MINNESOTA POLLUTION CONTROL AGENCY

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December 14, 2020

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Re: In The Matter of the Proposed Rules of the Minnesota Pollution Control Agency Governing Water Quality Standards; Revisor's ID Number RD4335

Dear Librarian:

The Minnesota Pollution Control Agency intends to adopt rule amendments governing water quality standards. We plan to publish a Notice of Hearing in the December 14, 2020 State Register.

The Department has prepared a Statement of Need and Reasonableness. As required by Minnesota Statutes, sections 14.131 and 14.23, the Department is sending the Library an electronic copy of the Statement of Need and Reasonableness at the same time we are mailing our Notice of Intent to Adopt Rules.

If you have questions, please contact me at 651-757-2622

Yours very truly,

Claudia Hochstein

Claudia Hochstein
Rule Coordinator
Minnesota Pollution Control Agency

Enclosure: Statement of Need and Reasonableness

MINNESOTA POLLUTION CONTROL AGENCY

STATEMENT OF NEED AND REASONABLENESS

In the Matter of Proposed Revisions of Minnesota Rule Chapters 7050 and 7053, Relating to Water Quality Standards – Use Classifications 3 and 4; Revisor ID No. 04335

Environmental Analysis and Outcomes Division

December 14, 2020

General information:

1) Availability: The State Register notice, this Statement of Need and Reasonableness (SONAR), and the proposed rule will be available during the public comment period on the Agency's Public Notices website: *https://www.pca.state.mn.us/public-notices*

2) View older rule records at: *https://www.revisor.mn.gov/rules/status/*

3) Agency contact for information, documents, or alternative formats: Upon request, this Statement of Need and Reasonableness can be made available in an alternative format, such as large print, braille, or audio. To make a request, contact Claudia Hochstein, Rulemaking Coordinator, Minnesota Pollution Control Agency, 520 Lafayette Road North, St. Paul, MN 55155-4194; telephone 651-757-2622; 1-800-657-3864; email claudia.hochstein@state.mn.us; or use your preferred telecommunications relay service.

4) How to read a sample Minnesota Statutes citation: Minn. Stat. § 116.07, subd. 2(f)(2)(ii)(A) is read as Minnesota Statutes section 116.07, subdivision 2, paragraph (f), clause (2), item (ii), subitem (A).

5) How to read a sample Minnesota Rules citation: Minn. R. 7150.0205, subp. 3(B)(3)(b)(i) is read as Minnesota Rules, chapter 7150, part 0205, subpart 3, item B, subitem (3), unit (b), subunit (i).

6) How to read a sample Code of Federal Regulations citation: 40 CFR § 52.21(b)(21)(v) is read as Title 40, Code of Federal Regulations, part 52, section 21, subsection (b), paragraph (21), subparagraph (v).

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Acronyms or abbreviations

§	Section
BBE	Department of Bioproducts and Biosystems Engineering
Ch.	Chapter
CFR	Code of Federal Regulations
CWA	Clean Water Act, formally known as the Federal Water Pollution Control Act of 1972 (33 USC § 1251 et. seq.)
DNR	Minnesota Department of Natural Resources
EPA	United States Environmental Protection Agency
mg/L	Milligrams per liter
Minn. R	Minnesota Rules
Minn. Stat.	Minnesota Statutes
MMB	Minnesota Management and Budget
MN	Minnesota
MnDOT	Minnesota Department of Transportation
MPCA or Agency	Minnesota Pollution Control Agency
Revisor	Minnesota Office of the Revisor of Statutes
NPDES	National Pollutant Discharge Elimination System
OAH	Office of Administrative Hearings
ORVW	Outstanding Resource Value Waters
pt.	Part
RFC	Request for Comments
RO	Reverse osmosis
RP	Reasonable potential (to cause or contribute to cause or contribute to a violation of a water quality standard)
SDS	State Disposal System
SONAR	Statement of Need and Reasonableness
TSD	Technical Support Document
U of M	University of Minnesota
WLA	Wasteload allocation
WQBEL	Water quality based effluent limit
WQS	Water quality standards

Definitions and concepts

- $7Q_{10}$ flow - the lowest 7-day average flow that occurs once every ten years.
- $122Q_{10}$ - the lowest 122-day average flow that occurs once every ten years.
- $30Q_{10}$ - the lowest 30-day average flow that occurs once every ten years.
- 304(a) Recommendation Water Quality Criteria – National recommended water quality criteria developed by United States Environmental Protection Agency (EPA) pursuant to Section 304(a) of the Clean Water Act (CWA 33. USC § 1314), they "provide guidance for states and tribes to use to establish water quality standards and ultimately provide a basis for controlling discharges or releases of pollutants." https://www.epa.gov/wqc/national-recommended-water-quality-criteria-tables.
- Beneficial use (or Designated Use) – A statement that identifies how people, aquatic communities, and wildlife use our waters. The uses that apply to specific waterbodies are known as the designated use.
- Chloride linkage – A flexible permitting concept used by the MPCA that relies on the fact that in most cases reducing chloride pollution also reduces levels of other important salts (like specific conductance). See Exhibit S-20.
- Criteria – The pollutant-specific protective component of the three components of water quality standards – the beneficial use, the criteria, and antidegradation. This term "criteria" is used by EPA and other states, but Minnesota uses the term "standard".
- Duration - The duration is the amount of time that the in-stream concentration of a pollutant is considered for comparison with the magnitude (numeric value) of the standard. It is also sometimes called the "averaging period".
- Frequency - The frequency component of the standard is the number of instances the standard can be exceeded in a specified period of time without affecting the designated use.
- Magnitude – The level of a numeric standard or criteria.
- Ordinary high water level – the boundary of water basins, watercourses, public waters and public water and wetlands as defined in Minn. Stat. 103G.005 subd. 14.
- Q_{90} - the 10^{th} percentile lowest flow rate.
- Reasonable potential (RP) – Based on the CWA, permitting actions must ensure that facilities do not have a "reasonable potential to cause or contribute" to an exceedance of a water quality standard. Often shortened to "Does the facility have RP?"
- Water appropriator – Water appropriators withdraw water from surface or groundwater for a specific purpose. "*Minn. Stat. 103G.265* requires the Department of Natural Resources to manage water resources to ensure an adequate supply to meet long-range seasonal requirements for domestic, agricultural, fish and wildlife, recreational, power, navigation, and quality control purposes…A water use permit from the DNR is required for all users withdrawing more than 10,000 gallons of water per day or 1 million gallons per year" (Minnesota Department of Natural Resources [DNR], 2020c). Although the programs are separate, the purposes for which water is appropriated (and appropriation permits issued by the DNR) often can be classified within one of the beneficial uses described in Minnesota's water quality standards. Some types of facilities are both appropriators and dischargers and thus hold both water appropriation permits from the DNR and National Pollutant Discharge Elimination System (NPDES)/ State Disposal System (SDS) discharge permits from the MPCA.

