitations and requirements necessary to implement the WQS variance shall be included as enforceable conditions of the NPDES permit for the permittee(s) subject to the WQS variance.

This section addresses the requirement for implementation of the Class 4A sulfate WQS for WUFPOWR variance in the U. S. Steel permit outlined in 40 CFR 131.14(c).

U. S. Steel proposes implementing the Class 4A sulfate WQS for WUFPOWR variance in the upcoming permit reissuance. Section 2.3 provides interim (Phase 1) sulfate discharge limitations for each permitted surface discharge station. These proposed values can be implemented in the permits for the duration of the variance.

Furthermore, U. S. Steel plans to continue evaluating sulfate reduction alternatives to incrementally reduce concentrations of sulfate discharge for the duration of the variance.

5 References

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2. **State of Minnesota Office of the State Auditor.** Minnesota City Finances: 2022 Revenues, Expenditures, and Debt. [Online] April 30, 2025. https://www.osa.state.mn.us/media/ai4dfdjk/cired_22_report.pdf.

3. **Minnesota Department of Human Services.** Minnesota County Human Service Cost Report for CY2020. [Online] [Cited: October 11, 2023.] https://edocs.dhs.state.mn.us/lfserver/Public/DHS-4179R-ENG.

4. **Minnesota Department of Revenue.** Production Tax by Company (2018-2024). [Online] [Cited: May 2, 2025.] https://www.revenue.state.mn.us/sites/default/files/2025-03/production-tax-company-2018-2024-3-12-24.xlsx.

5. **University of Minnesota, Duluth, Labovitz School of Business and Economics Bureau of Business and Economic Research.** Economic Impact of Ferrous and Nonferrous Mining on Minnesota and the Arrowhead Region including Douglas County, Wisconsin. June 3, 2020.

6. **Minnesota Power.** 2021 Integrated Resource Plan. February 1, 2021.

7. **Minnesota Environmental Quality Board.** Developing a carbon footprint and incorporating climate adaptation and resilience. July 2023.

8. **Minnesota Office of the Revisor of Statutes.** 4410.4300 Subpart 15.B. January 17, 2020.

9. **Minnesota Pollution Control Agency.** Framework for developing and evaluating site-specific sulfate standards for the protection of wild rice. June 2023. wq-s6-66.

Large Tables

Large Table 1 - Existing Effluent Quality (Sulfate DMR Data)

Parameter	Sulfate, as SO4			
Units	mg/l			
Location	SD-002	SD-003	SD-005	SD-012
04/10/2018	117	48.6	106	25.6
04/24/2018	81.8	47.0	103	26.6
05/01/2018	120	48.3	73.5	26.3
05/29/2018	128	57.4	--	26.1
06/12/2018	124	54.8	--	25.7
06/22/2018	--	--	90.9	--
06/26/2018	130	59.1	90.6	25.6
07/10/2018	119	59.5	87.6	24.5
07/31/2018	135	53.6	--	23.9
08/07/2018	128	55.5	--	24.8
08/21/2018	112	55.0	--	21.2
09/04/2018	124	54.6	--	21.7
09/14/2018	--	--	77.4	--
09/25/2018	121	56.7	--	21.4
10/10/2018	109	61.6	89.2	23.0
10/30/2018	125	60.5	--	22.3
11/06/2018	122	62.3	--	22.8
11/27/2018	125	--	--	21.3
12/11/2018	125	55.5	--	21.0
12/18/2018	115	52.1	--	21.4
01/08/2019	127	52.0	--	24.6
01/29/2019	137	51.4	--	25.2
02/12/2019	132	53.5	--	25.3
02/26/2019	125	49.2	--	24.9
03/12/2019	130	49.5	--	25.3
03/19/2019	--	--	120	--
03/26/2019	98.4	55.9	124	26.2
04/02/2019	112	56.1	121	26.5
04/30/2019	134	70.3	104	25.2
05/14/2019	130	77.3	97.1	23.5
05/28/2019	136	65.3	--	24.1
06/04/2019	137	59.3	100	24.2
06/18/2019	133	59.2	--	24.0
07/09/2019	130	55.0	--	22.6
07/23/2019	134	55.0	--	21.9
08/13/2019	125	63.5	96.1	22.8
08/26/2019	123	55.0	--	22.2
09/10/2019	117	59.8	--	20.8
09/20/2019	--	--	95.6	--
09/24/2019	111	64.6	95.3	19.3
10/08/2019	112	64.6	97.5	20.1
10/22/2019	117	73.1	87	19.2
11/12/2019	132	67.9	104	21.5
11/19/2019	127	57.9	103	20.3

Large Table 1 - Existing Effluent Quality (Sulfate DMR Data)

Parameter	Sulfate, as SO4			
Units	mg/l			
Location	SD-002	SD-003	SD-005	SD-012
12/03/2019	129	53.3	--	20.6
12/10/2019	--	--	98.9	--
12/17/2019	122	49.0	--	20.9
12/26/2019	--	--	105	--
01/07/2020	129	54.0	108	24.1
01/27/2020	132	58.8	115	25.2
02/04/2020	135	56.3	116	25.2
02/25/2020	136	55.9	--	25.5
02/27/2020	--	--	130	--
03/03/2020	140	55.9	125	25.8
03/24/2020	126	57.6	124	24.9
04/08/2020	117	64.9	107	28.1
04/21/2020	135	--	96.9	27.4
04/28/2020	--	57.8	--	--
05/05/2020	146	58.8	110	24.7
05/19/2020	150	59.6	--	24.4
06/02/2020	140	55.9	--	24.2
06/16/2020	131	69.4	--	25.2
07/10/2020	146	60.6	--	25.2
07/27/2020	137	72.7	--	25.1
08/05/2020	--	--	106	--
08/11/2020	136	69.7	--	23.9
08/25/2020	128	67.8	101	23.9
09/15/2020	140	62.8	96.8	21.1
09/29/2020	148	60.9	95.1	21.5
10/06/2020	145	61.7	95.7	22.2
10/27/2020	140	66.1	95.4	21.6
11/10/2020	138	62.0	95.3	21.6
11/24/2020	141	63.1	97.9	21.4
12/08/2020	128	58.9	--	21.2
12/22/2020	135	59.4	101	24.0
12/29/2020	--	--	104	--
01/05/2021	145	61.6	--	26.5
01/26/2021	137	60.0	--	25.8
02/02/2021	135	60.4	--	25.9
02/23/2021	146	61.4	--	26.3
03/09/2021	131	60.4	--	26.0
03/18/2021	--	--	120	--
03/30/2021	139	64.7	104	25.9
04/13/2021	134	74.3	106	25.3
04/27/2021	134	65.2	107	24.2
05/11/2021	147	62.1	107	22.1
05/25/2021	146	70.0	112	21.5
06/01/2021	--	70.0	--	--

Large Table 1 - Existing Effluent Quality (Sulfate DMR Data)

Parameter	Sulfate, as SO4			
Units	mg/l			
Location	SD-002	SD-003	SD-005	SD-012
06/15/2021	148	62.7	--	22.1
06/22/2021	143	--	--	22.8
07/13/2021	157	65.7	--	24.5
07/27/2021	145	70.7	--	23.7
08/10/2021	144	67.0	--	24.2
08/17/2021	143	63.6	--	23.6
09/07/2021	142	64.1	--	22.0
09/28/2021	128	84.3	--	22.0
10/20/2021	140	72.3	--	23.3
10/27/2021	130	66.6	--	22.9
11/09/2021	138	65.4	--	22.0
11/23/2021	148	73.3	--	23.0
12/07/2021	146	68.6	--	22.8
12/20/2021	--	--	131	--
12/28/2021	146	62.2	--	22.8
01/04/2022	143	66.0	--	24.1
01/25/2022	146	64.6	--	24.8
02/10/2022	146	63.6	--	24.8
02/24/2022	145	64.0	--	24.5
03/08/2022	145	--	--	25.2
03/24/2022	--	65.1	--	--
03/29/2022	137	68.0	--	26.1
04/12/2022	158	70.9	123	25.6
04/26/2022	145	76.5	87.3	26.5
05/10/2022	167	72.6	102	27.9
05/31/2022	142	49.9	87.8	27.0
06/14/2022	155	72.2	95.1	26.6
06/22/2022	153	71.4	95.6	26.7
07/12/2022	151	72.2	94.7	26.0
07/26/2022	151	71.1	95.5	26.0
08/09/2022	152	76.0	--	26.5
08/23/2022	153	71.2	--	26.4
09/15/2022	149	65.8	--	25.2
09/20/2022	--	--	93.6	--
09/29/2022	148	66.5	--	22.1
10/14/2022	150	60.3	--	21.2
10/25/2022	143	61.8	--	24.7
11/04/2022	139	62.4	--	24.0
11/28/2022	125	63.4	--	24.8
12/13/2022	136	61.7	--	25.0
12/29/2022	121	58.1	--	24.8
01/11/2023	126	59.1	--	24.9
01/31/2023	134	65.0	--	25.6
02/07/2023	132	61.1	--	24.9

Large Table 1 - Existing Effluent Quality (Sulfate DMR Data)

Parameter	Sulfate, as SO4			
Units	mg/l			
Location	SD-002	SD-003	SD-005	SD-012
02/14/2023	--	--	105	--
02/23/2023	127	60.1	106	24.3
03/07/2023	126	61.3	116	25.9
03/28/2023	138	67.1	--	25.9
03/31/2023	--	--	136	--
04/11/2023	132	58.7	133	25.7
04/25/2023	165	73.4	89.4	26.6
05/16/2023	156	68.6	86.7	24.4
	153	68.5	84.6	24.6
	--	--	87.5	--
05/31/2023	145	69.8	85.1	26.8
	--	--	87.5	--
06/08/2023	148	65.8	--	25.4
06/13/2023	--	--	87.6	--
	--	--	90.4	--
06/28/2023	130	68.3	--	26.5
07/12/2023	144	63.8	--	26.9
07/27/2023	140	68.8	--	28.4
07/31/2023	--	--	91.1	--
08/09/2023	157	63.5	--	26.2
08/30/2023	137	--	--	--
09/12/2023	130	--	--	23.2
09/27/2023	122	59.9	--	23.6
09/28/2023	--	64.9	--	--
10/04/2023	131	72.5	--	23.0
10/16/2023	--	--	98.7	--
10/26/2023	134	62.6	--	22.6
11/09/2023	143	68.0	102	24.3
11/30/2023	159	72.9	--	24.1
12/07/2023	140	60.0	--	23.0
12/28/2023	137	53.3	92.3	23.0
12/29/2023	--	--	97.9	--
01/11/2024	160	70.1	112	26.6
01/30/2024	152	63.4	--	23.4
02/12/2024	149	66.5	115	25.2
02/22/2024	154	61.7	--	24.2
02/28/2024	149	61.5	120	24.0
02/29/2024	149	61.4	--	24.0
03/13/2024	144	58.3	117	24.7
03/28/2024	139	60.6	--	21.9
04/11/2024	147	65.6	--	23.0
04/19/2024	--	--	122	--
04/29/2024	151	65.5	123	22.0
04/30/2024	--	--	127	--

Large Table 1 - Existing Effluent Quality (Sulfate DMR Data)

Parameter	Sulfate, as SO4			
Units	mg/l			
Location	SD-002	SD-003	SD-005	SD-012
05/08/2024	159	71.9	123	21.8
05/31/2024	161	70.7	120	22.2
06/10/2024	177	80.1	133	25.1
06/24/2024	182	80.8	113	23.4
07/12/2024	202	75.9	112	22.8
07/29/2024	179	71.4	109	22.7
08/12/2024	174	81.1	--	22.1
08/30/2024	161	79.4	--	21.5
09/09/2024	171	75.8	--	20.9
09/25/2024	165	73.5	--	19.8
10/01/2024	164	66.6	110	22.0
10/11/2024	166	66.2	112	22.0
10/18/2024	178	75.4	123	29.5
10/24/2024	166	64.1	116	27.7
10/31/2024	164	71.8	120	26.2
11/08/2024	166	63.6	125	21.2
	164	63.1	--	21.1
11/14/2024	161	70.1	124	22.6
11/22/2024	167	56.7	131	29.4
11/26/2024	165	--	--	24.3
12/13/2024	172	--	--	24.7
12/27/2024	--	--	135	--
12/31/2024	166	--	136	24.8
01/16/2025	175	--	--	24.5
01/24/2025	182	--	--	23.9
02/04/2025	172	--	143	--
02/06/2025	158	--	--	23.2
02/12/2025	159	--	135	--
02/20/2025	163	--	139	22.5
02/27/2025	--	--	139	--

Some samples were analyzed under different lab analyses resulting in multiple results for a single date.

Large Figures

Latitude: 47° 26' 52.576" N
Latitude: 47° 26' 54.234" N
Longitude: 93° 7' 57.039" W
Longitude: 93 °0' 25.788" W
Latitude: 47° 19' 32.728" N
Latitude: 47° 19' 33.651" N
Longitude: 93° 7' 54.632" W
Longitude: 93° 0' 24.771" W

Stevenson
Section 18
Mining Area
Russell
Bennett
Plant
SD001
Sargent
SD009
Old Mine Rd
Carlz Pit
Aromac
Perry
Mesabi Chief
SD012
SD003
3rd Ave
SD002
E 3rd Ave
Old Hwy 169
Depot St
Nashwauk-Keewatin POTW
Reservoir 2 North
SD0XX
SD005
Tailings Basin
Diversion Channel
Reservoir 6
SD001
Reservoir 2
Stage 2 Interior Pond
Stage 2 Exterior Pond
Welcome Creek
SW-001
West Swan River
Pelto Rd
Karkas Rd
Hay Creek
Reid Rd
O'Brien Creek
2nd Ave N

SD0XX Sulfate Compliance Point
Reservoir 2 North
Welcome Creek
SD005

Great Lakes/ Upper Mississippi Watershed Divide
Keetac Mine and Tailing Basin Perimeter
Mining Area and Tailings Basin NPDES/SDS Permit Boundary
City Boundary
DNR River and Stream Centerlines (Stream Type)
Stream, Ditch
River
Mining Area SD Locations
Tailing Basin SD Locations
SD0XX
Wastewater Treatment Plant

0 3,000 6,000
Feet
1:36,000

DISCHARGE AND MONITORING LOCATIONS
Keetac Mining and Tailing Basin Area
Keewatin, MN

LARGE FIGURE 1

Large Figure 2:
Water Balance and Water Flow Diagram

Mine Area NPDES/SDS Permit (MN0031879)
Monitoring Stations

Permitted stations identified on figure:

- WS005 Waste Stream: Wastewater Treatment Plant
- SD001 Surface Discharge: Potable Water Treatment Process Backwash
- SD002 Surface Discharge: Process Wastewater and Runoff
- SD012 Surface Discharge: Mine Dewatering and Runoff
- SD003 Surface Discharge: Mine Dewatering and Runoff

Permitted stations NOT identified on figure:

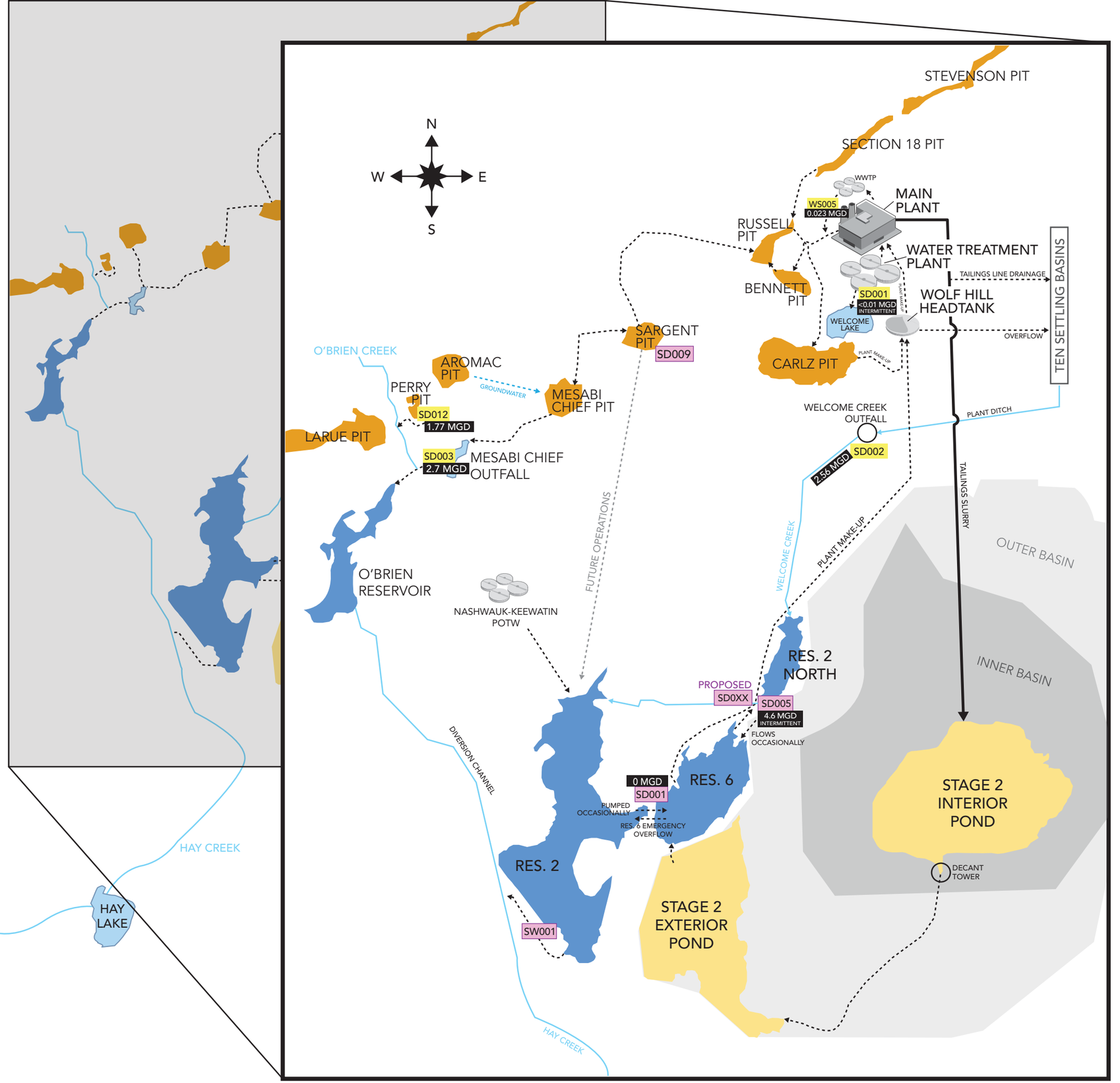
- WS011 Internal waste stream: Plant water to scrubber system
- WS012 Internal waste stream: Scrubber blowdown after treatment

Tailings Basin NPDES/SDS Permit (MN0055948)
Monitoring Stations

Permitted stations identified on figure:

- SD005 Surface Discharge: Tailings Slurry Decant and Runoff
- SD001 Surface Discharge: Tailings Slurry Decant and Runoff
- SW001 Surface Water: Reservoir 2 to Diversion Channel
- SD008 is the sum of SD001 and SD005 (not on figure)
- SD009 is the Sargent Discharge to Diversion Channel and has not been established yet

Flow rates provided are approximate and were estimated in 2023 based on the last ~five years of data.