- Water discharger – Water dischargers release water, usually with added pollutants, into surface or groundwater. An NPDES/SDS permit issued by the MPCA "establishes the terms and conditions that must be met when a facility discharges a specified amount of a pollutant into surface or groundwater of the state" (*MPCA,* 2018b). Some types of facilities are both appropriators and dischargers and thus hold both water appropriation permits from the DNR and NPDES/SDS discharge permits from the MPCA. When this SONAR refers to "permitted facilities" or "permitted dischargers", it means holders of NPDES/SDS permits.
- Water quality standards – Generally, the combination of beneficial use, criteria, and antidegradation components that protect water quality. In Minnesota, the word "standard" usually refers to the numeric or narrative criteria that protects a beneficial use. (For example, the "mercury standard" means the value for levels of mercury in fish tissue that protects the aquatic consumption beneficial use.)

1. Introduction and statement of general need

A. Introduction

The Minnesota Pollution Control Agency (MPCA) is proposing amendments to Minnesota Rules chapter (Minn. R. ch.) 7050 and Minn R. ch. 7053. Minn. R. ch. 7050 contains Minnesota's water quality standards (WQS). Under the Clean Water Act (CWA), WQS are the regulatory foundation for protecting water quality.

The proposed changes are to the WQS that protect water quality for use in industrial processes (Class 3A, 3B, 3C, and 3D), in Minn. R. 7050.0223, and agriculture - crop irrigation (Class 4A), and livestock and wildlife watering (Class 4B), in Minn. R. 7050.0224. The MPCA's main goal for this rule revision is that the standards reflect the latest scientific understanding of how water quality affects the ability to use the water for those industrial and agricultural purposes (or beneficial uses). The rule revisions also provide clarity around the implementation of the WQS, particularly in terms of how permit conditions are derived and applied to facilities that discharge to waters designated with these beneficial uses. Implementation procedures are found in Minn. R. ch. 7053.

The primary components of these rules have not been substantially changed since they were first promulgated in the late 1960s. The MPCA began to consider a complete review and revisions to these rules in the late 2000s. In 2007, the MPCA undertook rulemaking that included some minor changes to the Class 3 WQS, but deferred consideration of additional changes to both the Class 3 and 4 WQS in order to gather relevant information.

Since then, the MPCA has conducted extensive research and obtained information and advice from a number of sources regarding the water quality necessary to protect industrial consumption, irrigation, and livestock and wildlife uses. Based on this research, the MPCA has concluded that the existing standards are not based on the best current information about what is needed to protect waters for these beneficial uses.

Most of Minnesota's WQS are expressed as numeric values. These numeric values establish levels of pollutants in the water that cannot be exceeded without potentially harming the ability of the water to attain its beneficial use. In many cases, numeric standards are appropriate. However, the diversity of water quality needs for industrial and irrigation use means that identifying protective numeric values for each potential pollutant necessary to protect various wide-ranging industrial and irrigation uses is unreasonable to complete on a statewide basis. Therefore, the main component of the changes to both the Class 3 and Class 4A WQS is a move away from the existing one-size-fits-all numeric standard to a narrative standard coupled with a robust implementation approach that takes advantage of available information and tools to implement the WQS as location-specific protective values. The revisions include specific procedures for implementation of each of these WQS through permit processes, with the procedures incorporated by reference into the rules.

In the case of the Class 4B WQS for wildlife and livestock watering, numeric values are appropriate and supported. Therefore the MPCA is proposing to update the Class 4B WQS to reflect current science and agricultural best practices, replacing the total salinity standard with a total dissolved solids standard, and adding sulfate and nitrate + nitrite standards.

The MPCA is also proposing various other changes to clarify the water quality standards, the uses they protect, and their implementation.

The MPCA's Technical Support Document (TSD) (S-2) for this rulemaking provides the detailed scientific technical analysis supporting the rule revisions and is extensively referred to throughout this document.

The MPCA is also proposing minor formatting and organization changes to improve the readability of requirements and to adhere to the formatting standards of the Minnesota Office of the Revisor of Statutes (Revisor).

B. Statement of general need

Minnesota Statutes (Minn. Stat.) § 14.131 requires the MPCA to prepare and make available for public review a statement of the need for proposed rules. Minnesota has extensive water resources and a longstanding cultural and political commitment to the preservation of those resources. The water quality standards established in rule are a crucial piece of the regulatory structure that protects Minnesota's water resources. The fundamental need for any revisions to the water quality standards is the need to incorporate new/refined scientific understanding and maintain a regulatory structure that will continue to ensure the protection of Minnesota's water resources.

The proposed revisions are needed to reflect current science, which supports a tailored approach (as compared to the current "one-size-fits-all" numeric standards), and to provide additional details that support effective implementation.

The proposed revisions will meet the following needs:

1) Need to maintain protection of industrial consumption, irrigation and livestock/wildlife consumption beneficial uses

40 Code of Federal Regulations (CFR) § 131.10 requires that states consider protection of different beneficial uses of waters of the state, including "public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation." Since 1967, Minnesota has had water quality standards that specifically protect industrial, irrigation, and livestock and wildlife beneficial uses. The MPCA implements these water quality standards in multiple programs, with one key way being through permitting wastewater dischargers to ensure they do not cause or contribute to an exceedance of the standards. The industrial and agricultural beneficial uses are widespread across the state: There are over 1,500 active permits to appropriate water for use for industrial purposes, over 9,000 active permits for appropriations for irrigation purposes, and over 800 permits for livestock watering. Federal regulations require the protection of these beneficial uses. Therefore, the MPCA finds there is a need to maintain adequate protections for these beneficial uses.

2) Need to revise the standards to reflect current scientific understanding

A key tenet of water quality standards development is that the standards must be based on a strong scientific understanding of the level of water quality needed to protect the specific beneficial use. The level of understanding of pollutants and the nature of their impact on beneficial uses improves over time. Therefore water quality standards need to be reviewed and updated periodically.

A major drawback of the existing industrial, irrigation, and livestock and wildlife standards is a lack of available documentation of the scientific basis used to derive the standards in 1967. It is important that MPCA is able to demonstrate that standards are based on sound science.

When questions about the appropriateness of the current standards arose in the 2000s, the MPCA decided to review the existing standards and how they fit with a current understanding of the water quality needs of water used for industrial and agricultural purposes. In 2010, MPCA contracted with the Department of Bioproducts and Biosystems Engineering (BBE) at the University of Minnesota (U of M) to complete this review (S-6). The review panel included experts in the area of industrial water use requirements and quality control, crop production, irrigation, and livestock and wildlife physiology.

Following that initial evaluation, the MPCA determined that it was important to continue to evaluate the appropriateness of the standards and their implementation and potential revisions. Informed by the U of M review, the MPCA published a Request for Comments in the *State Register* on February 8, 2016 (S-11).

MPCA reviewed comments and conducted additional research before producing a Draft TSD (S-7) outlining the science behind the Agency's proposed changes to the standards. After receiving public comment and peer review of the Draft TSD (S-7) in 2019, the MPCA has refined the analysis (S-2) in response to comments so that the proposed rule revisions reflect the best current scientific understanding about industrial, irrigation, and livestock and wildlife designated uses.

3) Need to provide procedures for implementation of narrative standards in discharge permits

The current understanding about industrial and irrigation uses of water makes clear that water quality needs vary depending on type of industry, crop type, soil type, climatic differences, and other factors. Because of this variation, a one-size-fits-all approach to standards often leads to overprotection of the resource to meet the need of some users; however, it could also lead to underprotection for others.

Because of this, a more flexible approach that does not include specific numeric values applicable in all situations is being proposed. A narrative standard will protect the beneficial use by describing the qualities of the water needed to protect the water for industrial and irrigation consumption. The narrative standard provides flexibility to tailor any evaluation of water quality to consider what is needed in a specific location or for a specific use or process.

Once a water quality standard is established, a key component of its implementation is ensuring that permitted facilities do not discharge pollution in such a manner as to cause or contribute to a violation of that standard. Regulating permitted discharges to ensure compliance with narrative standards requires the development of additional procedural steps. This additional procedure is called a "translator" or "narrative translator," applying the language of the narrative standard to create numeric limitations on pollution that are generally placed in permits.

Therefore, determining if individual dischargers have the potential to impact the water quality for these uses and, if so, developing protective numeric values, will be done on a case-by-case basis using a specific translator process. The resulting numeric values are not standards, but rather site-specific values to determine if a facility has the reasonable potential (RP) to cause or contribute to a violation of the standard, and, if necessary, to calculate water quality based effluent limits (WQBELs) applicable to the facility in order to prevent a violation of the standard.

To ensure consistency and transparency in the process of reviewing facilities for determination of RP and development of protective values, MPCA developed detailed translator processes for the proposed Class 3 and 4A narrative standards and is proposing to incorporate them by reference in rule. The processes detail the methods that will be used to determine the protective value for each facility. Incorporating them by reference ensures that MPCA has a prescribed method that will be utilized consistently across facilities, and that the public has an opportunity to comment on this methodology.

4) Need to clarify the duration and frequency of the standards

The existing numeric Class 3 and 4 standards in Minn. R. 7050.0223 and Minn. R. 7050.0224 are difficult to implement because they do not provide sufficient information about how to interpret the value of the standard. Specifically, there is no information about the duration and frequency of the standards. The duration is the amount of time that the in-stream concentration of a pollutant is considered for comparison with the magnitude (numeric value) of the standard. It is also sometimes called the "averaging period". The frequency component of the standard is the number of instances the standard can be exceeded in a specified period of time without affecting the designated use. Having a defined duration and frequency is important to implementing standards because they indicate key components to consider in assessing whether the standard is being met and in determining how to develop the effluent limits.

The current rules do not discuss duration and frequency for the Class 3 and 4 standards, except for the language in Minn. R. 7050.0223, subps. 2, 3 and 4, and Minn. R. 7050.0224, subp. 3, for Class 4B, where it is indicated that pollutants "shall not be exceeded in the waters of the state." This could be interpreted as defining both the duration and frequency – the values described in rule should never be exceeded, even for an instant. In contrast, the Class 2 standards have a more rigorously described duration, laying out the averaging periods for the different types of standards, which vary depending upon the amount of time in which effects might be expected. As an example, standards for pollutants that are directly toxic to aquatic life might have two values:

- An acute value- A higher level of pollution that an organism can only be safely exposed to for an hour or a few days; or
- A chronic value- A lower level of pollution than an organism can be safely exposed to for 30 days.

The duration and frequency need to be clearly defined for Class 3 and 4 standards to more appropriately characterize the conditions that might cause an impairment to the beneficial use. In the case of the Class 3 and 4 standards, the effects that would prevent the attainment of the beneficial uses are not instantaneous. Instead, they result from longer term concentrations of pollutants. Recognizing this longer term effect, in the past, the MPCA has used a 30-day duration for the purpose of calculating the need for effluent limitations for wastewater dischargers. The MPCA has used these assumptions to include Class 3 and 4 effluent limitations in municipal wastewater permits and permits for industrial wastewater treatment plants.