Appendices

Appendix A

Pollutant Minimization Plan

Pollutant Minimization Plan

to support the *Application for a Variance from the Class 4A Sulfate Water Quality Standard for Waters Used for Production of Wild Rice*

Keetac Facility
NPDES/SDS Permit Nos. MN0031879 and MN0055948

Prepared for:
United States Steel Corporation
Minnesota Ore Operations - Keetac

Prepared by:
Barr Engineering Co.

May 2025

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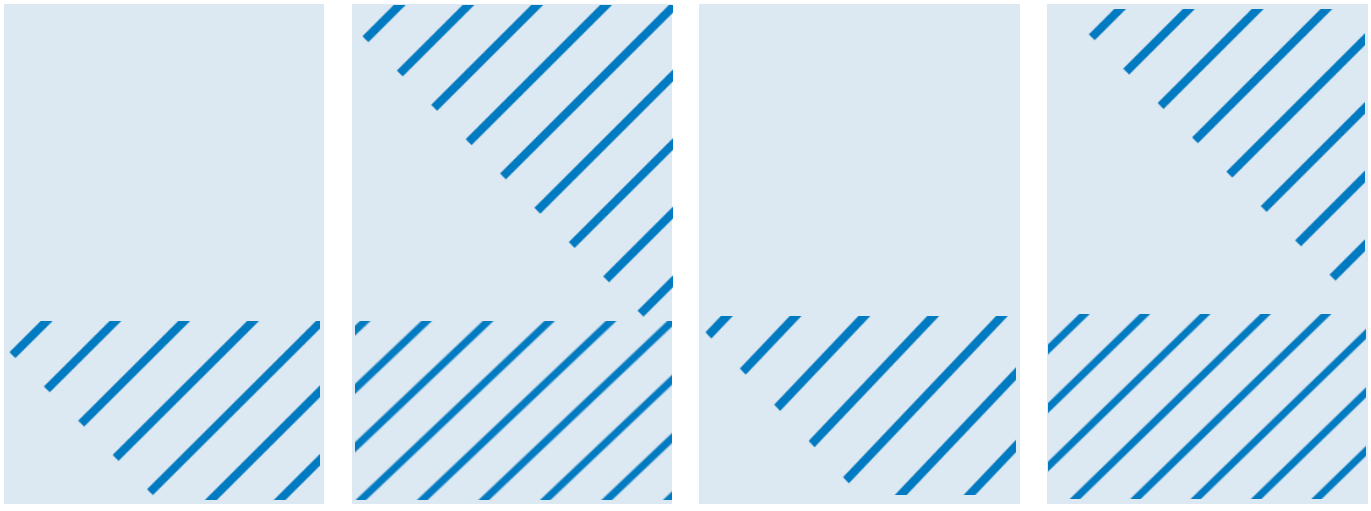

Pollutant Minimization Plan

to support *the Application for a Variance from the Class 4A Sulfate Water Quality Standard for Waters Used for Production of Wild Rice*
Keetac Facility - NPDES/SDS Permit Nos. MN0031879 and MN0055948

May 2025

Contents

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Abbreviations

CBOD5	carbonaceous five-day biochemical oxygen demand
EAW	Environmental Assessment Worksheet
GHG	greenhouse gas
lb/hr	pounds per hour
MGD	million gallons per day
mg/L	milligrams per liter
MPCA	Minnesota Pollution Control Agency
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
SDS	State Disposal System
TSS	total suspended solids

1 Introduction

The United States Steel Corporation (U. S. Steel) owns and operates the Keetac facility (Facility) in Keewatin, Minnesota. The Facility comprises open pit mining areas, a taconite processing plant, a tailings basin, and auxiliary support areas. NPDES/SDS Permit numbers. MN0031879 (Mining Area) and MN0055948 (Tailings Basin) limit wastewater discharges from the Facility. The MPCA has shared its pre-public notice draft permits with U. S. Steel that propose compliance schedules for sulfate, which culminate in a requirement that the Facility comply with the sulfate final effluent limits (14 mg/L monthly average and 24 mg/L monthly maximum) at outfalls SD 001, SD 002, SD 003, SD 005, SD 009 and SD 012 within 60 months of permit issuance. The pre-public notice draft permits also propose interim sulfate limits for all outfalls except SD 009 based on the 99th percentile of historical data reported to MPCA.[1]

U. S. Steel intends to apply for a variance to the Class 4A sulfate water quality standards for waters used for wild rice production, primarily because the economic burden of implementing the currently identified treatment technologies would negatively impact the facility and surrounding communities.

This pollutant minimization plan (Plan), a plan required under MN R 7000.7000 Subp. 2. H. (2.), describes steps U. S. Steel intends to take during the variance period to study and reduce levels of sulfate discharged to the lowest limits practicable. The primary objective is to identify feasible technologies/alternatives for non-mechanical or mechanical treatment/mitigation to reduce the concentration of sulfate to meet the final monthly effluent limits. This pollutant minimization plan consists of the following:

- **Section 2** describes the actions taken to date to reduce sulfate levels in the wastewater discharged from the Facility
- **Section 3** summarizes the affected outfalls and the associated compliance schedule requirements.
- **Section 4** describes the work that will be completed, as described in the Sulfate Treatment/Mitigation Alternatives Identification Plan, including the specific activities required by the compliance schedule.
- **Section 5** provides a milestone schedule for completing the work and describes how the results of the Sulfate Treatment/Mitigation Alternatives Identification Plan will be incorporated into the Sulfate Treatment/Mitigation Alternatives Evaluation Plan.

[1] NPDES/SDS Permit Program Fact Sheets for permit MN0031879 and MN0055948.

2 Actions Taken to Date

Sulfate is a persistent pollutant, and its removal is not amenable to conventional wastewater treatment methods. The Facility's primary sources of sulfate are the taconite ore processed and the process water used to operate it; economical source reduction methods have not been identified. The sulfate levels found at the NPDES permitted outfalls are identified in Large Table 1 of the *Application for a Variance from the Class 4A Sulfate Water Quality Standard for Waters Used for Production of Wild Rice.*

As discussed in following sections of this Plan, U. S. Steel intends to take steps during the variance period to study and reduce levels of sulfate discharged to the lowest limits practicable. Activities taken to date at the facility to reduce and/or study sulfate include:

- Direct Reduction Grade Pellet Project (DR): U. S. Steel broke ground in the fall of 2022 to install equipment necessary to produce DR-grade pellets. U. S. Steel submitted data to the MPCA demonstrating that producing DR-grade pellets will not increase the mass loading of sulfate and may lead to net sulfate reductions to process water and the tailings basin.

- Pilot testing: U. S. Steel has conducted laboratory and pilot-scale testing of alternative treatment technologies to address sulfate removal from process water at the Keetac and Minntac facilities. Technologies evaluated included biological-based packed-bed sulfate removal techniques, ion exchange, and membrane treatment using ultrafiltration/ nanofiltration. In addition, work has been conducted on treating the membrane reject stream via chemical precipitation and ion exchange. Most of the technologies tested proved to be technically feasible in achieving the target effluent sulfate concentrations at bench and pilot-scale flow rates. However, questions remain regarding scale-up, commercial viability, membrane reject management and its applicability to a mining area discharge setting.

The remainder of this Plan outlines the forward-looking steps U. S. Steel intends to conduct to study and reduce sulfate levels discharged.

3 Overview of Compliance Schedule Requirements

Table 1 summarizes the Facility outfalls to which the compliance schedules apply.

Table 1 Summary of Facility Outfalls in the Compliance Schedules

Outfall	Description	Permit	Status
SD 001	Reservoirs 6 siphon outflow (tailings slurry decant and runoff)	MN0055948	Active (intermittent)
SD 002	Plant area process wastewater and runoff	MN0031879	Active
SD 003	Mesabi Chief Pit discharge (mine dewatering and runoff)	MN0031879	Active
SD 005	Reservoirs 6 and 2 North outflow (tailings slurry decant and runoff)	MN0055948	Active (intermittent)
SD 009	Sargent Pit discharge	MN0055948	Inactive
SD 012	Perry Pit discharge (mine dewatering and runoff)	MN0031879	Active

The pre-public notice draft permits' proposed compliance schedules consist of the following major milestones. Figure 1 depicts the high-level workflow, with the work included in this plan shown in yellow.

- **Sulfate Treatment/Mitigation Alternatives Identification Plan**
    - Brief description: Identify potentially feasible technologies and approaches to reduce the sulfate concentration in the listed outfalls to meet the limits proposed in the pre-public notice draft permits.
    - Deliverables:
        - Plan: Due June 1, 2025
        - Revised Plan: Due within 30 days of receiving MPCA comments
        - Notification of work initiation: Due within 14 days of MPCA's approval of the Plan
        - Final Plan/report: Due December 1, 2025
- **Sulfate Treatment/Mitigation Alternatives Evaluation Plan**
    - Brief description: Evaluate potentially feasible treatment/mitigation methods to determine which would be most appropriate for the Facility to achieve the final effluent limits in the shortest reasonable amount of time.
    - Deliverables:
        - Evaluation plan: Due January 1, 2026
        - Revised Evaluation plan: Within 30 days of receiving MPCA comments
        - Final Evaluation plan/report: Due September 1, 2026

- **Final Compliance Plan**
    - Brief description: Document the rationale for selecting the proposed treatment/mitigation approach(es) for the Facility and provide the preliminary process design.
    - Deliverables
        - Final compliance plan: Due December 1, 2026
        - Revised final compliance plan: Within 30 days of receiving MPCA comments
        - NPDES permit major modification application: Due December 1, 2026
        - EAW: Due December 1, 2026
- **Final Plans and Specifications**
    - Description: Prepare a 90% design package for the Facility modifications as described in the Final Compliance Plan.
    - Deliverables:
        - Final plans and specifications: Due April 1, 2027
        - Revised final plans and specifications: Within 30 days of receiving MPCA comments
        - Detailed schedule of milestones and supporting justifications: Due April 1, 2027
        - Estimated date water quality standard and designates uses will be met at downstream monitoring stations: Due April 1, 2027
- **Construction**
    - Description: Construct a sulfate treatment/mitigation approach.
    - Deliverables
        - Notification of construction initiation: No later than 6 months after MPCA approval of final plans and specifications
        - Progress report: Due April 1, 2028
        - Notification of initiation of operation: 14 days prior to initiating operation
- **Attainment of Compliance**: No later than April 30, 2030

Compliance with this schedule is not economically viable with the currently identified treatment technology. The activities proposed by this pollutant minimization plan include specific tasks proposed by the pre-public notice draft permits, which aim to advance the understanding of facility flows and sulfate loads, identify sources of sulfate in the discharges, and identify economically feasible treatment and mitigation options for the Facility.

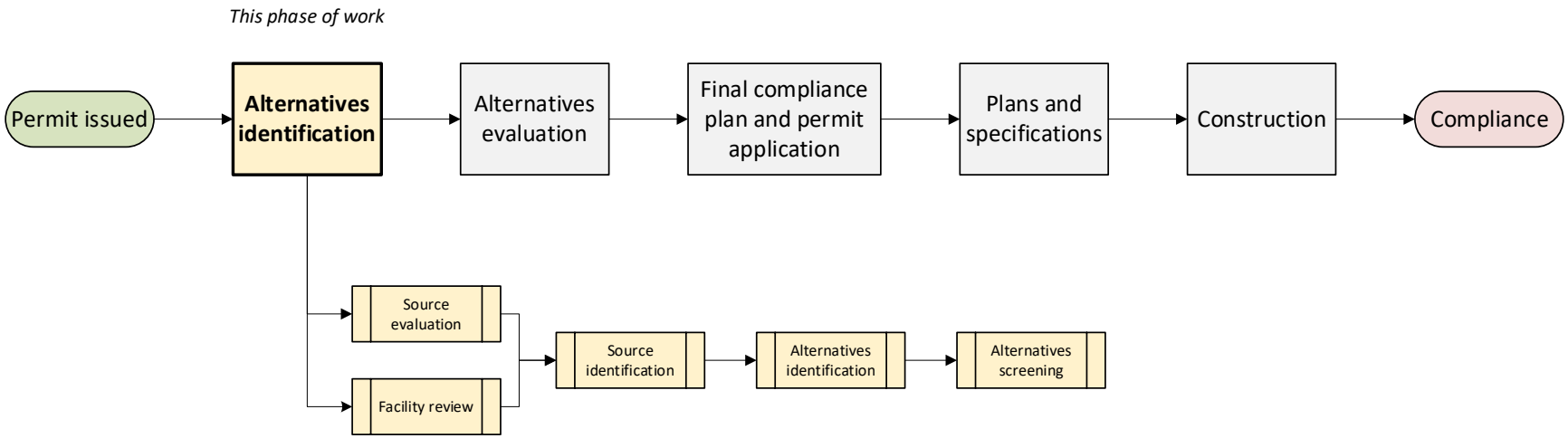

Figure 1 Overview of Compliance Schedule Workflow

4 Description of Proposed Work

This section discusses the activities proposed by this Plan, including specific tasks proposed by the pre-public notice draft permits, which aim to advance the understanding of facility flows and sulfate loads, identify sources of sulfate in the discharges, and identify potentially feasible treatment and mitigation options for the Facility.

4.1 Sulfate Source Evaluation

The requirements for a sulfate source evaluation are defined in the pre-public notice draft permits and include:

- Update the Facility water balance
- Identification of current sulfate sources
- Identification of recent or proposed process changes at the Facility
- Quantification of the sulfate quality and loading for permitted discharges

4.1.1 Facility Water Balance Model

A water balance and sulfate mass transport model will be constructed to investigate water quantity and quality throughout the Facility, including the discharges from the Mining and Tailings Basin areas. The model will help understand the relative significance of potential sulfate sources and simulate potential water management and/or treatment options. The water balance and sulfate mass transport model will be developed in GoldSim (v. 14.0), a software known for its use in water balance applications, with added capabilities for mass transport. GoldSim allows for model transparency and clarity in review and prevents mistakes in unit conversion, which often occur in Microsoft Excel-based models. The model will include active mine features within the Mining, Plant, and Tailings Basin areas. Other features outside these three areas may be added to the model either during the Facility review process or during model development, if deemed necessary.

The sulfate mass balance portion of the model is described in Section 4.1.4. A separate intra-plant water balance and sulfate mass balance model will also be prepared, as further described in Section 4.1.3.1.

For the water balance component of the model, mine features will be represented as storage elements with natural and controlled inflows and outflows. Variations in the inflows and outflows over time will result in changes to storage throughout the modeled period. Water volume inflows that will be considered for each mine feature include direct precipitation, surface runoff from rain events and snowmelt, groundwater inflow, and inflows from other mine features at the facility. Water volume outflows considered will include evaporation, groundwater outflow, and discharges to other mine features at the facility. Actual inflows and outflows included for each storage element in the model will vary based on environmental conditions. Additional inflows or outflows may be considered to optimize model performance. In cases where insufficient data are available to develop a storage element for a mine feature, other computational methods and elements may be used. The water balance component of the model will also include climatic inputs and simulate snowpack and pit lake ice formation and melt. Climatic inputs will allow for the simulation of current climate conditions as well as forecasting future climate conditions.

4.1.2 Identification of Current Sulfate Sources

To identify current sulfate sources, historical data (from the past five years) and data collected during this work for permitted monitoring stations within the Facility will be reviewed and evaluated, including all outfall locations (as described in Table 1) and surface water and waste stream monitoring locations (Table 2). It should be noted; the new SW monitoring sites may have limited data. However, these locations are primarily in receiving waters downstream of the Keetac facility and likely do not represent significant sources of sulfate.

Table 2 Summary of Facility Monitoring Stations (Excluding Outfalls)

Location ID	Description	Permit	Notes
WS 001	Non-precipitation water inputs to the Facility	MN0055948	Flow data only
WS 002	Tailings Basin precipitation and evaporation	MN0055948	New monitoring station; no sulfate data; water volume and flow data.
WS 003	Tailings Basin pool water	MN0055948	New monitoring station
WS 004	Stage 2 Exterior Pond	MN0055948	New monitoring station
WS 005	Wastewater Treatment Plant effluent	MN0031879	CBOD5, fecal coliform, flow, total nitrogen, pH, total phosphorus, TSS only
WS 011	Plant water to scrubber system	MN0031879	--
WS 012	Scrubber blowdown after treatment	MN0031879	--
SW 001	Reservoir 2 outlet	MN0055948	Historically only flow, TSS, turbidity, and specific conductivity
SW 002	Hay Creek	MN0055948	New monitoring station
SW 003	Reservoir 2 to Hay Creek (south monitoring point)	MN0055948	New monitoring station
SW 004	Hay Lake	MN0055948	New monitoring station
SW 005	Reservoir 2 to Hay Creek (north monitoring point)	MN0055948	New monitoring station
SW 006	Hay Creek headwaters	MN0055948	New monitoring station
SW 007	Unnamed wetland	MN0055948	New monitoring station
SW 008	Hart Lake	MN0055948	New monitoring station
SW 009	Unnamed creek east of Hay Creek	MN0055948	New monitoring station

The data review will include, at minimum, flow and sulfate concentration data, with additional parameters added as deemed necessary. The data review at each monitoring location will summarize overall data characteristics (e.g., mean flow rates or mean sulfate concentrations), notable seasonal variability, and notable trends. Depending upon data availability, sulfate loading will also be assessed at each monitoring location by combining paired flow rate and sulfate concentration data.