In recent years, wastewater permittees have raised concerns about the reasonableness and legality of these duration and frequency assumptions. This demonstrates a need to provide clarity on the duration and frequency of the standards in this rulemaking.

5) Need to make supporting changes to Minnesota rules to facilitate implementation of effluent limits

The MPCA has identified certain changes necessary to support the implementation of the revised standard through permit effluent limits.

Minn. R. ch. 7053 establishes specific conditions relating to the implementation of water quality standards through effluent limits and facility discharge permits. Effluent limits restrict how much of a pollutant a facility can discharge into surface water and still be protective of a standard. The proposal makes several changes to Minn. R. ch. 7053, including:

- Incorporating by reference documents (i.e., narrative translators) for the purpose of establishing WQBELs for the Class 3 and Class 4A narrative standards; and
- Establishing the flow rate for determining RP and for calculating effluent limits for discharges. Scope of the proposed revisions.

C. Scope of the proposed revisions

1) In scope

The proposed revisions update the WQS in Minn. R. ch. 7050 by consolidating existing Class 3A, 3B, 3C, and 3D uses into a single Class 3 use, incorporate by reference methods for translating the proposed narrative standards into numeric values for effluent limits in Minn. R. ch. 7053, update minimum flow rate requirements for assessing reasonable potential in Minn. R. ch. 7053, and in both chapters make minor administrative changes as required by the Revisor.

2) Not in scope

Wild Rice

Although the existing water quality standard to protect wild rice from the impacts of sulfate is part of the Class 4A standards, the MPCA has continually expressed that this rulemaking will not impact the wild rice standard. Any changes made to the wild rice standard language are intended solely to accommodate needed language changes to the remainder of the Class 4A standards.

The MPCA has engaged in consultation with Minnesota's federally recognized Tribal Nations about the process and procedures to work together to develop a comprehensive path forward for the protection and restoration of wild rice in Minnesota, including the wild rice sulfate standard. While a path forward is not yet complete, the MPCA hopes that we can develop a collaborative plan to protect wild rice. Substantive changes to the wild rice sulfate standard are contentious, complex, and outside of the scope of this rulemaking.

Aquatic Life Standards

The MPCA has been working on this Class 3 and 4 rulemaking for many years. As the standards have been under discussion – whether in the triennial reviews that set water quality standards development priorities and work plan (MPCA, 2018c) or through the requests for comment issued for this rulemaking – the MPCA has received many comments (S-9 and S-10) concerning the need to protect aquatic life (fish and macroinvertebrates) from adverse effects due to some of the pollutants for which there are currently numeric standards in either the Class 3 or Class 4 standards (primarily the Class 4A irrigation standards).

As described below, Minnesota's water quality rules set out multiple beneficial use classes. This rulemaking is intended to revise the standards for the industrial (Class 3) and agricultural (Class 4) use classes. The MPCA believes it is reasonable, and in compliance with the Clean Water Act and Minnesota's water quality statutes, to focus solely on these classes and to make any necessary revisions to the aquatic life (Class 2) water quality standards in a separate rulemaking.

The existing Class 3 and 4 standards contain numeric water quality standards for certain pollutants that are known to potentially impact aquatic life, but for which there are no other numeric water quality standards in Minnesota rule. Some commenters have therefore interpreted the Class 3 and 4 standards as providing "backstop" aquatic life protection and stated that the MPCA should not move forward with this rulemaking unless aquatic life standards for these pollutants are included.

The MPCA does not agree with this interpretation of the CWA, which would seem to imply that water quality standards crafted specifically to protect agricultural and industrial uses somehow, without thought or consideration, also protect all other beneficial uses. This is not the case. Each use class standards are precisely designed for the protection of the beneficial uses in that use class. When developed, consideration is not given to the science related to the protection of other beneficial uses. If water quality standards were designed to protect all beneficial uses at once, then differentiated use classes would not be needed. A water quality standard, particularly a numeric standard, is specific to the beneficial use being protected and the specific pollutant that can negatively impact that beneficial use.

In addition, the idea that the water quality standards in one use class cannot be changed without changing all other water quality standards would create an absurd situation. For example, when the science advances related to one water quality standard it should not have to wait to be updated until the science related to all other water quality standards is complete.

Also, it is a fundamental pillar of the CWA that multiple water quality criteria are independently applicable to any given waterbody to meet that waterbody's multiple listed beneficial uses. Commenters have, in the past, stated that "any changes to MPCA's water quality criteria must protect the most sensitive use for which the water body is designated" (S-9b, p. 162). This argument appears to be based on interpreting [40 CFR § 131.11(a)(1)](), which states that "States must adopt those water quality criteria that protect the designated use. Such criteria must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use. For waters with multiple use designations, the criteria shall support the most sensitive use."

The MPCA agrees that when multiple use designations, and thus multiple standards/criteria, apply to a single waterbody, the waterbody must be protected for the most sensitive use. In other words, if multiple use classes have standards for a pollutant, water quality program actions, such as permitting, need to ensure that the most stringent standard/criteria value is met to protect the most sensitive use. However, the MPCA does not agree that every revision to water quality standards must specifically address the most sensitive use. Generally, human health or aquatic life will be the most sensitive use, resulting in the most stringent standard. However, if every single revision must cover those uses, then essentially there is one single unified water quality standard. This is an unreasonable result, given that the CWA and Minn. Stat. § 115.03, subd. 1(b) and Minn. Stat. § 115.44 specifically reference and direct the creation of different classes of uses.

While there are strong indications that aquatic life are sensitive to the kinds of pollutants at issue in this rulemaking, there are no EPA-recommended 304(a) ambient water quality criteria to protect aquatic life. The scientific support for protecting aquatic life and recreation uses would be entirely different than that necessary to demonstrate protection of the Class 3 and 4 uses. The Class 3 and 4 standards were not designed or intended to protect aquatic life, and revision of these standards should not be tied to aquatic life standards. EPA is working on scientific studies for some of these parameters, particularly chloride and sulfate, and adding aquatic life standards for these pollutants is on the MPCA's water quality standards work plan (MPCA, 2018d) to occur after the EPA scientific work is complete. However, it is appropriately outside of the scope of this rulemaking.

Minnesota's Class 2 (aquatic life and recreation) water quality standards rules contain a biological narrative standard to protect aquatic life. The main expression of the narrative standard is in Minn. R. 7050.0150, subp. 3: "For all class 2 waters…the normal aquatic biota and the use thereof shall not be seriously impaired or endangered, the species composition shall not be altered materially, and the propagation or migration of aquatic biota normally present shall not be prevented or hindered by the discharge of any sewage, industrial waste, or other wastes to the waters."

In addition, Minn. R. 7050.0222 contains narrative statements that the quality of each surface water with a Class 2 designation should be "such as to permit the propagation and maintenance of a health community of…aquatic biota and their habitats[,]" as appropriate to the Class 2 subclass (Class 2A cold water, Class 2B warm or cool water, Class 2D wetlands).

While a narrative standard provides a clear statement of the conditions that should be present in waterbodies, it does not provide numeric values that must be met to ensure those conditions. It therefore is less easily used to craft permit conditions, and an additional step is needed in order to implement narrative standards in discharge permits.

The MPCA has not previously developed a well-defined policy for implementing the Class 2 aquatic life narrative standard in permits. MPCA has the authority to do so at any time in order to provide for effective and efficient implementation of the narrative water quality standard. However, as there have been several comments concerning the impacts of salty or ionic pollutants on aquatic life, the MPCA has developed such a policy in conjunction with this rulemaking (S-5). Although the policy is in support of other promulgated rules, not the rules being proposed here, MPCA has provided the policy in response to comments.

Mercury

Commenters mentioned that the proposed class 4B water quality standard would have negative effects on water used for wildlife because it would increase methyl mercury in the ecosystem and the increased methyl mercury would be bad for wildlife that consumes aquatic life. This rulemaking is not an aquatic life rulemaking, but the MPCA is providing additional clarity because the methyl mercury issue is complex and clearly important.

Minnesota has adopted Class 2 (Minn. R. 7050.0222) water column and fish tissue water quality standards for mercury to protect aquatic consumption of fish by humans. Those water quality standards are the applicable standards for mercury.

The Fond du Lac band has consistently raised concerns about the role of sulfate in mercury methylation. The sulfate-mercury-wildlife argument veers away from the intended beneficial use (watering of wildlife) and into the ways water quality is protected for aquatic life. The MPCA acknowledges that increased concentrations of sulfate have been shown to increase the methylation of mercury in specific aquatic systems – where organic carbon is available and especially where background sulfate concentrations are low. Only methylmercury accumulates in fish, so enhanced production of methylmercury is a significant concern.

The MPCA has reviewed what is known about the effect of elevated sulfate on mercury methylation, and finds that the relationship between sulfate and mercury methylation is significantly complex, and it cannot be assumed that a standard on sulfate will decrease mercury methylation. A review of the literature does not support a clear predictive relationship between increased sulfate concentrations and methylmercury formation. The recent review article by Bravo and Cosio summarizes this complexity as a "conundrum" in this statement:

> The available data demonstrate fact that Hg^2 [mercury] methylation is a bio-physico-chemical conundrum in which the efficiency of biological Hg^2 methylation appears to depend chiefly on Hg^2 and nutrients availability, the abundance of electron acceptors such as sulfate or iron, the abundance and composition of organic matter as well as the activity and structure of the microbial community. An increased knowledge of the relationship between microbial community composition, physico-chemical conditions, MMHg [methylmercury] production, and demethylation is necessary to predict variability in MMHg concentrations across environments (2019, Abstract).

The available literature suggest that non-point source sulfate (i.e. from air deposition related to burning coal) is linked to elevated methyl mercury (Harris et al., 2007), (Hammerschmidt & Fitzgerald, 2006), (Sorensen et al., 1990), (Paranjape & Hall, 2017) but that point source sulfate (i.e. from WWTPs and mines) is not linked to elevated mercury (Berndt et. al., 2016) in the St. Louis watershed.

Minnesota has aquatic life mercury standards applicable to every water of the state that ensure that mercury does not bioaccumulate in the ecosystem. Ultimately, the clearest and best way to prevent mercury bioaccumulation is to reduce total mercury loading from air deposition which the MPCA does through the statewide mercury TMDL.

2. Background

A. General background on standards and water classification

It is important to have a basic understanding of Minnesota's water quality standards to understand the proposed revisions.

As required by 40 CFR § 131and Minn. Stat. § 115.44, water quality standards form the fundamental regulatory foundation to preserve and restore the quality of all waters of the state. Water quality standards include several components:

1) Beneficial uses: Identification of how people, aquatic communities, and wildlife use Minnesota waters.
2) Numeric standards: Typically the allowable concentrations of specific chemicals in a water body, established to protect beneficial uses. Can also include measures of biological health.
3) Narrative standards: Statements of unacceptable conditions in and on the water.
4) Antidegradation protections: Extra protection for high-quality or unique waters and existing uses.
5) Assigning an appropriate beneficial use and establishing numeric and narrative standards to protect the beneficial use are responsibilities assigned to the MPCA by Minn. Stat. § 115.03 and Minn. Stat. § 115.44. The assigned beneficial use and the applicable supporting numeric and narrative standards are fundamental considerations in decisions relating to the establishment of discharge effluent limitations, implementation of antidegradation requirements and impaired water assessments, and other water quality management activities. Assigning the appropriate beneficial use is an important first step in the process of assuring that the beneficial use for each water body are attainable and can be protected.

1) Beneficial use classifications

Minnesota has designated seven beneficial use classes associated with surface waters: Class 1 through Class 7, which are listed in Table 1. Minnesota's beneficial uses for surface waters. below.[1]

Table 1. Minnesota's beneficial uses for surface waters.