The areas represented by the permitted discharge locations may be further subdivided to identify unique sources within areas of the Facility. For example, the intra-plant water balance and sulfate mass balance model, as further described in Section 4.1.3.1, will be used to identify whether any potential process units within the processing area are significant sources of sulfate loading.

4.1.3 Facility Review

A Facility review will be conducted to identify potential sources of sulfate. Goals of the Facility review will be to 1) establish an understanding of current conditions at the Facility, 2) identify key features, current and future operations (as currently known), and potential external influences that may impact water quantity and quality at monitored locations, and 3) identify potential gaps in data that may limit understanding of flow quantity and quality at the Facility monitoring locations. The Facility review will also identify any:

- Recent or proposed process changes that could affect sulfate concentrations at the permitted outfalls
- Changes to mine dewatering practices
- Projected changes due to adjustments to the overall mine plan
- Impact of any potential external influences and/or additional sources of water and sulfate loading to the Facility

To meet these goals, Facility documents and datasets will be reviewed, including but not limited to operational practices, sampling data from monitoring locations (Section 4.1.2) and other key locations throughout the facility, past studies conducted at the Facility, and documentation related to operational changes or facility capital updates. Attempts to fill data gaps identified during the Facility review process will be made, as deemed necessary, by collecting additional measurements or samples, requesting and reviewing additional facility documentation or peer-reviewed literature, or a combination of these methods. The Facility will be subdivided into three areas for review based on location and operational practices:

- Mining areas consisting of active and former mining areas, including active mining pits (Sargent, Russell, and Section 18), pit sumps (Aromac, Mesabi Chief, Bennett, Carlz), one natural ore pit (Perry), and one reservoir (O'Brien Reservoir).
- Plant areas consisting of the processing plant, the ten settling basins that surround the plant, Carlz Pit and the Wolf Hill Head Tank, which provides water for plant processing.
- Tailings Basin area consisting of the active tailings facility, which receives tailings slurry from the plant, and two tailings basin ponds (Stage 2 Interior Pond and Stage 2 Exterior Pond), and reservoirs which receive decant water from the tailings basins facility, Reservoir 2, and Reservoir 6.

The Facility review will also consider how the three areas described above interact with one another.

4.1.3.1 METSIM Plant Water and Mass Balance Model

To investigate and determine sulfate sources within the boundaries of the Plant areas (concentrator and pellet plant), a METSIM model will be constructed and used to identify inflows and outflows. Anticipated model inputs are as follows:

- Inputs
    - Plant ore feed rate (modeled as cobber magnetic separator feed)

    - Plant recoveries and solid percentages, overall and individual stages:
        - Cobber Magnetic Separator
        - Cyclone
        - Rougher Magnetic Separator
        - Hydroseparator
        - Finisher Magnetic Separator
        - Concentrate Thickener
    - Measured sulfate concentrations
        - Feed process water
        - Scrubber blowdown
- Output
    - Estimated sulfate concentrations (mg/L) and mass flows (lb/hr)
        - Plant feed (cobber magnetic separator feed)
        - Plant feed process water
        - Concentrate
        - Scrubber blowdown
        - Total tailings

4.1.4 Quantification of Sulfate Quality and Loading

Sulfate quality will be quantified and completed in conjunction with the review of existing sulfate quality data for the identification of sulfate sources, as described in Section 4.1.2.

The GoldSim model will be used to quantify sulfate loading. Mine features will be represented as cell elements and linked to water balance storage elements for the sulfate mass transport component of the model, where available. Cell elements will track sulfate mass inflows and outflows to determine sulfate mass and concentration at a mine feature for each time step. Sulfate mass inflows to be considered for each element will include groundwater inflow, runoff from rainfall and snowmelt, and inflows from other mine features at the facility. Mass outflows from each element will consist of discharge from the mine feature. Other mass inflows and outflows may be considered to optimize model performance. No chemical precipitation or biological transformation of sulfate will be included in any of the elements for the initial model.

Available Facility data, peer-reviewed literature, and publicly available data from governmental agencies or other sources will be used to inform the model's inflow, outflow, and sulfate concentration terms. Model outputs will consist of flow rates and sulfate concentrations for discharges from Facility features. The water balance and mass transport model will be calibrated using flow and sulfate concentration data at

monitored outfall locations (specifically, SD 002, SD 003, SD 005, and SD 012). Attempts to fill data gaps identified during the modeling process will be made, as deemed necessary and practical (given the time constraints for the work), via additional measurement or sample collection, additional Facility documentation or peer-reviewed literature, or a combination of these two methods.

4.2 Alternatives Identification

A Preliminary Alternatives Identification Plan (PAIP) has been developed and informs the economic evaluation prepared for the variance application.

Other potentially viable alternatives will be identified. In subsequent steps of the compliance schedule, they will be evaluated, proposed, and potentially implemented to achieve the goals outlined in the pre-public notice draft permits in the shortest reasonable time while maintaining the viability of the overall taconite mining and processing operations and considering future closure and post-closure activities.

Identification of possible alternatives will be accomplished in a stepwise fashion as follows:

1) Develop a comprehensive list of possible options

2) Screen the list of possible options to include potentially viable options from the data collected from the sulfate source evaluation

3) Assemble potentially viable options for further evaluation, including:

    a) A description of each potentially viable option, including the relative reliability associated with each option.

    b) An analysis of the technical feasibility of each potentially viable option.

    c) A review of relative costs to install and implement each potentially viable option, including the potential costs for secondary environmental impacts associated with each option, such as greenhouse gas (GHG) emissions and costs to dispose of the removed salts permanently.

4) Prepare the Sulfate Treatment/Mitigation Alternatives Identification Plan Final Report

4.2.1 Alternative Identification

Step 1 will be completed by identifying possible options from engineering experience on similar projects, vendor publications, scientific research publications, data review, and/or scenario modeling. Input from these and other available sources will be used to create a comprehensive list of options for further screening.

4.2.2 Alternative Screening

Step 2 will use screening criteria to quantitatively assess the applicability of the options for potential use at the Keetac Facility. The following criteria will be used when considering the potential viability of the various alternatives:

- Technical feasibility

- Performance (as documented or currently understood)

- Reliability (seasonality, etc.)
- Capital cost (relative)
- Operation and maintenance (O&M) cost (relative)
- Time to implement
- Operational complexity (relative)
- Residuals management complexity and/or cost (relative)
- Degree of commercialization
- Safety
- Flexibility (relative)
- Secondary impacts
    - GHG emissions (relative)
    - Short-term and long-term site/production impacts

These criteria will be ranked on a scale of 0 to 3 to provide a meaningful comparison. A score of 0 would mean that the criterion does not impact the project outcome. A score of 3 would mean the criterion is critical to the project outcome. Then, each possible alternative will be given a value from 0 to 5 to assess its potential to achieve the objectives of each criterion. The score for each alternative will be the rank times the value. The scores for all criteria will be summed up for each possible alternative. Alternatives with the highest total score will be retained for further consideration.

5 Next Steps

U. S. Steel anticipates that a select group of potentially feasible alternatives will be identified for further consideration in the Sulfate Treatment/ Mitigation Evaluation Plan after completing its alternatives identification process, as described in the proposed compliance schedule of the pre-public notice draft permits.

Appendix B

Preliminary Alternatives Identification Plan

Sulfate Water Treatment

Preliminary Alternatives Identification Plan

Prepared for
United States Steel Corporation
Minnesota Ore Operations – Keetac

Prepared by
Barr Engineering Co.

April 30, 2025

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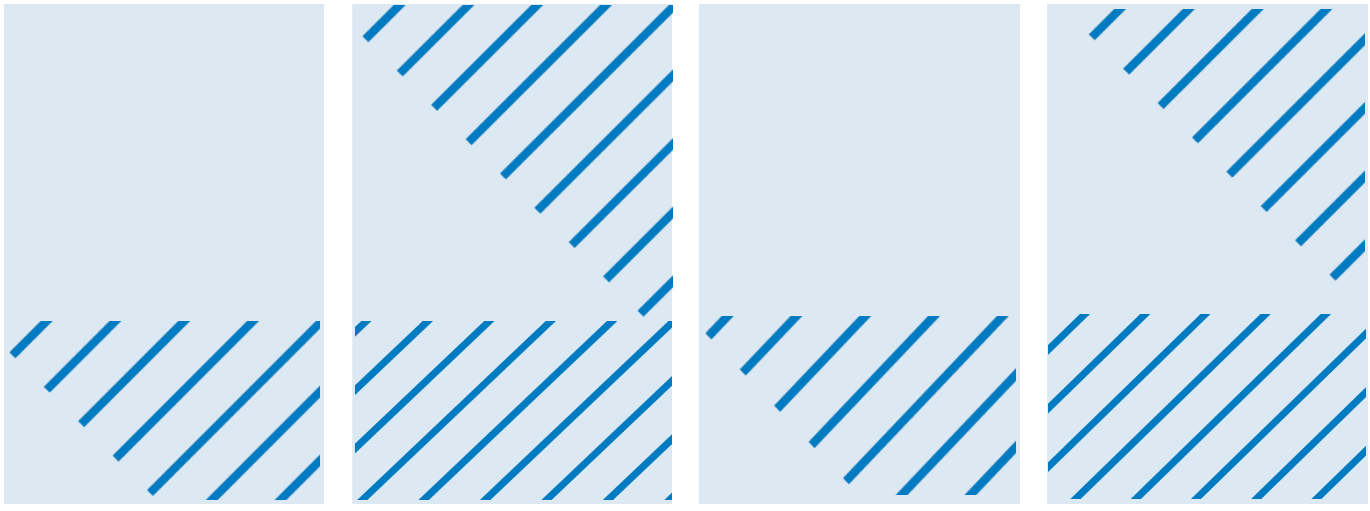

Certification

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Aklima Hossain
MN #: 62407

April 30, 2025
Date

Preliminary Alternatives Identification Plan

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Abbreviations

Barr	Barr Engineering Co.
BOP	balance of plant
CAPEX	capital expenditures
CY	cubic yard(s)
gpm	gallon(s) per minute
HHRO	High efficiency reverse osmosis
HVAC	heating, ventilation, and air conditioning
KW	kilowatt
MCC	motor control center
mg/L	milligram(s) per liter
NF	nanofiltration
NPV	net present value
O&M	operating and maintenance
OPEX	operating expenditures
PEMB	pre-engineered metal building
SD	surface discharge
TDH	total dynamic head
tpd	ton(s) per day
TSS	total suspended solids
U. S. Steel	United States Steel Corporation
UF	ultrafiltration
WQS	Water Quality Standards
WTS	water treatment system
WWTS	wastewater treatment system

1 Executive Summary

United States Steel Corporation (U. S. Steel) retained Barr Engineering Co. (Barr) to conduct a preliminary assessment of commercially available water treatment technologies and define a concept design for implementation at U. S. Steel's Keetac facility to lower surface discharge (SD) stream sulfate level to less than 14 mg/L. Four SD streams are under consideration and denoted as SD-002, SD-003, SD-005, and SD-012.

The purpose of this memorandum is to present the conceptual water treatment system design, Barr's opinion of the probable total construction cost (CAPEX), and Barr's estimate of the probable cost to operate the proposed water treatment system (OPEX). The cost estimates are based on a preliminary design (1-15% completion) and considered a feasibility-level, Class 4 cost estimate per AACE International Recommended Practice No. 18R-97.

The process flow schematic (SK-1) included in Appendix 1 provides an overview of the preliminary conceptual water treatment system design, which will be similar for each SD stream. Only the equipment size and/or number of modules will vary depending on the different flow rates established for each SD stream. SK-1 represents a base water treatment system (WTS) utilizing nanofiltration (NF) membrane technology. The NF units are expected to separate over 95% of the feedwater sulfate into an NF reject stream. The treated water, NF permeate stream, will have a sulfate concentration lower than 14 mg/L.

The NF reject stream, with a high concentration of sulfate, will be treated by a zero-liquid-discharge (ZLD) system to generate solid waste for landfill disposal. The NF reject stream will first be softened with lime to mainly precipitate calcium and magnesium salts. The softened water from the clarifier will be filtered with ultrafiltration (UF) units to remove suspended solids before processing with a reverse osmosis (RO) system to concentrate the salts into a RO reject stream. The RO permeate will be high-quality water with lower than 14 mg/L sulfate and will be discharged with the NF permeate. The main purpose of the pretreatment step (softening/UF/RO) is to lower the volume of NF reject stream for treatment by the relatively more CAPEX/OPEX intensive evaporator/crystallizer system to generate solids waste. This report will refer to the ZLD system as the wastewater treatment system.

The source water sulfate level is low; therefore, the corresponding NF reject stream sulfate concentration will also be low. The first couple of years, the NF reject stream will be routed back to the source water body until sufficient sulfate concentration builds up that mixing lime with the NF reject stream will precipitate salts.

The total cost to implement the proposed treatment system is summarized in Table 1, including the 20-year, net present value (NPV) of the operating costs.

Section 3.1 provides a detailed description of the treatment scheme, including the water treatment equipment involved and the cost of equipment. Section 3.2 provides a narration of how the total construction cost was estimated. Section 3.3 provides our approach to roughly estimating the operating and maintenance (O&M) costs, including labor.

Table 1 Barr's Opinion of the Probable Total Construction Cost and Operating Cost

	GRAND TOTAL	SD-002	SD-003	SD-005	SD-012
SD Design Flows, gpm	-	3,800	2,800	5,000	1,400
CAPEX =	$538,000,000	$158,000,000	$125,000,000	$186,000,000	$69,000,000
20-year NPV OPEX =	$276,298,000	$77,341,000	$61,698,000	$101,418,000	$35,841,000
Total =	$814,298,000	$235,341,000	$186,698,000	$287,418,000	$104,841,000
+50% =	$1,300,000,000	$400,000,000	$300,000,000	$500,000,000	$200,000,000
-30% =	$600,000,000	$200,000,000	$200,000,000	$300,000,000	$100,000,000

2 Background

NPDES Permits MN0055948 (Tailings Basin) and MN0031879 (Mining Area) contain effluent limits for sulfate of 14 mg/L (monthly average) and 24 mg/L (daily max). These are based on the Class 4A water quality standards (WQS) of 10 mg/L sulfate for waters used for the production of wild rice (WUFPOWR). Pre-public notice copies of these permits recently obtained from the MPCA contain compliance schedules, which will require U. S. Steel to study, plan, design, construct, and commence operation of water treatment infrastructure capable of achieving these WQS. This study is a preliminary Alternatives Identification Plan to support a variance application U. S. Steel intends to submit.

The WQS for sulfate are intended to protect wild rice in downstream waters. These NPDES permits are among the first in Minnesota requiring a taconite facility to meet effluent limits for sulfate. Meeting these permit limits will require the construction and operation of wastewater treatment infrastructure. While technologies to achieve these WQS exist, it has never been implemented at the scale required to treat the volume of water generated by taconite mining facilities to these levels of sulfate.

Due to the economic infeasibility and subsequent negative impacts to the communities surrounding Keetac associated with the implementation of this technology, U. S. Steel intends to request a variance from these Class 4A WQS. This study is intended to provide a preliminary indication of the economics required to treat wastewater discharged at Keetac to the levels required by the effluent limits in the permits, based on a concept water treatment design. This study will support the variance request U. S. Steel intends to submit.

Based on Barr's experience, previous studies, and pilot testing, the water treatment technology proposed in this study is expected to allow Keetac to meet these permit limits for sulfate. Other treatment alternatives that could allow Keetac to meet the effluent limits will be explored in subsequent studies.

3 Detailed Discussions

3.1 Basis of Design

The following sections describe how the basis of design for the water treatment system was established for the WTS and WWTS. WTS will consist of UF, NF, gypsum desaturation, and sludge dewatering equipment. WWTS will consist of UF, RO, crystallizer, and salt dewatering equipment.

3.1.1 SD Design Flow Rate

The design flow rate was chosen using guidance from the Minnesota Pollution Control Agency's *Design Flow and Loading Determination Guidelines for Wastewater Treatment Plants (January 2023).* This document provides definitions for WTS design flows. For the WTS, the primary equipment is membrane filtration, which requires a continuous, normalized flow.

Five years of daily flow data from January 2019 through December 2023 was obtained from Discharge Monitoring Reports (DMR). The average wet weather (AWW) flow rate was determined by the wettest 30-day average when the groundwater is high. The design flow rate was chosen to treat the average wet weather flow rate (rounded up to 1,000 gpm), for continuous membrane filtration, as shown below in Table 2.

SD-005 is a manual discharge, historically operated either open or closed. For the proposed treatment system, a continuous flow would be implemented. The maximum annual volume (May 2022 – May 2023) was normalized for continuous discharge (in gpm) to determine the design flow rate.

Table 2 below summarizes the basis of design for the water treatment system.

Table 2 Design Flow

	SD-012	SD-002	SD-003	SD-005
Feedwater Flow Rate, gpm	1,400	3,800	2,800	5,000[1]

[1] Manual discharge was normalized for the annual maximum flow, with additional EQ for a peak hour flow (factor 2.5).

3.1.2 Design Equalization Volume

The peak hourly wet weather (PHWW) flow was determined by assuming the groundwater is high when a five-year, one-hour storm event occurs. For each of the continuous surface discharges (SD-012, SD-002, and SD-003), a HydroCAD model was developed to determine the flow rate during a five-year, one-hour storm. PHWW was determined by adding this storm event to the AWW design basis.

For all surface discharges, the PHWW was more than three times the AWWF; therefore, equalization was required. The volume of the equalization storage was determined by the total accumulation from one hour during a five-year, one-hour storm, minus the treatment system design basis flow, as shown in Table 3.

For SD-005, natural equalization is provided in the tailings basin. Additional equalization capacity is considered within the treatment system for one hour of peak flow (2.5 factor) above the design basis flow.

Table 3 Design Basis for Equalization Tank Sizing

	SD-012	SD-002	SD-003	SD-005
Equalization Tank, gallons	150,000	1,500,0000	350,000	500,000[1]

[1] Manual discharge was normalized for the annual maximum flow, with additional EQ for a peak hour flow (factor 2.5).

3.1.3 SD Source Water Quality

Available water quality data for each SD stream was reviewed (Appendix 2), and the design feedwater quality for the WTS was established as shown in the design basis column. The treatment scheme proposed was selected to treat the raw source water to meet the project objectives of lowering sulfate to less than 14 mg/L for discharge. A secondary objective was to process wastewater from the primary treatment system to generate solid waste for landfill disposal. The solid waste would be transported to the landfill(s) by haul trucks.

3.2 Water Treatment System

3.2.1 WTS Process Overview

The primary WTS will include the following major components (also see SK-1 drawing in Appendix 1):

- Equalization tank(s) to normalize flow to the WTS. The basis for tank size is provided in Section 3.1.2.
- Ultrafiltration (UF) membrane technology to filter the raw water from the SD streams. UF was selected primarily to remove suspended solids (TSS) and make the water suitable for feed to downstream equipment. Raw water TSS is expected to be lowered from 10-15 mg/L to less than 1 mg/L.
- NF membrane technology to process the filtered water to separate the sulfate and concentrate it in the NF reject stream. Most other divalent ions, such as calcium/magnesium, and a relatively small portion of monovalent ions, such as sodium/chloride, will also be separated and concentrated in the NF reject stream.
    - NF membrane projections indicate that 85% water recovery is possible through 1-stage NF membranes (i.e., for 100 gpm feedwater flow to the NF, 85 gpm treated water will be generated). The corresponding NF reject stream will be 15 gpm.
    - Membrane projections also indicate that the design feedwater sulfate concentration of 167 mg/L results in an NF reject stream sulfate level of around 1,100 mg/L and an NF permeate sulfate in single digits, thereby providing buffer for upset conditions to achieve the target 14 mg/L sulfate for discharge.

  Note: the source water sulfate level is low (167 mg/L); therefore, the corresponding NF reject stream sulfate concentration is also low (1,112 mg/L). At these levels, calcium sulfate is not expected to precipitate. The addition of lime to the NF reject stream will only serve to lower the calcium and magnesium hardness. Based on the design source water quality, the preliminary treatment scheme is reducing the hardness of NF reject to allow higher recovery through the RO membrane. With controlled lime softening, the remaining species is expected to be magnesium

sulfate, which has a high solubility rate and is not considered a scaling source on the RO membrane.

- The NF reject stream will be mixed with lime in a rapid-mix tank and then routed to a reaction tank. The reaction tank will be sized with sufficient hydraulic retention time for the softening reactions to take place. The content of the reaction tank will be pumped into a settling tank (clarifier) to settle the solids into a bed of sludge. Sludge will be recycled within the system to optimize chemical reactions, and a portion will be bled and dewatered to form sludge cake for landfill disposal.

- A portion of the sludge that settles in the clarifier will be recycled to optimize the softening reaction, and a portion will be bled to balance the solids loading into the WTS. Sludge dewatering filter presses will be utilized to dewater the excess sludge slurry to dry sludge cake suitable for landfill disposal. The percent of sludge solids is expected to be 45-55% by weight and pass the paint filter test.

Pumps, tanks, and chemical storage and feed systems will be part of the packaged WTS, as shown in SK-1 in Appendix 1.

3.2.2 WWTS Process Overview

NF concentrate from the WTS will be softened by mixing with lime. The softened water (clarifier effluent) will be routed to the WWTS.

The WWTS will include the following major components:

- UF units to filter clarifier effluent for downstream membrane treatment.

- High-efficiency reverse osmosis (HHRO) units to concentrate the softened water into a smaller stream for thermal evaporation.

    - Thermal evaporation is relatively complex and both CAPEX and OPEX intensive (Figure 1). Therefore, the goal is to lower the flow to the evaporators.

    - With lime softening, RO recovery is assumed to be around 75%. Example: for SD-012, the NF reject stream, after softening, can be lowered from 208 gpm to about 50 gpm.

- An evaporation system to concentrate the HHRO reject stream to generate a highly concentrated brine solution. Figure 1 below provides an overview of a thermal evaporation process using mechanical vapor recompression technology. Depending on the supplier selected, there will be some variation of the design.

    - The net recovery of water through the evaporator depends on feedwater inlet TDS. For Keetac, 80-90% could be obtained. Example: for SD-012, with water recovery of about 90%, the concentrated solution left will be about 5 gpm.

    - Although the volume of water is significantly reduced by the evaporator, the remaining volume is substantial enough to warrant further treatment. Example: for SD-012, at 5 gpm, the volume of water that would need to be hauled each day is about 7,000 gallons.

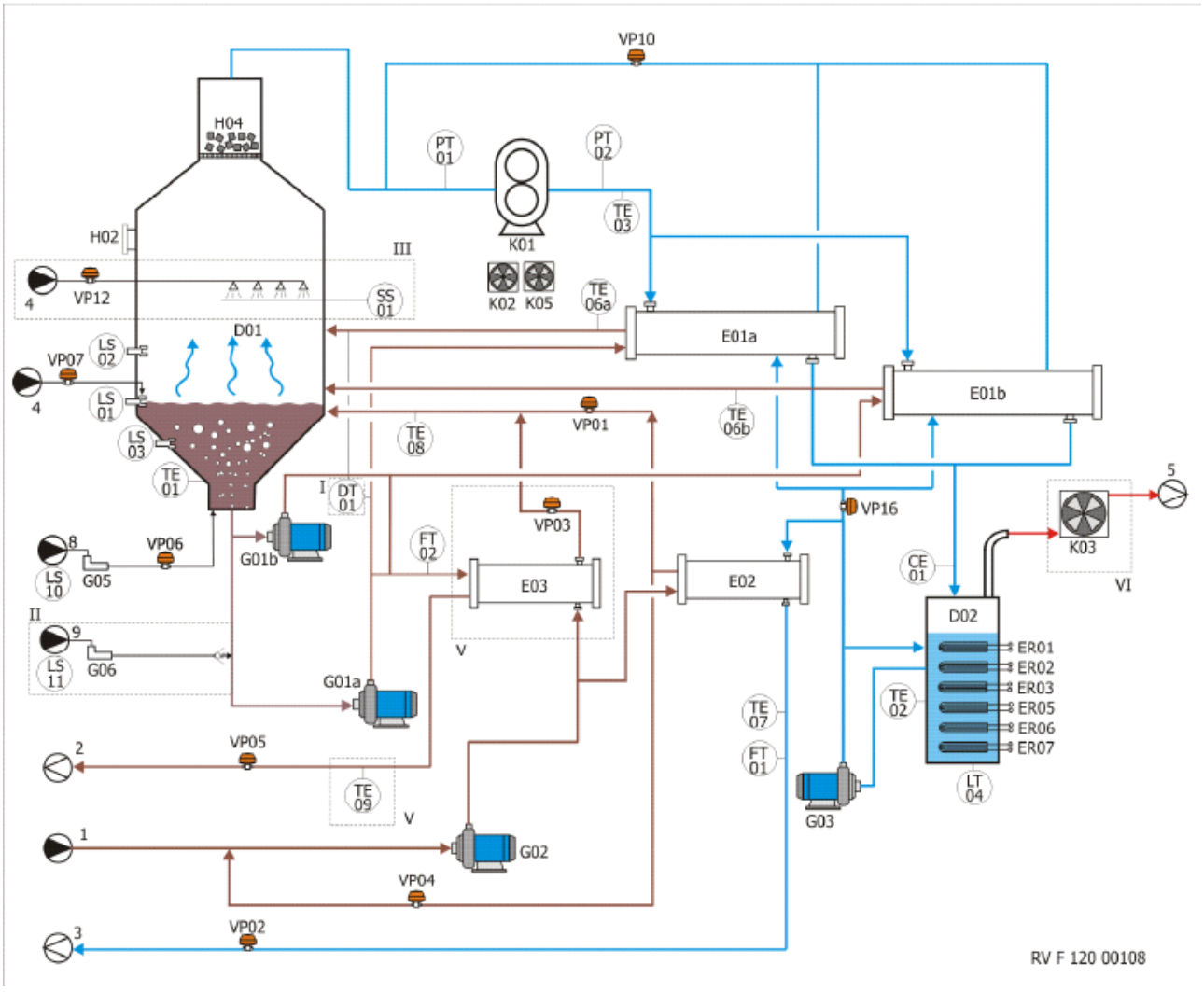


Figure 1 Thermal Evaporation Process (modular courtesy of Veolia)

The evaporator will generate good quality distillate (Stream 3 shown on Figure 1) and highly concentrated brine (Stream 2 shown on Figure 1). If solid waste is desired, a crystallization system will need to be added.

- A crystallizer was considered for implementation downstream of the evaporator to generate a much lower volume of waste for hauling. Figure 2 shows a crystallization system downstream of the evaporator.

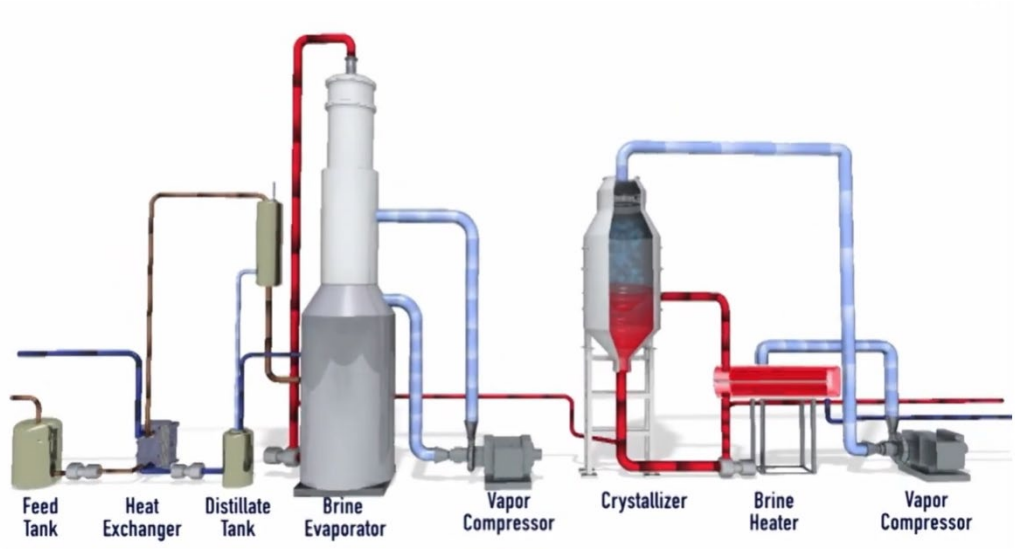


Figure 2 Brine Evaporator Followed by Crystallizer (courtesy of Veolia)

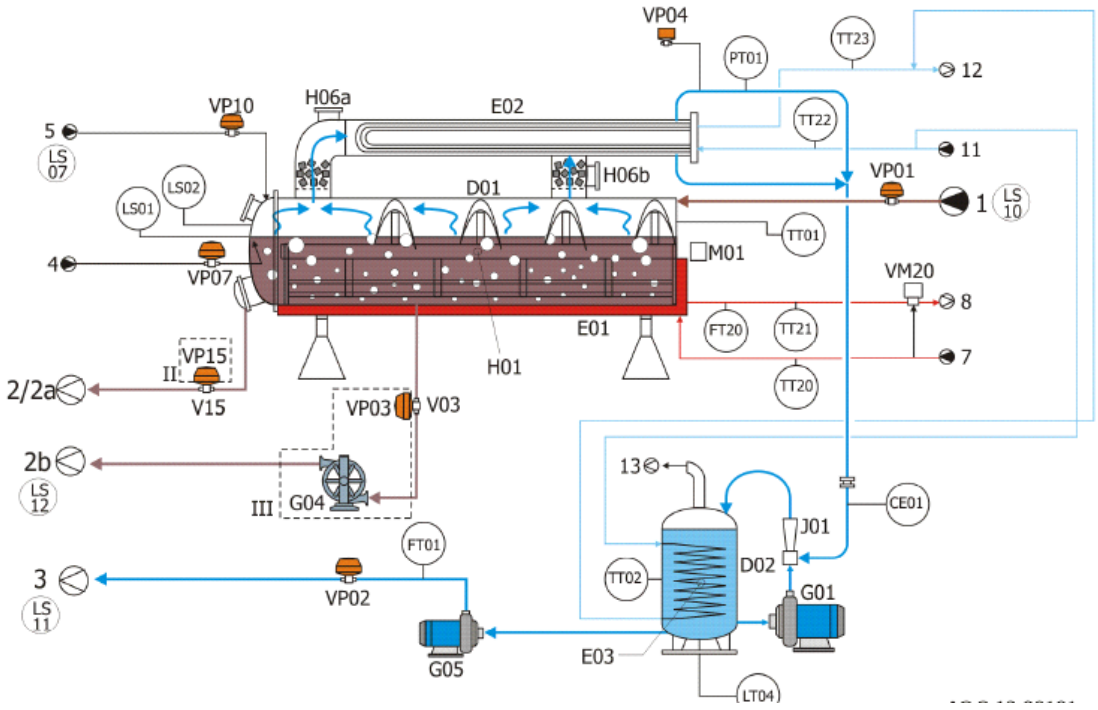


Figure 3 Modular Crystallizer (courtesy of Veolia)

The crystallization step adds to the complexity and cost of running a ZLD plant. The concentrated liquid stream from the crystallizer will need to be further processed by a centrifuge to generate solids salt for landfill disposal.

Evaporator, crystallizer, and centrifuge design will vary from supplier to supplier.

Depending on the flow rate (i.e., SD case considered), the evaporator/crystallization process can be accomplished in a single combined unit, as shown on Figure 4 below.

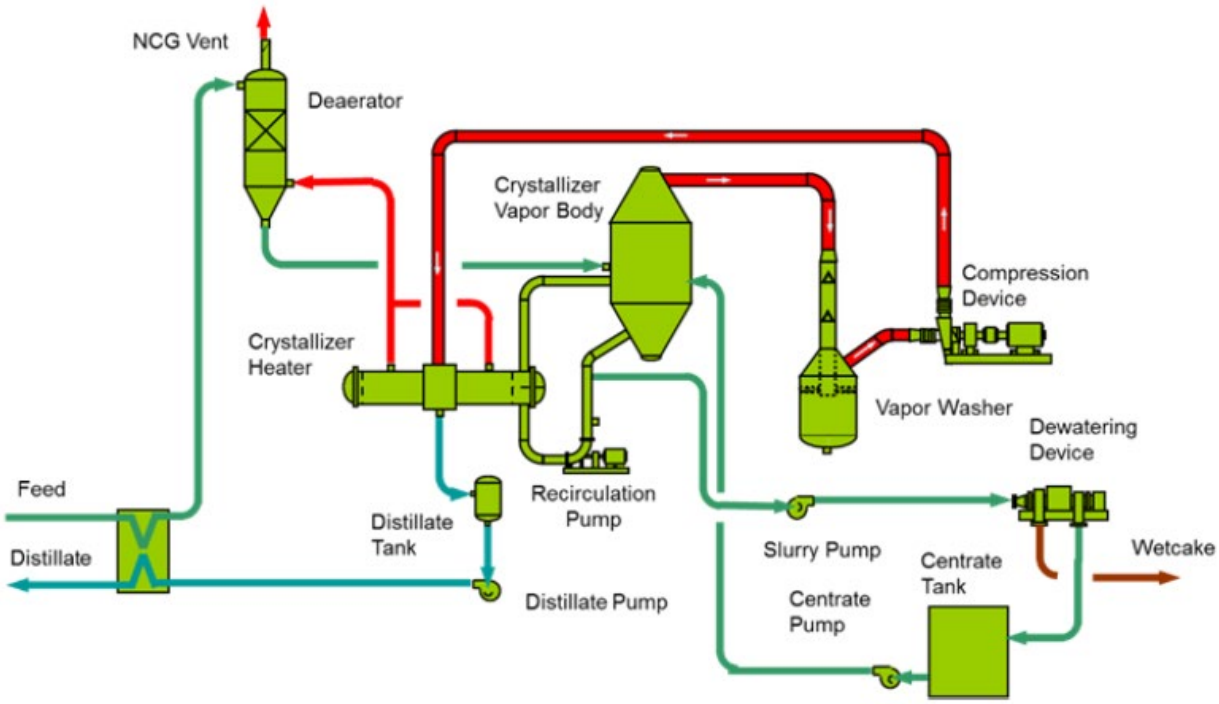


Figure 4 Veolia HPD® Evaporator/Crystallizer (courtesy of Veolia)

Veolia also offers a modular “one-step” evaporation/crystallization system. Figure 5 and Figure 6 represent the MBD system.

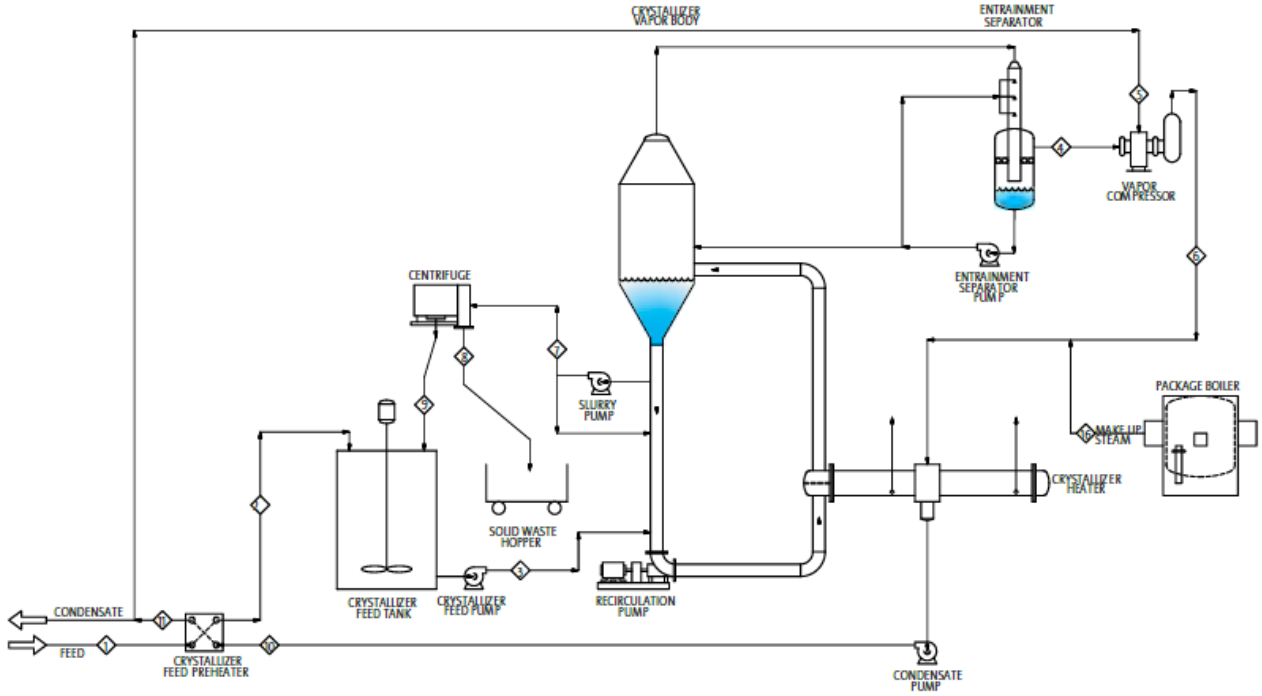


Figure 5 MBD™ Modular Brine Crystallization System (courtesy of Veolia)

A portion of the Veolia crystallization equipment can be located outdoors, reducing building costs.