Use Class	Beneficial use
Class 1	Domestic consumption – drinking water protection (includes subclasses 1A, 1B, 1C)
Class 2	Aquatic life and recreation (includes subclasses 2A, 2B, 2C, 2D)
Class 3	Industrial use and cooling (includes subclasses 3A, 3B, 3C, 3D)
Class 4	Agriculture and wildlife (includes subclasses 4A, 4B, 4C)
Class 5	Aesthetics and navigation
Class 6	Other uses
Class 7	Limited resource value waters

[1] *The numbers 1 – 7 do not imply a priority ranking.*

Minn. R. ch. 7050 assigns a series of beneficial use classifications to all waters of the state. Most waters of the state are classified for multiple uses, such as Classes 2, 3, 4, 5 and 6. Although there is commonality among the beneficial uses established by states – for example, every state designates and protects drinking water as a beneficial use – states may also set beneficial uses that reflect the unique nature of their waters and aquatic resources.

In Minnesota, industrial, agricultural and wildlife beneficial uses are protected with separate water quality standards from other beneficial uses. Some states combine several of these beneficial uses into one "general use" class, but Minnesota (and other states) have separate standards for these different individual uses. In addition, some of Minnesota's beneficial uses are divided into subclasses that further differentiate the beneficial uses. For instance, Class 2 is divided into Class 2A and Class 2B based on water temperature, as species present in different water temperatures need different standards.

Minn. R. 7050.0470 specifically identifies certain waters with their associated beneficial uses. These waters, while numerous, are only a fraction of the total number of waters in Minnesota. Examples of waters that are specifically listed include: cold waters, surface waters protected for drinking, outstanding resource value waters (ORVWs), and limited resource value waters. All waters not listed in Minn. R. 7050.0470 have a default designation of protection for aquatic life and recreation (Class 2), plus additional designations as one or more of Classes 3, 4, 5, and 6 (Minn. R. 7050.0430). Once a water is classified for a given beneficial use, to remove that beneficial use from a water body, federal regulations (40 CFR § 131.10(h)) require that the state demonstrate that the use to be removed is not an existing use or an attainable use.

2) Numeric water quality standards

A numeric standard is the concentration of a pollutant or chemical allowable in water associated with a specific beneficial use. Both Minn. R. chs. 7050 and 7052 include numeric water quality standards. The standards in Minn. R. ch. 7050 apply statewide and the standards in Minn. R. ch. 7052 apply only to the waters in the Lake Superior basin. Numeric standards are specific and relevant to the protection of the beneficial use classification to which they apply.

There are numeric standards for most use classifications. Numeric standards should have three parts:

- Magnitude – the acceptable amount of a parameter's concentration or level of concern;
- Duration – the time over which the in-stream concentration of a pollutant is considered for comparison with the magnitude of the standard or criterion; and
- Frequency – the number of instances a standard can be exceeded in a specified period of time without affecting a designated beneficial use.

3) Narrative water quality standards and translators

A narrative standard (also known as a narrative criteria) is a descriptive statement of the conditions to be maintained or avoided in or upon the water. For example, a narrative standard may state: "*there shall be no material increase in undesirable slime growths or aquatic plants, including algae…*"

While narrative standards provide plain language general statements of what the water quality should be, a drawback is the complexity of implementation, particularly in permitting. While numeric standards also need implementation procedures, the general framework for doing so is relatively well-established at both the federal and state levels. Narrative standards require a specific process, which is usually referred to as a translator, in order to be able to be converted to numeric limitations placed on permitted dischargers. Both narrative and numeric standards are the fundamental benchmarks used to assess the quality of all surface waters. In general, if applicable numeric and narrative standards are met, the associated beneficial uses are protected.

4) Antidegradation requirements

In addition to the water use classifications and the numeric and narrative standards, Minnesota's rules also provide water quality protection through antidegradation requirements. Minn. R. 7050.0250 to 7050.0335 establish the State's antidegradation requirements. Antidegradation requirements maintain and protect existing uses, prevent unnecessary degradation of high quality water, and maintain and protect the quality of outstanding water resources.

5) Uses of water quality standards

Numeric and narrative water quality standards are used for a variety of purposes by the MPCA and outside parties. Outside parties that routinely use water quality standards include other State agencies; local government entities such as counties, cities and watershed districts; consulting firms; and environmental groups.

Primary uses of water quality standards are to:

- Protect beneficial uses;
- Assess the quality of the State's water resources;
- Identify waters that are polluted or impaired;
- Help establish priorities for the allocation of treatment resources and clean-up efforts; and
- Set effluent limits and treatment requirements for discharge permits and cleanup activities.

Another component of implementing water quality standards is the process of gathering data on the level of pollutants in waterbodies, and then comparing that data to the water quality standard through a process known as assessment. Waterbodies that are not meeting water quality standards are designated as impaired and placed on the state's impaired waters list, which is developed biannually and sent to EPA for approval. Plans, known as Total Maximum Daily Load (TMDL) studies must be developed covering each impaired water, to demonstrate how the waterbody may be returned to compliance with the standards. The MPCA provides a more complete discussion of water quality standards on its website (n.d.)

It is important to explain the difference between water quality standards and effluent limits. Water quality standards describe the conditions that must exist in the water body to fully support each designated beneficial use. Effluent limits must be set to ensure that a permitted facility will not cause or contribute to a violation of a standard (either numeric or narrative) and potential degradation of a use. Effluent limits are established by the MPCA and are specified in a discharger's National Pollutant Discharge Elimination System (NPDES) or State Disposal System (SDS) permit. They define the allowable concentration and/or mass (e.g., kilograms per day) of pollutants that can be discharged to the receiving water and be protective of the water quality standards.

B. Background about the Class 3 and 4 standards

The MPCA established the industrial, agricultural and wildlife use classes and their associated standards in 1967. The standards to protect these beneficial use include both narrative standards that generally describe that the water quality should not have an adverse effect on the beneficial use and numeric standards that specify levels of pollutants.

The Class 3 industrial beneficial use class is divided into multiple subclasses, based on the level of treatment envisioned as being applied before the water is used for industrial processes. The Class 4 agricultural beneficial use class is also divided into subclasses. Class 4A is the subclass of water used for irrigation of crops, along with the further division of Class 4A that is the beneficial use "waters used for production of wild rice". Class 4B is the subclass of water used for livestock watering and wildlife drinking water.