Figure 6 MBD™ Modular Brine Crystallization System – Model 300 (courtesy of Veolia)

The evaporator/crystallizer equipment requires both process chemicals (e.g., anti-foam agents) and cleaning chemicals for periodic cleaning. All spent chemical cleaning wastewater will be disposed of off-site via haul trucks. Costs have been included in the OPEX.

3.2.3 Balance-of-Plant

The equalization tank and some components of the WWTS will be located outdoors. The remaining equipment will be located indoors in a heated pre-engineered metal building (PEMB). Within the PEMB will be rooms for the motor control center (MCC), control room, laboratory, and restrooms.

Mechanical equipment such as air compressors, air dryers, air receiver tanks, sump/sump pumps, eyewash, and safety showers will be installed inside the PEMB.

Monorails, hoists, and trolleys will be utilized to service the equipment.

Barr roughly estimated the PEMB footprint and height based on the estimated space needed to house the water treatment and balance-of-plant (BOP) equipment. Previous Barr projects and vendor equipment cutsheets were used as a reference to establish the PEMB size.

3.3 Total Construction Costs

Barr solicited quotes from major water treatment equipment suppliers and also used pricing from recent Barr projects to establish the cost of the water treatment equipment.

Next, Barr determined the infrastructure needed (civil, structural, mechanical, electrical) to support the installation and operation of water treatment equipment. Major considerations include site improvements, foundation, building, interconnecting piping/valves/fittings, utilities (service air, service water, potable water), power supply, controls, and service facilities. This exercise constituted a pre-feasibility study level effort with 1% to 15% project definition and reflective of AACE Class 4 cost estimate (-30%,+50%).

Appropriate cost factors were applied to the major equipment cost to estimate the probable total construction cost. Factors were selected based on the pre-feasibility level study and best engineering judgment. Using appropriate factors, construction and material costs were determined for the following categories:

- Equipment Erection
- Piping, Valves, and Fittings
- Electrical
- Site Improvements
- Building(s)
- Service Facilities

The factor for each category was adjusted based on the design raw water flow rate established for each SD case.

For all SD cases, other project costs were determined, such as:

- Project Management and Overhead
- Design, Engineering, and Construction Management
- Contingency (30%).

Table 4 Barr's Opinion of the Probable Total Construction Cost (CAPEX) – WTS

	SD-002	SD-003	SD-005	SD-012
Design Feedwater Flow to WTS, gpm =	3,800	2,800	5,000	1,400
Total Constructed Capital Cost Estimate =	**$105,421,000**	**$81,330,000**	**$123,846,000**	**$41,739,000**
+50% =	$529,000,000	$159,000,000	$122,000,000	$186,000,000
-30% =	247,000,000	$74,000,000	$57,000,000	$87,000,000

Table 5 Barr's Opinion of the Probable Total Construction Cost (CAPEX) – WWTS

	SD-002	SD-003	SD-005	SD-012
Design Feedwater Flow to WTS, gpm =	3,800	2,800	5,000	1,400
Corresponding Flow to WWTS, gpm =	565	420	745	210
Total Constructed Capital Cost Estimate =	**$60,000,000**	**$49,000,000**	**$71,000,000**	**$31,000,000**
+50% =	$90,000,000	$73,500,000	$106,500,000	$46,500,000
-30% =	$48,000,000	$35,000,000	$50,000,000	$22,000,000

Note: Barr's opinion of probable project cost provided is based on our experience, qualifications, and the level of engineering completed thus far. Based on this level of engineering, Barr has made assumptions that have not been confirmed or vetted, which may significantly impact the overall cost. Barr has no control over the cost of labor, materials, equipment, services furnished by others, the contractor(s)' methods of determining prices, competitive bidding, or market conditions. Therefore, these opinions of costs represent our best judgment as an experienced and qualified professional engineer familiar with the construction industry. However, we cannot and do not guarantee that actual project and/or construction costs will not vary from the cost estimate prepared by Barr.

3.4 Operating and Maintenance Cost

3.4.1 Net Present Value of Total O&M Costs

The following were considered when estimating the O&M cost.

- Power draw by equipment
- Solids waste disposal
- Chemicals injected for treatment
- UF/NF/RO membrane cleaning chemicals
- UF/NF/RO membrane replacement
- Equipment overhaul and parts replacement
- Laboratory costs associated with monitoring the process
- Operator labor
- Maintenance (mechanical, I&C) labor
- Outside general contractor labor for system equipment overhaul and major work

2023-2024 pricing was utilized in estimating the cost for each line item and then projected for the next 20 years based on assumed escalation rates.

The following economic factors were utilized in estimating the NPV cost.

- Spare parts as a percentage of equipment cost: 2% for WTS and 5% for WWTS.
- Material escalation: 5%
- Labor escalation: 3%
- Discount rate: 10%
- Plant capacity factor: 90%
- Plant life: 20 years

Table 6 and Table 7 provide the 20-year NPV of the estimated O&M cost for WTS and WWTS, respectively.

Table 6 Barr's Opinion of the 20-year NPV O&M Cost – WTS

	SD-002	SD-003	SD-005	SD-012
Design Feedwater Flow to WTS, gpm =	3,800	2,800	5,000	1,400
WTS O&M Cost =	**$28,441,000**	**$25,698,000**	**$37,118,000**	**$17,841,000**
+50% =	$43,000,000	$39,000,000	$56,000,000	$27,000,000
-30% =	$20,000,000	$20,000,000	$30,000,000	$20,000,000

Table 7 Bar's Option of the 20-year NPV O&M Cost – WWTS

	SD-002	SD-003	SD-005	SD-012
Design Feedwater Flow to WTS, gpm =	3,800	2,800	5,000	1,400
Corresponding Flow to WWTS, gpm =	565	420	745	210
WWTS O&M Cost =	$48,900,000	$36,000,000	$64,300,000	$18,000,000
+50% =	$74,000,000	$54,000,000	$97,000,000	$27,000,000
-30% =	$40,000,000	$30,000,000	$50,000,000	$20,000,000

3.4.2 Auxiliary Power

Power (480 V, 3 phase) will be routed to the PEMB.

For the WTS, the major power draw will be by pumps that will be utilized to feed process fluid (water, sludge) through the various components of the WTS. For each SD case, the power draw was estimated based on the design flow rate for that case and the estimated total dynamic head (TDH) required to overcome piping and system losses. A pump efficiency of 75% and a motor efficiency of 90% was utilized to estimate the power draw. The WTS NF skids will also draw significant power by nature of the high-pressure feed pumps required to overcome the osmotic pressure across the membranes. Other power users are tank mixers, filter press hydraulic units, chemical feed pumps, and building heating, ventilation, and air conditioning (HVAC) system.

Even though the flow rate is relatively lower than WTS, the WWTS is expected to draw power comparable to or more than the WTS. This is mainly due to the HHRO and vapor compressors for the evaporator/crystallizer systems.

The plant capacity factor was assumed to be 90% (i.e., the WTS/WWTS will be in operation for 90% of the year), and the remaining time is assumed downtime of annual system maintenance and overhaul).

Table 8 and Table 9 provide the estimated annual auxiliary power demand and corresponding costs for the WTS and WWTS, respectively.

Table 8 Estimated Annual Auxiliary Power Cost – WTS

	SD-002	SD-003	SD-005	SD-012
Design Feedwater Flow to WTS, gpm =	3,800	2,800	5,000	1,400
Estimated Power Demand, kW =	1,096	860	1,328	459
Power Cost, $/kW-hr (2024) =	$0.10	$0.10	$0.10	$0.10
Annual Auxiliary Power Cost =	$864,000	$678,000	$1,048,000	$362,000

Table 9 Estimated Annual Auxiliary Power Cost – WWTS

	SD-002	SD-003	SD-005	SD-012
Design Feedwater Flow, gpm =	3,800	2,800	5,000	1,400
Corresponding Flow to WWTS, gpm =	565	420	745	210
Estimated Power Demand, kW =	2,035	1,499	2,677	750
Power Cost, $/kW-hr (2024) =	$0.10	$0.10	$0.10	$0.10
Annual Auxiliary Power Cost =	$1,605,000	$1,183,000	$2,111,000	$592,000

3.4.3 Solid Disposal

Barr evaluated available water quality data for the four SD streams (Appendix 2). Detailed analysis was only available for SD-002 and S-005. Data for SD-002 indicated a higher concentration of species that would, in turn, cause more sludge to be generated; therefore, Barr prepared process calculations using water quality data for SD-002 as the worst-case scenario.

Barr estimated the sludge production rate using SD-002 data and the design flow of each SD stream. Other key assumptions in preparing the process calculations included the percentage of excess reagents (lime, soda ash) needed to drive chemical equilibriums and the extent to which chemical precipitation reactions were complete. Without project-specific bench and/or pilot tests, our reliance is on theoretical calculations with adjustments based on findings from other similar applications.

The annual sludge production rate was adjusted for a 90% plant capacity factor.

Table 10 provides the solid production rate and corresponding disposal costs. Solids include sludge cake from the WTS and salts from the bolt-on thermal evaporator/crystallizer. Solid waste is assumed to be non-hazardous.

Table 10 Estimated Annual Solid Disposal Cost – Total WTS & WWTS

	SD-002	SD-003	SD-005	SD-012
Design Feedwater Flow, gpm =	3,800	2,800	5,000	1,400
Filter Press Sludge Cake (50% moisture), tpd =	22	16	29	8
Filter Press Sludge Cake (50% moisture), CY =	19	14	25	7
Solids Salts from Crystallizer (dry), (10% moisture), tpd =	15	11	20	5
Sludge disposal cost, $/ton (2024) =	$35	$35	$35	$35
Annual Disposal Cost =	$500,000	$400,000	$600,000	$200,000

3.4.4 Crystallizer System Incremental Labor Cost

Labor cost is one of the major contributors to the OPEX cost for the WWTS.

As seen on Figure 1 through Figure 5, the evaporator/crystallizer system is complex, requiring monitoring of process and process chemistry. Therefore, additional labor is required to operate this type of system.

Considerations in selecting the number of additional staff are as follows:

- Evaporator/crystallizer systems operate satisfactorily only when feedwater chemistry and flow are constant. Deviations from design chemistry and flow swings (up/down) cannot be tolerated. Therefore, the evaporator/crystallizer system must be monitored continuously.
- Evaporator/crystallizer is designed to recover specific salts. Chemical feed is often required to balance chemistry.
- Evaporator/crystallize systems degrade over time and lose capacity. Degradation can be up to 20% between cleanings. Cleaning frequency depends on water chemistry and could be up to once per month. Cleaning waste is assumed to be non-hazardous and will be hauled off-site. During detailed design, recycling to the front of the WWTS will be evaluated.
- Experience is needed to operate evaporator/crystallize systems; therefore, dedicated operators are needed.

Depending on the number of shifts established for the operation of the Keetac water treatment facility, Barr estimates around six experienced personnel to run the evaporator/crystallize system. For lower SD flow cases, the size and/or number of modules may be lower, so a full-time mechanic and technician may not be needed.

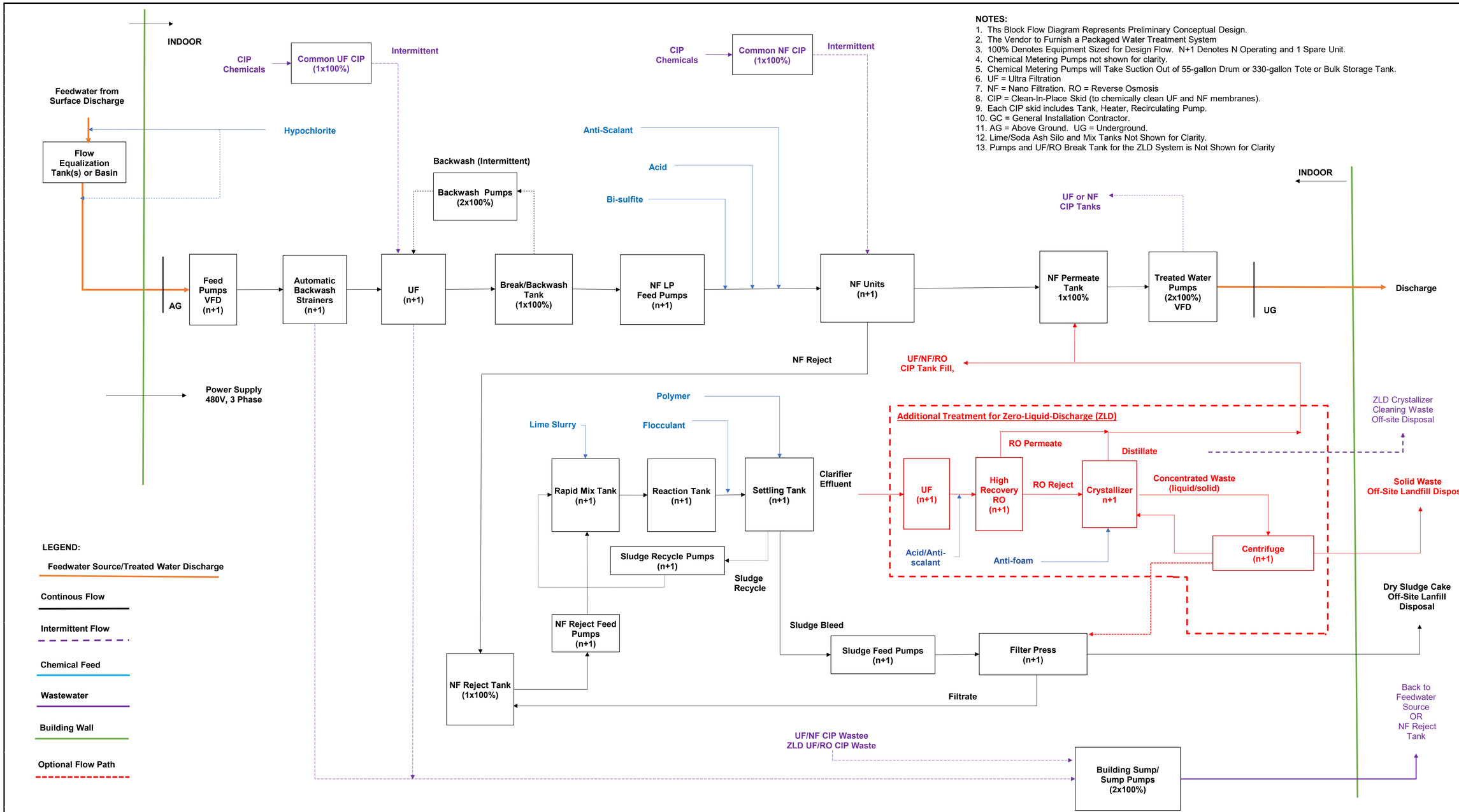
- Three operators to cover two shifts per day, including weekend rotation
- One full-time mechanic to cover the day shift
- One full-time instrumental and controls (I&C) technician to cover the day shift
- One full-time chemist to cover the day shift

The O&M cost included a multiplier of 1.5 to cover base salary and benefits.

Appendices

Appendix 1

Proposed Water Treatment System Conceptual Design



NOTES:

1. Ths Block Flow Diagram Represents Preliminary Conceptual Design.
2. The Vendor to Furnish a Packaged Water Treatment System
3. 100% Denotes Equipment Sized for Design Flow. N+1 Denotes N Operating and 1 Spare Unit.
4. Chemical Metering Pumps not shown for clarity.
5. Chemical Metering Pumps will Take Suction Out of 55-gallon Drum or 330-gallon Tote or Bulk Storage Tank.
6. UF = Ultra Filtration
7. NF = Nano Filtration. RO = Reverse Osmosis
8. CIP = Clean-In-Place Skid (to chemically clean UF and NF membranes).
9. Each CIP skid includes Tank, Heater, Recirculating Pump.
10. GC = General Installation Contractor.
11. AG = Above Ground. UG = Underground.
12. Lime/Soda Ash Silo and Mix Tanks Not Shown for Clarity.
13. Pumps and UF/RO Break Tank for the ZLD System is Not Shown for Clarity

1	NF recovery = 85%. ZLD HHRO recovery = 75% and ZLD Crystallizer recovery = 90%	Revision B	Issue for Information	BARR		BLOCK FLOW DIAGRAM	Project	Drawing
2	Majority of the equipment will be located indoors in a pre-engineered metal building (PEMB)	Revision C	Issue for Information				23311154.05	SK-1
3	PEMB = electric heat.	Revision D	Issue for Information			U. S. STEEL - KEETAC	SH 1 OF 1	Rev
4	Block Flow Diagram Applicable for SD-002, SD-003, SD-004, SD-012. Number of UF and NF units changes for each.	Revision E	Issued with Draft Report Dated 1/31/2025	Eng: ASH2	Dwg: ASH2			E
		Revision F	Issued with Final Report Dated 4/30/2025	Check: EJA	Date: 4/30/25	Sulfate Water Treatment System		

Appendix 2

Surface Discharge Water Quality

U.S. Steel - Keetac
Water Treatment for Sulfate Reduction: SD-002, SD-003, SD-005, SD-012

Table A - Design Feedwater Quality Data

Parameter [mg/L]	SD002	SD003	SD005	SD012	WTS design notes	Design Basis Feedwater to WTS for Each SD Stream
Temperature (min), deg F	50	38	34	41	*pump hp consideration*	**34**
Temperature (max), deg F	74	54	69	45		**74**
pH (min)	6.5	7.0	8.0	6.4	*disinfection consideration, membrane scaling potential*	**6.4**
pH (max)	8.0	7.8	9.0	7.7		**7.5 to 9**
O&G	5	5	5	5	*pre-treatment considerations*	**< 5**
TOC	4	1	2	2		**4**
BOD	3	3	3	3		**3**
COD	21	76	18	21		**76**
TSS	11	13	15	9		**15**
Iron, total	0.71	0.19	0.26	0.10		**<1**
Manganese	0.39	0.00	0.05	0.09		**<1**
TDS	**563**	NA	440	NA	*membrane projection (% recovery, % reject)*	**563**
Alkalinity as $CaCO_3$	324	NA	306	NA		**324**
Bicarbonate as HCO_3	389	NA	295	NA		**389**
Calcium	75	NA	21	NA		**75**
Chloride	16	NA	18	NA		**16**
Magnesium	66	55	73	17		**66**
Phosphorus as P	0.003	NA	0.009	NA		**0**
Potassium	4	NA	3	NA		**4**
Sodium	29	NA	51	NA		**29**
Sulfate	167	84	136	28		**167**
Silica as SiO_2	NA	NA	NA	NA	*membrane design consideration, anti-scalent selection, and sometime pre-treatment consideration*	**5**
Barium	0.03	0.02	0.01	0.01		**0.1**
Boron	0.05	0.04	0.08	0.01		**0.1**
Strontium	0.14	NA	0.071	NA		**0.2**

NA = not available

Appendix C

Economic Burden Support Documents

Economic Burden Approval

I am a Certified Public Accountant (CPA) and approve of the financial statements prepared which fairly set forth the status of the business, plant, system, or facility for each of the three financial years immediately preceding the year of the application, and an analysis of the effect of such financial status if the variance is not granted.

Joseph Wyse

Name: Joseph Wyse
Title: Assistant Corporate Controller
Employer: United States Steel Corporation

Commonwealth of Pennsylvania CA051053

CPA License Number

Date: May 27, 2025

Calculation of Total Annualized Project Costs (Worksheet G in the Guidance)
Description: This worksheet identifies and documents the pollution control project(s) needed to meet water quality standards. See the Guidance documentation below for more information.
Instructions: Enter information in the **cells marked with an asterisk (*)** about the most cost-effective approach to meet water quality standards.The most accurate estimate of project costs may be available from the discharger's design engineers. If site-specific engineering cost estimates are not available, preliminary project cost estimates may be derived from a comparable project in the State or from the judgment of experienced water pollution control engineers.
Discharge management options to consider include: • Pollution prevention • End-of-pipe treatment • Upgrades or additions to existing treatment.
Types of pollution prevention activities to consider are: • Change in raw materials • Substitution of process chemicals • Change in process • Water recycling and reuse • Pretreatment requirements
Whatever the approach, the information should demonstrate that the proposed approach is the most appropriate means of meeting water quality standards, and fully document the cost estimates. If at least one of the treatment alternatives that would attain water quality standards would not impose substantial impacts, then do not proceed with the analysis.

Capital costs to be financed ($)	$565,000,000 *	(1)
Interest rate for financing (%)	10% *	(i)
Time period of financing (Assume 10 years[1])	10	(n)
Annualization factor = $i/([(1 + i)^n - 1] + i)$	0.1627	(2)
Annualized capital cost [(1) × (2)]	$91,951,148	(3)
Annual cost of operation and maintenance (including but not limited to monitoring, inspection, permitting fees, waste disposal charges, repair, administration and replacement) ($)[2]	$13,214,900 *	(4)
Total annual cost of pollution control project [(3) + (4)]	$105,166,000	(5)

Notes:
1. While actual payback schedules may differ across projects and companies, assume equal annual payments over a 10-year period for consistency in comparing projects.
2. For recurring costs that occur less frequently than once a year, pro rate the cost over the relevant number of years (e.g., for pumps replaced once every three years, include one-third of the cost in each year).

Guidance Documentation		
Component	***Section***	***Page***
Verify Project Costs	3.1.a	3-2
Capital Cost to be Financed	3.1.a; 3.1.b	3-2; 3-3
Annual Cost of Operation and Maintenance	3.1.b	3-3
Interest Rate for Financing	3.1.b	3-3
Time Period for Financing	3.1.b	3-3

Data Needed to Calculate the Primary and Secondary Indicators (Worksheets H, I, J, K and L in the Guidance)
Description: This worksheet contains the information needed to calculate primary (profit test) and secondary (liquidity, solvency, and leverage) indicators of impact. The purpose of this financial impact analysis is to assess the extent to which existing or planned activities and/or employment will be reduced as a result of meeting the water quality standards. See the Guidance documentation below for more information. **Instructions:** Enter the requested information in the **cells marked with an asterisk (*)**. Calculating ratios for several years of operation to allow long-term trends to be differentiated from short-term conditions. If the information is not available at the discharger level, it can be estimated from the balance sheets or income statements of the firm that owns or controls the discharger. If necessary, refer to an example application in the tabs named: "Example Financial Information" and "Example Financial Inputs."

Applicant Name	**United States Steel Corporation**			*
Three most recently completed fiscal years (most recent first):	**2024**	**2023**	**2022**	*
Revenues ($)	$15,640,000,000	$18,053,000,000	$21,065,000,000	*
Cost of Goods Sold (including the cost of materials, direct labor, indirect labor, rent and heat) ($)	$14,060,000,000	$15,803,000,000	$16,777,000,000	*
Portion of Corporate Overhead Assigned to the Discharger (selling, general, administrative, interest, R&D expenses, and depreciation on common property) ($)	$435,000,000	$501,000,000	$422,000,000	*
Net Income after Taxes ($)	$384,000,000	$895,000,000	$2,524,000,000	*
Depreciation ($)	$913,000,000	$916,000,000	$791,000,000	*
Current Assets (the sum of inventories, prepaid expenses, and accounts receivable) ($)	$5,232,000,000	$6,943,000,000	$7,866,000,000	*
Current Liabilities (the sum of accounts payable, accrued expenses, taxes, and the current portion of long-term debt) ($)	$3,373,000,000	$3,948,000,000	$3,959,000,000	*
Current Debt ($)	$95,000,000	$142,000,000	$63,000,000	*
Long-term Debt ($)	$4,078,000,000	$4,080,000,000	$3,914,000,000	*
Long-term Liabilities (long-term debt such as bonds, debentures, and bank debt, and all other noncurrent liabilities such as deferred income taxes) ($)[1]	$5,422,000,000	$5,363,000,000	$5,188,000,000	*
Owner Equity (the difference between total assets and total liabilities, including contributed or paid in capital and retained earnings) ($)[1]	$11,440,000,000	$11,140,000,000	$10,311,000,000	*

Note:
1. Because it is usually the firm, not the facility, that borrows money, these values should be provided at the firm level.

Guidance Documentation		
Component	***Section***	***Page***
Financial Impact Analysis (overview)	3.2	3-3
Current Assets	3.2b	3-7
Current Liabilities	3.2b	3-8

Calculation of Earnings Before Taxes With and Without Pollution Control Project Costs (Worksheet H in the Guidance)

Description: Earnings Before Taxes is used to calculate profits with and without pollution control project costs for use in the Profit Test. Calculating Earnings Before Taxes for at least the three previous fiscal years facilitates the identification of any trends or atypical years. Earnings with Pollution Control Project Costs should be calculated for the latest year with complete financial information. See the Guidance documentation below for more information.

Instructions: Review the Earnings Before Taxes and provide appropriate comments in the **cells marked with an asterisk (*)**.

A. Earnings Without Pollution Control Project Costs

EBT = R - CGS - CO

Where:

EBT =	Earnings Before Taxes
R =	Revenues
CGS =	Cost of Goods Sold
CO =	Portion of Corporate Overhead Assigned to the Discharger

	Three Most Recently Completed Fiscal Years			
	2024	2023	2022	
R	$15,640,000,000	$18,053,000,000	$21,065,000,000	(1)
CGS	$14,060,000,000	$15,803,000,000	$16,777,000,000	(2)
CO	$435,000,000	$501,000,000	$422,000,000	(3)
EBT [(1) - (2) - (3)]	$1,145,000,000	$1,749,000,000	$3,866,000,000	(4)

Considerations: Have Earnings Before Taxes changed over the three year period? If so, what would a "typical" year's EBT be? Explain below.

We have high exposure to market influence, and therefore, are highly cyclical and subject to volatility. As an example, earnings have changed over the three year period. There is no "typical" year. Of the 3 years, 2022 is most closely aligned with our through-cycle profitability. *

B. Earnings with Pollution Control Project Costs

EWPR = EBT - ACPR

Where:	EWPR =	Earnings with Pollution Control Project Costs
	EBT =	Earnings Before Taxes (4)
	ACPR =	Total Annual Costs of Pollution Control Project [Worksheet G, (5)]

	The Most Recently Completed Fiscal Year	
	2024	
EBT (4)	$1,145,000,000	(5)
ACPR [**Worksheet G**, (5)]	$105,166,000	(6)
EWPR [(5) - (6)]	$1,039,834,000	(7)

Will earnings be positive after paying the annual cost of pollution control? *Yes*

Additional comments:

The cost of the pollution control may cause us to evaluate other strategic or footprint options to lessen the capital intensity and enhance the profitability of our business.

*

Guidance Documentation		
Component	***Section***	***Page***
Profitability	3.2.a	3-6

Calculation of Profit Rates With and Without Pollution Control Project Costs (Worksheet I in the Guidance)

Description: This worksheet is used to evaluate the Profit Test, the primary measure of financial impacts. The Profit Test is a measure of what may happen to earnings if additional pollution control is required. Profitability (before pollution control investments have been made) is required to claim substantial financial impacts from compliance with water quality standards; current lack of profits or profits far below industry norms indicates trouble before compliance with water quality standards. Current profitability that would turn negative with the pollution control, or greatly reduced, but still positive, profits are of concern. See the Guidance documentation below for more information.

Instructions: Determine and interpret the Profit Test, then provide comments about how these profit rates compare to those for facilities in similar lines of business in the **cells marked with an asterisk (*)**. As with other tests, it may not be possible to compare the rate directly with the rates of similar facilities. In such cases, compare the rate with that of firms that concentrate in similar businesses. Although complicated, consider the ability to raise prices to cover some or all of the pollution control costs. In such a case, revenues increase and earnings fall by an amount less than the costs of pollution control. Price increases may be difficult to predict, and depend on many factors. Consider the level of competition in the industry, the likelihood of competitors' facilities facing similar project costs, and the willingness of consumers to pay more for the product.

A. Profit Rate Without Project Costs

PRT = EBT ÷ R

Where:

PRT = Profit Rate Before Taxes
EBT = Earnings Before Taxes
R = Revenues

	Three Most Recently Completed Fiscal Years			
	2024	2023	2022	
EBT [**Worksheet H**, (4)]	$1,145,000,000	$1,749,000,000	$3,866,000,000	(1)
R [**Worksheet H**, (1)]	$15,640,000,000	$18,053,000,000	$21,065,000,000	(2)
PRT [(1) / (2)]	0.07	0.10	0.18	(3)

Considerations: How have profit rates changed over the three years?

The profit rate has fluctuated over the last three years. Our industry is cyclical and subject to market fluctuations that can adjust profit substantially. *

Is the most recent year typical of the three years?

- [x] Yes, use 2024. *
- [ ] No, use 2023. It is more representative of a 'typical' year. *
- [ ] No, use 2022. It is more representative of a 'typical' year. *

How do these profit rates compare with the profit rates for this line of business?

They are not as good as competitors in our line of business. *

B. Profit Rate With Pollution Control Costs

PRPR = EWPR ÷ R

Where:	PRPR =	Profit Rate with Pollution Control Costs
	EWPR =	Before-Tax Earnings With Pollution Control Costs
	R =	Revenues

	The Most Recently Completed Fiscal Year	
	2024	
EWPR [**Worksheet H**, (7)]	$1,039,834,000	(4)
R [**Worksheet H**, (1)]	$15,640,000,000	(5)
PRPR [(4) / (5)]	0.07	(6)

Considerations:

What would be the percentage change in the profit rate for the most recent year due to pollution control costs? [(PRPR - PRT) / PRT × 100]

-9%

How does the Profit Rate with Pollution Control Costs compare to the profit rate of this line of business?

The profit rate is not as good as other competitors in the steel business, particularly those that do not even have mining operations, and operate mini-mills which do not require the capex or ongoing maintenance costs of these pollution control measures. Additional Pollution Control Costs would likely negatively impact our profit rate and cost competitiveness in the steel industry. *

Is there ability to raise prices to cover some or all of the pollution control costs? Explain below:

No. Our business is not cost plus a margin. Our revenues are highly dictated by the market price for commodity steel and differentiated products, which this cost does not differentiate our product in any way. *

Guidance Documentation		
Component	***Section***	***Page***
Revenues	3.1b	3-2
Profitability (overview)	3.2.a	3-6
Comparison to Similar Line of Business	3.2.a	3-6
Interpretation of Profit Test	3.2.a	3-6
Earnings Before Taxes	3.2.a	3-6
Effect of Pollution Control on Profit	3.2.a	3-6
Potential to Raise Prices	3.2.a	3-7

Calculation of the Current Ratio (Worksheet J in the Guidance)

Description: The Current Ratio is one of the secondary measures that provides information about specific impacts that may result from compliance with water quality standards. The ratio provides a measure of liquidity (the ability to pay short-term bills) by comparing current assets with current liabilities. The general rule is that a Current Ratio greater than 2 indicates ability to cover short-term obligations. However, the impact of a major capital investment such as the pollution control project must be judged in conjunction with the other three financial tests. See the Guidance documentation below for more information.

Instructions: Determine the most representative measure of the Current Ratio and select the corresponding option, then provide comments about how this ratio compares with the Current Ratio for other firms in this line of business in the **cells marked with an asterisk (*)**. Favorable comparison with the median or upper quartile ratio for similar businesses suggests ability to cover short term obligations. If a direct comparison cannot be made, compare the Current Ratio to the ratio for firms that concentrate in similar businesses.

CR = CA ÷ CL

Where:

CR = Current Ratio
CA = Current Assets
CL = Current Liabilities

	Three Most Recently Completed Fiscal Years			
	2024	2023	2022	
CA	$5,232,000,000	$6,943,000,000	$7,866,000,000	(1)
CL	$3,373,000,000	$3,948,000,000	$3,959,000,000	(2)
CR [(1) / (2)]	1.55	1.76	1.99	(3)

Considerations:

Is the most recent year typical of the three years?

- (●) Yes, use 2024. *
- ( ) No, use 2023. It is more representative of a 'typical' year's ratio. *
- ( ) No, use 2022. It is more representative of a 'typical' year's ratio. *

Is the current ratio (3) greater than 2.0? *No*

How does the current ratio (3) compare with the current ratios for other firms in this line of business?

The current ratio is not as good as other competitors in the steel business. The integrated steelmaking model is historically more capital intensive and additional pollution controls would further add to this burden. *

Guidance Documentation		
Component	***Section***	***Page***
Liquidity (overview)	3.2.b	3-7
Current Ratio	3.2.b	3-7
Current Assets	3.2b	3-7
Current Liabilities	3.2b	3-8
Interpretation of Current Ratio	3.2.b	3-8
Comparison to Similar Lines of Business	3.2.b	3-9

Calculation of Beaver's Ratio (Worksheet K in the Guidance)

Description: The Beaver's Ratio is a secondary measure that provides information about specific impacts that may result from compliance with water quality standards. The ratio is a test of solvency that compares cash flow to total debt, and has been shown to be a good indicator of the likelihood of bankruptcy. Beaver's Ratios greater than 0.20 indicate solvency (i.e., ability to pay long-term debts). Ratios less than 0.15 suggest insolvency (i.e., potential for bankruptcy). Ratios between 0.15 and 0.20 are indeterminate. See the Guidance documentation below for more information.

Instructions: Determine the most representative measure of the Beaver's Ratio and select the corresponding option, then provide comments about how this ratio compares with the Beaver's Ratio for other firms in this line of business in the **cells marked with an asterisk (*)**. A favorable comparison to that of similar businesses suggests ability to meet fixed and long term obligations. If a direct comparison cannot be made, compare the Beaver's Ratio with that of firms that concentrate in similar businesses.

BR = CF ÷ TD

Where:

BR = Beaver's Ratio
CF = Cash Flow
TD = Total Debt

	Three Most Recently Completed Fiscal Years			
	2024	2023	2022	
Net income after taxes	$384,000,000	$895,000,000	$2,524,000,000	(1)
Depreciation	$913,000,000	$916,000,000	$791,000,000	(2)
CF [(1) + (2)]	$1,297,000,000	$1,811,000,000	$3,315,000,000	(3)
Current debt	$95,000,000	$142,000,000	$63,000,000	(4)
Long-term debt	$4,078,000,000	$4,080,000,000	$3,914,000,000	(5)
TD [(4) + (5)]	$4,173,000,000	$4,222,000,000	$3,977,000,000	(6)
BR [(3) / (6)]	0.31	0.43	0.83	(7)

Considerations:

Is the most recent year typical of the three years?

- (•) Yes, use 2024. *
- ( ) No, use 2023. It is more representative of a 'typical' year. *
- ( ) No, use 2022. It is more representative of a 'typical' year. *

Is the Beaver's Ratio greater than 0.2? *Yes*

Is the Beaver's Ratio less than 0.15? *No*

Is the Beaver's Ratio between 0.2 and 0.15? *No*

How does this ratio compare with the Beaver's Ratio for other firms in the same business?