The 1967 rulemaking lacks documentation to support the numeric values chosen as standards to protect the class 3 and 4B designated uses. A review of documentation and testimony presented at public hearings during that rulemaking indicate that the Class 4A standards were likely based on research published in the 1950s and 1960s, and were copied from a two page letter by a staff member at the United States Salinity Laboratory in California (S-18). The letter from the Salinity Laboratory did not contain any scientific justification or supporting literature to support their recommendations.

In 1973, a rulemaking to revise Class 3 and 4 standards resulted in several changes to the Class 3, 4A, and 4B standards:

- Total coliform standards that were in rule were changed to fecal coliform standards.
- The acceptable pH range for all of the use classes was narrowed.
- Temperature standards were removed from Class 3.
- A wild rice standard was added to Class 4A.
- Both Class 3B and 3C were defined as the default classifications for waters of the state. Because Class 3B is more stringent, it would take precedence.

A 1981 rulemaking updated the Class 3 and 4 standards to remove the fecal coliform standard in both classes, because fecal coliform standards already existed in Class 2 and 7, which would cover all surface waters.

In 1993, the creation of subclasses 3D and 4C added wetland protection to the Class 3 and 4 use classes, but those revisions did not contain any additional numeric standards. Those revisions added narrative standards for wetlands to maintain background concentrations, intending to protect wetlands with naturally higher concentrations of certain parameters included in Class 3 and 4. The numeric protections provided in Classes 4A and 4B apply to wetlands, except for pH, where maintaining background is the given standard.

In 2007, the MPCA changed the default Class 3 use designated to most of Minnesota's water from 3B to 3C, making most waters of the state Class 3C. Language in Class 3A and 3B that associated the quality of those waters to Class 1B and 1D waters was removed. Additionally, the "shall not be exceeded" language of the standards was added. In this rulemaking, MPCA also indicated that further updates to the Class 3 and 4 standards were forthcoming.

While there have been revisions to the Class 3 and 4 standards over the years, for the most part, the numeric standards included have remained unchanged since the original crafting of the rules in 1967. Because of this, the MPCA has received questions about whether the standards in Classes 3 and 4 are based on up-to-date and supportable science of what is needed to protect the beneficial uses. Given the lack of scientific documentation for the stringency of the Class 3 and 4 standards, permittees have questioned whether the cost and difficulty of treating pollutants in effluent to levels that would ensure compliance with the Class 3 and 4 standards is reasonable. They have asked the MPCA to consider the appropriate standards needed to protect the beneficial uses. Table 2 presents the current narrative and numeric water quality standards that apply to protect the Class 3 and Class 4 beneficial uses.

Table 2. Current Class 3 and 4 standards.

Class	Narrative standard	Numeric standard Parameter and value (specified units)
3A	"shall be such as to permit their use without chemical treatment, except softening for groundwater, for most industrial purposes, except food processing and related uses, for which a high quality of water is required."	Chloride: 50 mg/L Hardness: 50 mg/L, Ca+Mg as $CaCO_3$ pH: 6.5 minimum pH: 8.5 maximum
3B	"shall be such as to permit their use for general industrial purposes, except for food processing, with only a moderate degree of treatment."	Chloride: 100 mg/L Hardness: 250 mg/L Ca+Mg as $CaCO_3$ pH: 6 minimum pH: 9 maximum
3C	"shall be such as to permit their use for industrial cooling and materials transport without a high degree of treatment being necessary to avoid severe fouling, corrosion, scaling, or other unsatisfactory conditions."	Chloride: 250 mg/L Hardness: 500 mg/L Ca+Mg as $CaCO_3$ pH: 6 minimum pH: 9 maximum
3D	"shall be such as to permit their use for general industrial purposes, except food processing, with only a moderate degree of treatment."	Chloride: Maintain background Hardness: Maintain background Ca+Mg as $CaCO_3$ pH: Maintain background
4A	"shall be such as to permit their use for irrigation without significant damage or adverse effects upon any crops or vegetation usually grown in the waters or area, including truck garden crops. The following standards shall be used as a guide in determining the suitability of the waters for such uses, together with the recommendations contained in Handbook 60 published by the Salinity Laboratory…"	Bicarbonates: 5 milliequivalents/L Boron: 0.5 mg/L pH: 6.0 minimum pH: 8.5 maximum Specific conductance: 1,000 micromhos/cm at 25°C Total dissolved salts: 700 mg/L Sodium: 60 % of total cations as milliequivalents/L
4B	"shall be such as to permit their use by livestock and wildlife without inhibition or injurious effects"	pH: 6.0 minimum pH: 8.5 maximum Total salinity: 1,000 mg/L
4C	"shall be such as to permit their use for irrigation and by wildlife and livestock without inhibition or injurious effects and be suitable for erosion control, groundwater recharge, low flow augmentation, storm water retention, and stream sedimentation. The standards for classes 4A and 4B waters shall apply to these waters except as listed below:"	pH: Maintain background Settleable solids: "Shall not be allowed in concentrations sufficient to create the potential for significant adverse impacts on one or more designated uses."

C. Description of the proposed revisions

1) Class 3

The existing Class 3A, 3B, and 3C standards, found in Minn. R. 7050.0223, subps. 2, 3, and 4 consist of both narrative and numeric standards (Table 2. Current Class 3 and 4 standards.) in subparts 2, 3 and 4, and these standards are applicable to all waters of the state that are not wetlands. In Minn. R. 7050.0223, subp. 1, the beneficial use of industrial consumption is described in rule, simply stated as "industrial consumption designated public uses and benefits." The narrative standards in the individual subparts further describe the beneficial use (Table 2. Current Class 3 and 4 standards) by describing in more detail the water use that should be supported and the problems that the water should not cause.