Over similar time period, this was not as good as other steel producers. *

Guidance Documentation		
Component	***Section***	***Page***
Solvency (overview)	3.2.b	3-9
Beaver's Ratio	3.2.b	3-9
Interpretation of Beaver's Ratio	3.2.b	3-10
Comparison to Similar Lines of Business	3.2.b	3-10

Debt to Equity Ratio (Worksheet L in the Guidance)

Description: The Debt to Equity Ratio is a secondary measure that provides information about specific impacts that may result from compliance with water quality standards. The Debt to Equity Ratio is the most common measure of leverage, or the capability to borrow for new projects given the extent of existing fixed financial obligations. Firms that rely heavily on debt may find it difficult and expensive to borrow additional funds. The Debt to Equity Ratio cannot be easily calculated for a single facility; it must be calculated for the firm, since it is usually the firm, not the facility, that borrows money. The ratio measures how much the firm has borrowed (debt) relative to the amount of capital which is owned by its stockholders (equity). For entities with special sources of funding, leverage is not an appropriate measure of their ability to raise capital. Examples are agriculture and affordable housing, where special loan programs may be available. In these cases, an analysis of the probability that the project would receive this money is appropriate. See the Guidance documentation below for more information.

Instructions: Determine the most representative measure of the Debt to Equity Ratio and select the corresponding option, then provide comments about how this ratio compares with the Debt to Equity Ratio for other firms in this line of business in the **cells marked with an asterisk (*)**. Favorable comparison with the median or upper quartile ratio for similar businesses suggests ability to borrow additional funds.

DER = LTL ÷ OE

Where:

DER = Debt/Equity Ratio

LTL = Long-Term Liabilities (long-term debt such as bonds, debentures, and bank debt, and all other noncurrent liabilities such as deferred income taxes)

OE = Owner Equity (the difference between total assets and total liabilities, including contributed or paid in capital and retained earnings)

	Three Most Recently Completed Fiscal Years			
	2024	2023	2022	
LTL	$5,422,000,000	$5,363,000,000	$5,188,000,000	(1)
OE	$11,440,000,000	$11,140,000,000	$10,311,000,000	(2)
DER [(1) / (2)]	0.47	0.48	0.50	(3)

Considerations:

Is the most recent year typical of the three years?

- ◉ Yes, use 2024. *
- ○ No, use 2023. It is more representative of a 'typical' year. *
- ○ No, use 2022. It is more representative of a 'typical' year. *

How does the debt to equity ratio (3) compare with the ratio for firms in the same business?

The debt to equity ratio is not as good as others in the same business. *

Guidance Documentation		
Component	***Section***	***Page***
Leverage (overview)	3.2b	3-10
Debt/Equity Ratio	3.2b	3-10
Owner Equity	3.2b	3-10
Interpretation of Debt/Equity Ratio	3.2.b	3-11
Comparison to Similar Dischargers	3.2.b	3-11
Impact of Special Sources of Funding	3.2.b	3-11

Financial Analysis Summary

Description: This worksheet summarizes the financial analysis and determines if the pollution control project is likely to cause substantial adverse financial impacts. See the Guidance documentation below for more information.

Instructions: Enter information for comparison to firms in similar lines of business in the **cells marked with an asterisk (*)**. Then summarize the results in the space provided. As indicated previously, the Profit Test should be considered first. For all of the tests, it is important to look beyond the individual test results and evaluate the total compliance situation. While each test addresses a single aspect of financial health, the results of the four tests should be considered jointly to obtain an overall picture of economic health and the potential impact of compliance with water quality standards. If substantial financial impacts are likely to occur, proceed to the tab named: "8. Widespread Impact Inputs." If the pollution control project is not likely to cause substantial financial impacts, compliance with water quality standards is required.

Primary Measure: Profit Test[1]

Entity	Annual Pollution Control Costs	Most Recently Completed Fiscal Year	Profit Rate Without Pollution Controls	Profit Rate With Pollution Controls	Percent Change in Profit Rate Due to Pollution Controls
United States Steel Corporation	$105,166,000	2024	0.07	0.07	-9.2%

Note:1. Based on the most recently completed fiscal year

Comparison with Typical Values for Facilities/Firms in Similar Line of Business[2]

Entity	Primary Measure: Profit Test (Profitability)	Secondary Measures		
		Current Ratio (Liquidity)	Beaver's Ratio (Solvency)	Debt/Equity Ratio (Leverage)
United States Steel Corporation	0.07	1.55	0.31	0.47
Typical Value for Facilities/Firms in Similar Lines of Business	0.10	2.51	0.58	0.35

Note:
2. Based on a typical fiscal year

Summarize and discuss financial circumstances with and without pollution controls, and compare primary and secondary measures with the corresponding typical values for facilities/firms in similar lines of business.
In a review of those in similar lines of business, Cleveland-Cliffs historically was a merchant seller of Iron Ore and the business model was vastly different from that of an integrated steel producer making their own raw materials, like USS. Now, through acquisition, Cliff's has adopted an integrated steelmaking model. The closing of these transactions happened in 2020 and recently 2024 (Stelco), therefore, we do have limited historical data to reference. Therefore, the best comparison would be to look to that of the steel competitor Nucor, who not only competes with us in most steel markets, but does have some raw material lines of business which includes sourcing materials from mines in South America to source and use in steel mills in the US. This major competitor does not have to pay for the same level of pollution controls for their raw materials, nor do some other steel producers even have to maintain mining assets with the transition to more minimills, which do not consume blast furnace grade pellets. The capex to convert a pellet to DR grade requires immense capital, as well as a significant amount of capital to build a DRI/HBI facility to be able to consume it within a mini mill. If USS has to pay for that level of pollution control, strategic investment are more difficult to make in our mining assets to make them more viable for the future of the steel industry and compete with those that have higher profits within similar lines of business. *

Guidance Documentation		
Component	***Section***	***Page***
Financial Impact Analysis (overview)	3.2	3-3
Primary Measure (profitability)	3.2.a	3-6
Secondary Measures	3.2.b	3-7
Interpreting the Results	3.3	3-11
Measuring Substantial Impacts (flowchart)	Figure 3-1	3-13

Worksheet N
Factors to Consider in Making a Determination of Widespread Social and Economic Impacts
United States Steel Corporation Keetac
Description: This worksheet displays the widespread impact indicators. These indicators are helpful in determining whether substantial financial impacts are likely to have widespread economic and social impacts on the surrounding community. Whether or not such impacts are successfully demonstrated, however, will depend upon the EPA Regional Administrator's review of the application.

Define the affected community in this case; what areas are included (narrative)	The U.S. Steel Keetac Tailings Basin is located in multiple Sections of Townships 56 and 57 North, Ranges 21 and 22 West in Keewatin, Itasca County, Minnesota. Employees, contractors, and suppliers live in the nearby community as well as other communities on the Iron Range, including Buhl, Calumet, Chisholm, Hibbing, Marble, Nashwauk, and in unincorporated areas of Itasca and St. Louis Counties.	(1)
Current unemployment rate in affected community ([Current # of persons collecting unemployment in affected community / labor force in affected community]) (%)	5.26%	(2)
Current national unemployment rate (%)	5.3%[(1)]	(3)
Additional number of persons expected to collect unemployment in affected community due to compliance with water quality standards (#)	453	(4)
Expected unemployment rate in the affected community after compliance with water quality standards ([Current # of persons collecting unemployment in affected community + (4)] / labor force in affected community) (%)	9.15%	(5)
Median household income in affected community ($)	$52,004	(6)
Total number of households in affected community (#)	11,212	(7)
Percent of population below the poverty line in affected community (%)	15.40%	(8)
Current expenditures on social services in affected community ($)	$28,395,927	(9)

Expected expenditures on social services due to job losses in the affected community ($)	$521,776	(10)
Current total tax revenues in the affected community ($)	$13,026,268	(11)
Tax revenues paid by the private entity to the affected community ($)	$8,401,736	(12)
Tax revenues paid by the private entity as a percentage of the affected community's total tax revenues (%)	64.50%	(13)
Current statewide unemployment rate ([Current # of persons collecting unemployment in state] / labor force in state]) (%)	4.00%	(14)
Additional number of persons expected to collect unemployment in the state due to compliance with water quality standards (#)	453	(15)
Expected statewide unemployment rate, after compliance with water quality standards ([Current # of persons collecting unemployment in state + (15)]/labor force in state)	4.01%	(16)
Current expenditures on social services in state ($)	$5,310,239,742	(17)
Expected statewide expenditures on social services due to job losses ($)	$414,622	(18)
Other current community characteristics or anticipated impacts that are not listed in the worksheet:		
Refer to narrative		
Notes: (1) U.S. Census Data, 2022 American Community Survey 5-Year Estimates (http://data.census.gov, accessed May 1, 2025)		

Guidance Documentation		
Component	***Section***	***Page***
Affected Community	4.1	4-1
Unemployment Rates	4.3	4-3
Labor Force	4.3	4-3
Expenditures on Social Services	4.3	4-4
Tax Revenues	4.3	4-3
Multiplier Effect	4.4	4-5
Consideration of Economic Benefits of Clean Water	4.5	4-6

Affected Community Data

Affected Area	County	2022 Population[1]	Total Civilian Labor Force[2]	U.S. Census Unemployment Rate (%)[2]	Number of Persons Collecting Unemployment[3]	DEED Unemployment Rate (%)[4]	Number of Households[2]	Median Household Income (2022 U.S. Dollars)[2]	Percent of Population Below Poverty Level (%)[2]	Number of Persons Below Poverty Level[5]	Tax Revenue (2022 U.S. Dollars)[1]
Buhl	St. Louis	957	525	5	26	No data	447	$ 55,925	3.6	34	$ 425,528
Calumet	Itasca	332	113	14.2	16	No data	136	$ 31,000	25.6	85	$ 247,407
Chisholm	St. Louis	4,732	2,010	5.7	115	No data	1,948	$ 47,792	19.3	913	$ 1,852,177
Hibbing	St. Louis	16,064	7,612	4.9	373	5	7,458	$ 52,881	14.2	2,281	$ 8,657,656
Keewatin	Itasca	979	522	5.9	31	No data	492	$ 50,658	27.6	270	$ 623,169
Marble	Itasca	618	328	7.3	24	No data	251	$ 51,094	21.0	130	$ 253,384
Nashwauk	Itasca	971	541	5.2	28	No data	480	$ 59,615	8.4	82	$ 966,947
Affected Community Total		**24,653**	**11,651**	**5.3**	**613**	**No data**	**11,212**	**$ 52,004**	**15.4**	**3,795**	**$ 13,026,268**

(1) State of Minnesota, Office of the State Auditor, Minnesota City Finances: 2022 Revenues, Expenditures, and Debt (https://www.osa.state.mn.us/media/ai4dfdjk/cired_22_report.pdf, accessed April 30, 2025)
(2) U.S. Census Data, 2022 American Community Survey 5-Year Estimates, Selected Economic Characteristics Table DP03 (http://data.census.gov, accessed May 1, 2025)
(3) Calculated based on Total Civilian Labor Force and Unemployment Rate
(4) State of Minnesota Department of Employment and Economic Development, Local Area Unemployment Statistics, March 2025 value, not seasonally adjusted (https://mn.gov/deed/data/data-tools/laus/, accessed April 30, 2025)
(5) Calculated based on 2022 Population and Percent of Population Below Poverty Level

State and County Data

Area	2022 Population[1]	Total Civilian Labor Force[2]	U.S. Census Unemployment Rate (%)[2]	Number of Persons Collecting Unemployment[3]	DEED Unemployment Rate (%)[4]	Number of Households[2]	Median Household Income (2022 U.S. Dollars)[2]	Percent of Population Below Poverty Level (%)[2]	Number of Persons Below Poverty Level[5]	Tax Revenue (2022 U.S. Dollars)[1,6]	Social Services Expenditures (2020 U.S. Dollars)[7]	Annual Average Social Services Expenditure per Capita
Itasca County	45,584	20,470	6.2	1,269	6.6	18,121	$ 63,962	11.8	5,379	$ 42,841,024	$ 59,043,835	$ 1,295
St. Louis County	200,916	101,399	4.6	4,664	4.4	85,726	$ 66,491	13.7	27,525	$ 174,004,273	$ 227,577,598	$ 1,133
Minnesota	5,801,769	3,112,649	4	124,506	3.9	2,256,126	$ 84,313	9.3	539,565	$ 34,096,657,000	$ 5,310,239,742	$ 915

(1) State of Minnesota, Office of the State Auditor, Minnesota County Finances: 2022 Revenues, Expenditures, and Debt (https://www.osa.state.mn.us/media/acqhhgxq/county_22_report.pdf, accessed April 30, 2025)
(2) U.S. Census Data, 2022 American Community Survey 5-Year Estimates, Selected Economic Characteristics Table DP03 (http://data.census.gov, accessed May 1, 2025)
(3) Calculated based on Total Civilian Labor Force and Unemployment Rate
(4) State of Minnesota Department of Employment and Economic Development, Local Area Unemployment Statistics, August 2023 value, not seasonally adjusted (https://mn.gov/deed/data/data-tools/laus/, accessed April 30, 2025)
(5) Calculated based on 2022 Population and Percent of Population Below Poverty Level
(6) State of Minnesota 2022 Annual Comprehensive Financial Report (https://mn.gov/mmb/assets/2022%20-%20Final%20ACFR%20accessible_tcm1059-552884.pdf, accessed April 30, 2025)
(7) State of Minnesota Department of Human Services, Minnesota County Human Service Cost Report for CY2020 (https://edocs.dhs.state.mn.us/lfserver/Public/DHS-4179R-ENG, accessed May 28, 2025)

Appendix D

Indirect Emissions Calculations

Table C-1: GHG Secondary Emissions from Incremental Power Demand per Unit

	Unit							
	SD-002		SD-003		SD-005		SD-012	
GHG Emission	Coal Boiler (tpy) [1]	NGCC (tpy) [2]	Coal Boiler (tpy) [1]	NGCC (tpy) [2]	Coal Boiler (tpy) [1]	NGCC (tpy) [2]	Coal Boiler (tpy) [1]	NGCC (tpy) [2]
CH4	2.56	0.15	1.94	0.12	3.25	0.20	1.00	0.06
N2O	0.37	0.02	0.28	0.01	0.47	0.02	0.15	0.01
CO2	22,601	8,193	17,124	6,207	28,707	10,406	8,823	3,198
Total CO2e [3]	22,771	8,201	17,253	6,214	28,924	10,417	8,889	3,201

[1] Calculated using emission factors from Minnesota Power Boswell Unit 4 PTE Calculations in Air Individual Permit 06100004-008, pg. 404

[2] Calculated using emission factors from 40 CFR 98 Subpart C, Tables C-1 and C-2.

Greenhouse Gas Name	CAS Number	Chemical Formula	Global Warming Potential (100-yr.) [3]
Carbon dioxide	124–38–9	CO_2	1
Methane	74–82–8	CH_4	28
Nitrous oxide	10024–97–2	N_2O	265

[3] Global Warming Potentials, 100-Year Time Horizon, Table A-1 to Subpart A of Part 98, Title 40

Operating Time (hrs)
8760

Table C-2: GHG Secondary Emissions from Incremental Power Demand per Permit

Permit	Mine Area [1]		Tailings Basin [2]	
GHG Emission	Coal Boiler (tpy)	NGCC (tpy)	Coal Boiler (tpy)	NGCC (tpy)
CH4	5.50	0.33	3.25	0.20
N2O	0.80	0.03	0.47	0.02
CO2	48,547	17,598	28,707	10,406
Total CO2e [3]	48,913	17,616	28,924	10,417

[1] Mine area permit includes SD-002, SD-003, and SD-012.

[2] Tailings basin permit includes SD-005.

Greenhouse Gas Name	CAS Number	Chemical Formula	Global Warming Potential (100-yr.) [3]
Carbon dioxide	124–38–9	CO_2	1
Methane	74–82–8	CH_4	28
Nitrous oxide	10024–97–2	N_2O	265

[3] Global Warming Potentials, 100-Year Time Horizon, Table A-1 to Subpart A of Part 98, Title 40

Table C-3: WTS GHG Emission Rate per Unit

WTS (PTE)	Unit							
	SD-002		SD-003		SD-005		SD-012	
GHG Emission	Coal Boiler (lb/hr) [1]	NGCC (lb/hr) [2]	Coal Boiler (lb/hr) [1]	NGCC (lb/hr) [2]	Coal Boiler (lb/hr) [1]	NGCC (lb/hr) [2]	Coal Boiler (lb/hr) [1]	NGCC (lb/hr) [2]
CH4	2.55E-01	1.54E-02	2.00E-01	1.21E-02	3.09E-01	1.86E-02	1.07E-01	6.44E-03
N2O	3.71E-02	1.54E-03	2.91E-02	1.21E-03	4.49E-02	1.86E-03	1.55E-02	6.44E-04
CO2	2250	816	1766	640	2727	988	942	342
Total CO2e [3]	2265	817	1777	641	2745	989	949	342

[1] Calculated using emission factors from Minnesota Power Boswell Unit 4 PTE Calculations in Air Individual Permit 06100004-008, pg. 404

[2] Calculated using emission factors from 40 CFR 98 Subpart C, Tables C-1 and C-2.

Greenhouse Gas Name	CAS Number	Chemical Formula	Global Warming Potential (100-yr.) [3]
Carbon dioxide	124–38–9	CO_2	1
Methane	74–82–8	CH_4	28
Nitrous oxide	10024–97–2	N_2O	265

[3] Global Warming Potentials, 100-Year Time Horizon, Table A-1 to Subpart A of Part 98, Title 40

Table C-4: WWTS GHG Emission Rate per Unit

WWTS (PTE)	Unit							
	SD-002		SD-003		SD-005		SD-012	
GHG Emission	Coal Boiler (lb/hr) [1]	NGCC (lb/hr) [2]	Coal Boiler (lb/hr) [1]	NGCC (lb/hr) [2]	Coal Boiler (lb/hr) [1]	NGCC (lb/hr) [2]	Coal Boiler (lb/hr) [1]	NGCC (lb/hr) [2]
CH4	3.29E-01	1.99E-02	2.43E-01	1.46E-02	4.33E-01	2.61E-02	1.21E-01	7.32E-03
N2O	4.79E-02	1.99E-03	3.53E-02	1.46E-03	6.30E-02	2.61E-03	1.76E-02	7.32E-04
CO2	2910	1055	2144	777	3827	1387	1072	389
Total CO2e [3]	2928	1056	2158	778	3852	1389	1079	389

[1] Calculated using emission factors from Minnesota Power Boswell Unit 4 PTE Calculations in Air Individual Permit 06100004-008, pg. 404

[2] Calculated using emission factors from 40 CFR 98 Subpart C, Tables C-1 and C-2.

Greenhouse Gas Name	CAS Number	Chemical Formula	Global Warming Potential (100-yr.) [3]
Carbon dioxide	124–38–9	CO_2	1
Methane	74–82–8	CH_4	28
Nitrous oxide	10024–97–2	N_2O	265

[3] Global Warming Potentials, 100-Year Time Horizon, Table A-1 to Subpart A of Part 98, Title 40

Table C-5: Annual Household Energy Consumption Equivalency Calculations

Unit	Unit Power Demand (MW)	Annual Operating Hours	Annual Household Energy Consumption (kWh) [1]	Annual Household Equivalency (homes)
SD-002	2.51	8,760	10,791	2,040
SD-003	1.90	8,760	10,791	1,546
SD-005	3.19	8,760	10,791	2,591
SD-012	0.98	8,760	10,791	796
Totals				
Mine Area Permit	5.40	8,760	10,791	4,382
Tailings Basin Permit	3.19	8,760	10,791	2,591

[1] https://www.epa.gov/green-power-markets/green-power-equivalency-calculator-calculations-and-references

Table C-6: Solid Waste Disposal Emissions

Unit	Ton of waste/yr [1]	Dumpster Loads/yr [2]	Hours Hauling/yr [2]	CO2 (tpy) [3]
SD-002	17,160	679	340	89
SD-003	12,640	500	250	65
SD-005	22,560	893	446	116
SD-012	6,320	250	125	33

[1] Estimated from annual waste disposal cost

Unit	SD-002	SD-003	SD-005	SD-012
Disposal Cost ($)/ton	25	25	25	25
Disosal Cost ($)	429,000	316,000	564,000	158,000

[2] Waste hauling assumptions

450	Assumed engine horspower		Survey of https://wasteadvantagemag.com/marketplace-category/roll-off-trucks/
30	yard^3	dumpster capacity	
62.4	lb/ft^3	density	Assuming water
15	travel distance, mile/trip		
30	Assumed average speed mph		

[3] Emission factor

Emission Calcs

Pollutant	Emission Factor	Units	Source	lb/hr
CO2	1.16	lb/hp-hr	AP-42 Table 3.4-1	522

Appendix E

USFWS IPaC Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Minnesota-Wisconsin Ecological Services Field Office
3815 American Blvd East
Bloomington, MN 55425-1659
Phone: (952) 858-0793

In Reply Refer To: 12/04/2024 17:40:07 UTC
Project Code: 2025-0027237
Project Name: Keetac Mining Area and Tailings Basin

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

This response has been generated by the Information, Planning, and Conservation (IPaC) system to provide information on natural resources that could be affected by your project. The U.S. Fish and Wildlife Service (Service) provides this response under the authority of the Endangered Species Act of 1973 (16 U.S.C. 1531-1543), the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d), the Migratory Bird Treaty Act (16 U.S.C. 703-712), and the Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*).

Threatened and Endangered Species
The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and may be affected by your proposed project. The species list fulfills the requirement for obtaining a Technical Assistance Letter from the U.S. Fish and Wildlife Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

Consultation Technical Assistance
Please refer to refer to our Section 7 website for guidance and technical assistance, including step-by-step instructions for making effects determinations for each species that might be present and for specific guidance on the following types of projects: projects in developed areas, HUD, CDBG, EDA, USDA Rural Development projects, pipelines, buried utilities, telecommunications, and requests for a Conditional Letter of Map Revision (CLOMR) from FEMA.

We recommend running the project (if it qualifies) through our **Minnesota-Wisconsin Federal Endangered Species Determination Key (Minnesota-Wisconsin ("D-key"))**. A demonstration video showing how-to access and use the determination key is available. Please note that the Minnesota-Wisconsin D-key is the third option of 3 available d-keys. D-keys are tools to help Federal agencies and other project proponents determine if their proposed action has the potential to adversely affect federally listed species and designated critical habitat. The Minnesota-Wisconsin D-key includes a structured set of questions that assists a project proponent in determining whether a proposed project qualifies for a certain predetermined consultation outcome for all federally listed species found in Minnesota and Wisconsin (except for the northern long-eared bat- see below), which includes determinations of “no effect” or “may affect, not likely to adversely affect." In each case, the Service has compiled and analyzed the best available information on the species’ biology and the impacts of certain activities to support these determinations.

If your completed d-key output letter shows a "No Effect" (NE) determination for all listed species, print your IPaC output letter for your files to document your compliance with the Endangered Species Act.

For Federal projects with a “Not Likely to Adversely Affect” (NLAA) determination, our concurrence becomes valid if you do not hear otherwise from us after a 30-day review period, as indicated in your letter.

If your d-key output letter indicates additional coordination with the Minnesota-Wisconsin Ecological Services Field Office is necessary (i.e., you get a “May Affect” determination), you will be provided additional guidance on contacting the Service to continue ESA coordination outside of the key; ESA compliance cannot be concluded using the key for “May Affect” determinations unless otherwise indicated in your output letter.

Note: Once you obtain your official species list, you are not required to continue in IPaC with d-keys, although in most cases these tools should expedite your review. If you choose to make an effects determination on your own, you may do so. If the project is a Federal Action, you may want to review our section 7 step-by-step instructions before making your determinations.

Using the IPaC Official Species List to Make No Effect and May Affect Determinations for Listed Species

1. If IPaC returns a result of “There are no listed species found within the vicinity of the project,” then project proponents can conclude the proposed activities will have **no effect** on any federally listed species under Service jurisdiction. Concurrence from the Service is not required for **no effect** determinations. No further consultation or coordination is required. Attach this letter to the dated IPaC species list report for your records.
2. If IPaC returns one or more federally listed, proposed, or candidate species as potentially present in the action area of the proposed project – other than bats (see below) – then project proponents must determine if proposed activities will have **no effect** on or **may affect** those species. For assistance in determining if suitable habitat for listed, candidate, or proposed species occurs within your project area or if species may be affected by project activities, you can obtain Life History Information for Listed and Candidate Species on our office website. If no impacts will occur to a species on the IPaC species list (e.g., there is no habitat present in the project area), the appropriate determination is **no effect**. No further consultation or coordination is required. Attach this letter to the dated IPaC species list report for your records.

3. Should you determine that project activities **may affect** any federally listed, please contact our office for further coordination. Letters with requests for consultation or correspondence about your project should include the Consultation Tracking Number in the header. Electronic submission is preferred.

Northern Long-Eared Bats
Northern long-eared bats occur throughout Minnesota and Wisconsin and the information below may help in determining if your project may affect these species.

Suitable summer habitat for northern long-eared bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥3 inches dbh for northern long-eared bat that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of forested/wooded habitat. Northern long-eared bats have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat and evaluated for use by bats. If your project will impact caves or mines or will involve clearing forest or woodland habitat containing suitable roosting habitat, northern long-eared bats could be affected. For bat activity dates, please review Appendix L in the Range-wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines.

Examples of unsuitable habitat include:

- Individual trees that are greater than 1,000 feet from forested or wooded areas,
- Trees found in highly developed urban areas (e.g., street trees, downtown areas),
- A pure stand of less than 3-inch dbh trees that are not mixed with larger trees, and
- A monoculture stand of shrubby vegetation with no potential roost trees.

If IPaC returns a result that northern long-eared bats are potentially present in the action area of the proposed project, project proponents can conclude the proposed activities **may affect** this species **IF** one or more of the following activities are proposed:

- Clearing or disturbing suitable roosting habitat, as defined above, at any time of year,
- Any activity in or near the entrance to a cave or mine,
- Mining, deep excavation, or underground work within 0.25 miles of a cave or mine,
- Construction of one or more wind turbines, or
- Demolition or reconstruction of human-made structures that are known to be used by bats based on observations of roosting bats, bats emerging at dusk, or guano deposits or stains.

If none of the above activities are proposed, project proponents can conclude the proposed activities will have **no effect** on the northern long-eared bat. Concurrence from the Service is not required for **No Effect** determinations. No further consultation or coordination is required. Attach this letter to the dated IPaC

species list report for your records.

If any of the above activities are proposed, and the northern long-eared bat appears on the user's species list, the federal project user will be directed to either the northern long-eared bat and tricolored bat range-wide D-key or the Federal Highways Administration, Federal Railways Administration, and Federal Transit Administration Indiana bat/Northern long-eared bat D-key, depending on the type of project and federal agency involvement. Similar to the Minnesota-Wisconsin D-key, these d-keys helps to determine if prohibited take might occur and, if not, will generate an automated verification letter. Additional information about available tools can be found on the Service's northern long-eared bat website.

Whooping Crane
Whooping crane is designated as a non-essential experimental population in Wisconsin and consultation under Section 7(a)(2) of the Endangered Species Act is only required if project activities will occur within a National Wildlife Refuge or National Park. If project activities are proposed on lands outside of a National Wildlife Refuge or National Park, then you are not required to consult. For additional information on this designation and consultation requirements, please review "Establishment of a Nonessential Experimental Population of Whooping Cranes in the Eastern United States."

Other Trust Resources and Activities
Bald and Golden Eagles - Although the bald eagle has been removed from the endangered species list, this species and the golden eagle are protected by the Bald and Golden Eagle Act and the Migratory Bird Treaty Act. It is the responsibility of the project proponent to survey the area for any migratory bird nests. If there is an eagle nest on-site while work is on-going, eagles may be disturbed. We recommend avoiding and minimizing disturbance to eagles whenever practicable. If you cannot avoid eagle disturbance, you may seek a permit. A nest take permit is always required for removal, relocation, or obstruction of an eagle nest. For communication and wind energy projects, please refer to additional guidelines below.

Migratory Birds - The Migratory Bird Treaty Act (MBTA) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Service. The Service has the responsibility under the MBTA to proactively prevent the mortality of migratory birds whenever possible and we encourage implementation of recommendations that minimize potential impacts to migratory birds. Such measures include clearing forested habitat outside the nesting season (generally March 1 to August 31) or conducting nest surveys prior to clearing to avoid injury to eggs or nestlings.

Communication Towers - Construction of new communications towers (including radio, television, cellular, and microwave) creates a potentially significant impact on migratory birds, especially some 350 species of night-migrating birds. However, the Service has developed voluntary guidelines for minimizing impacts.

Transmission Lines - Migratory birds, especially large species with long wingspans, heavy bodies, and poor maneuverability can also collide with power lines. In addition, mortality can occur when birds, particularly hawks, eagles, kites, falcons, and owls, attempt to perch on uninsulated or unguarded power poles. To minimize these risks, please refer to guidelines developed by the Avian Power Line Interaction Committee and the Service. Implementation of these measures is especially important along sections of lines adjacent to wetlands or other areas that support large numbers of raptors and migratory birds.

Wind Energy - To minimize impacts to migratory birds and bats, wind energy projects should follow the Service's Wind Energy Guidelines. In addition, please refer to the Service's Eagle Conservation Plan Guidance, which provides guidance for conserving bald and golden eagles in the course of siting, constructing, and operating wind energy facilities.

State Department of Natural Resources Coordination
While it is not required for your Federal section 7 consultation, please note that additional state endangered or threatened species may also have the potential to be impacted. **Please contact the Minnesota or Wisconsin Department of Natural Resources for information on state listed species that may be present in your proposed project area.**

Minnesota
Minnesota Department of Natural Resources - Endangered Resources Review Homepage
Email: Review.NHIS@state.mn.us

Wisconsin
Wisconsin Department of Natural Resources - Endangered Resources Review Homepage
Email: DNRERReview@wi.gov

We appreciate your concern for threatened and endangered species. Please feel free to contact our office with questions or for additional information.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Minnesota-Wisconsin Ecological Services Field Office
3815 American Blvd East
Bloomington, MN 55425-1659
(952) 858-0793

PROJECT SUMMARY

Project Code: 2025-0027237
Project Name: Keetac Mining Area and Tailings Basin
Project Type: Stormwater Discharge
Project Description: U.S. Steel is seeking water quality variances for 20-years for three surface discharge stations located within their Keetac Mining Area and Tailings Basin in Itasca County and St. Louis County, Minnesota.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@47.38871315,-93.0501242685823,14z

Counties: Itasca and St. Louis counties, Minnesota

ENDANGERED SPECIES ACT SPECIES

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Canada Lynx *Lynx canadensis* Population: Wherever Found in Contiguous U.S. There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3652	Threatened
Gray Wolf *Canis lupus* Population: MN There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/4488	Threatened
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

BALD & GOLDEN EAGLES

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider

implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

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1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to Bald Eagle Nesting and Sensitivity to Human Activity

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

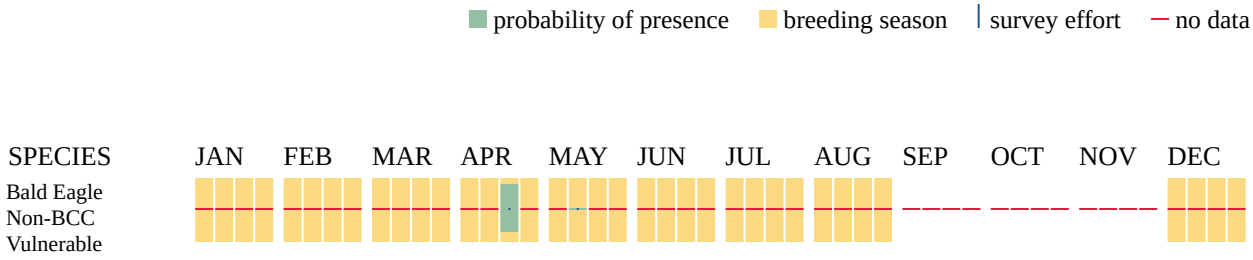
Probability of Presence (▪)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (▪)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9454	Breeds May 20 to Jul 31
Evening Grosbeak *Coccothraustes vespertinus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9465	Breeds May 15 to Aug 10
Golden-winged Warbler *Vermivora chrysoptera* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8745	Breeds May 1 to Jul 20
Veery *Catharus fuscescens fuscescens* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/11987	Breeds May 15 to Jul 15

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)

Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

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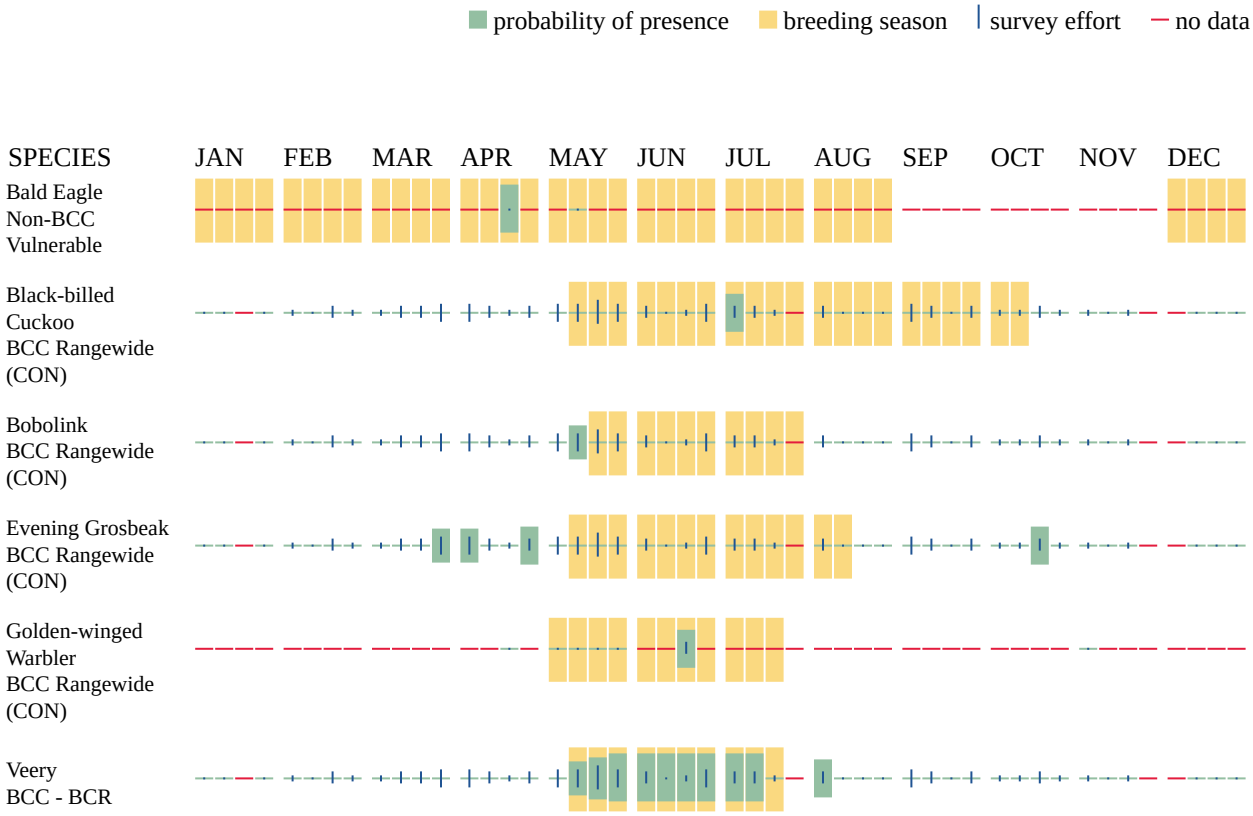

Additional information can be found using the following links:

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- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER FORESTED/SHRUB WETLAND

- PSS1Ch
- PSS1D
- PFO1/4D
- PSS1B
- PSS3/4Dg
- PSS1Cx
- PFO1/SS1D
- PFO4/SS1D
- PSS1/EM1D
- PSS4Dg
- PSS1C
- PSS1Dh
- PSS1/EM1Cx
- PFO1C
- PFO4Dg
- PSS1/EM1C
- PFO1D
- PSS3/EM1Dg
- PFO4D
- PSS1/4D

FRESHWATER EMERGENT WETLAND

- PEM1F
- PEM1A
- PEM1D
- PEM1Dh
- PEM1Fx
- PEM1Cx
- PEM5B
- PEM1Dx
- PEM1C

- PEM1Fh
- PEM1Ch

LAKE
- L2ABHh
- L2UBK
- L2UBKx

RIVERINE
- R3UBH
- R2UBH

FRESHWATER POND
- PUBHb
- PUBGx
- PUBK
- PUBGh
- PUBFh
- PABG
- PUBG
- PUBFx
- PUBF

IPAC USER CONTACT INFORMATION

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