In amending the Class 3 standards, the MPCA proposes to:

- Remove all numeric standards currently in subparts 2, 3, and 4;
- Replace numeric standards with a single narrative standard that incorporates language from the existing descriptions of both the overall class and the subclasses;
- Remove the subclasses, consolidating the beneficial use protection to a single, general Class 3 designation; and
- Incorporate by reference the translator methodology for implementing the narrative standard in a way that ensures permittees do not cause or contribute to a violation of the narrative standard. This includes which dischargers to evaluate, what conditions mean the standard might be exceeded, and how to develop a numeric expression of the narrative in the form of a protective WQBEL where necessary.

Currently, all waters of the state are designated as Class 3 waters, though the specific subclasses applied to individual waters vary. Unless explicitly designated differently in Minn. R. 7050.0470, most non-wetland waters are designated as Class 3C as a default. Unless designated differently in Minn. R. 7050.0470, all wetlands are designated as Class 3D. The proposed revisions would designate all waters, including wetlands, as having the new, general Class 3 designation. The reasons for this change are discussed in section 5.

A narrative translator is included that converts the protective goals of the narrative standard into a calculation of the need for enforceable numeric wastewater effluent limitations that protects industrial consumption from excess hardness scaling. The narrative translator procedures are proposed to be incorporated by reference into the rule.

2) Class 4A

The existing Class 4A standards, found in Minn. R. 7050.0224, subp. 2, consist of both narrative and numeric standards Table 2. Current Class 3 and 4 Standards and apply to all waters of the state. Minn. R. 7050.0224, subp. 2 describes that the beneficial use of the waters is to "permit their use for irrigation," with an associated narrative standard describing that the condition of the water must be such that it does not cause "significant damage or adverse effects upon any crops or vegetation usually grown in the waters or area, including truck garden crops."
In amending the Class 4A standards, the MPCA proposes to:

- Remove the numeric standards for bicarbonate, pH, specific conductance and total dissolved salts currently in subpart 2;
- Keep the numeric standards for boron and the narrative standard for radioactive materials;
- Keep unchanged all language related to the wild rice sulfate standard, as any changes are out of scope for this rulemaking;

- Replace the removed numeric standards with a general narrative standard;
- Remove language requiring that "The following standards shall be used as a guide…";
- Keep the beneficial use substantially the same ; and
- Incorporate by reference the translator methodology for implementing the narrative standard in a way that ensures permittees do not cause or contribute to a violation of the narrative standard. This includes which dischargers to evaluate, conditions that indicate the standard might be exceeded, and how to develop a numeric expression of the narrative in the form of a protective WQBEL where necessary.

Currently, all waters of the state are designated as Class 4A waters, unless the water is a wetland, when it is designated as Class 4C. The proposed revisions would designate all waters, including wetlands, as Class 4A.

Class 4A subclasses

The current and proposed Class 4A standards ensure that water quality is sufficient so that waters of the state can be appropriated and used for irrigation of usually grown crops without significant damage or adverse effects. The proposed changes: are the results of the most up-to-date science; ensure that waters are neither over nor under protected and allow for greater precision and accuracy in considering site-specific factors that control irrigation water quality needs.

Minnesota's rules include a subclass of the existing Class 4A beneficial use, described as "waters used for production of wild rice" (Minn. R. 7050.0224, subp. 2). The wild rice water quality standard is highly controversial, and past MPCA attempts to revise the wild rice standard have been unsuccessful. This rulemaking does not make any substantive changes to the wild rice standard. Any apparent changes are solely to ensure that both the main Class 4A (irrigation) beneficial use and the wild rice subclass beneficial use are clearly linked to the matching standards, and are appropriately and clearly described.

3) Class 4B

The existing Class 4B standards, found in Minn. R. 7050.0224, subp. 3, consist of both narrative and numeric standards (Table 2. Current Class 3 and 4 standards). In Minn. R. 7050.0224, subp. 3, the beneficial use is described in rule as simply "use by livestock and wildlife" and the narrative standard that the water quality is such that livestock and wildlife can use the water "without inhibition or injurious effects." In amending the Class 4B standards, the MPCA proposes to:

- Update the numeric standard for total salinity;
- Add numeric standards for sulfate and nitrate; and
- Keep the beneficial use substantially the same.

Currently, all waters of the state are designated as Class 4B waters, unless the water is a wetland, when it is designated as Class 4C. The proposed revisions would designate all waters, including wetlands, as Class 4B.

4) Classes 3D and 4C

The existing Class 3D and 4C standards, found in Minn. R. 7050.0223, subp. 5 and Minn. R. 7050.0224, subp. 4 respectively, consist of narrative or numeric standards (Table 2. Current Class 3 and 4 standards) that protect the industrial consumption and agricultural and wildlife designated uses. These standards are applicable to wetlands of the state (wetlands are defined in Minn. R. 7050.0186. In amending the Class 3D and 4C standards, the MPCA proposes to:

- Remove the 3D and 4C subclasses;
- Designate wetlands as Class 3, 4A and 4B; and

- Move wetlands standards for chloride and settleable solids from Classes 3D and 4C to Class 2D, and move the narrative Class 4C standard to Minn. R. 7050.0186 to more appropriately reflect the uses being protected.

Currently, all wetlands of the state (as defined in Minn. R. 7050.0186) of the state are designated as Class 3D and 4C waters. The proposed revisions would maintain protections for industrial consumption and agricultural and wildlife uses by designating all wetlands as Class 3, 4A and 4B.

5) Applying and implementing the standards

To further improve clarity of the rule and provide for more effective implementation, the proposed revisions also include additional definition of the components of the standard, in order to define how the standard will be applied.

In general, numeric water quality standards (also called numeric water quality criteria) include three components: magnitude, duration, and frequency (S-13). The number itself is the magnitude, the averaging time of the standard is the duration, and the frequency is how often the magnitude may be exceeded before the standard is considered to be violated or exceeded. The current standards set a clear magnitude (e.g., 0.5 mg/L for boron). However, the standards give no information about the duration of the standard and are vague about the frequency of the standard (only Class 4B indicates "shall not be exceeded," which seems to imply that any instantaneous measurement over the value of 0.5 mg/L is a violation of the standard).

Implementation of the standard through permitting also requires the permitting authority to set a protective flow condition. Most water quality standards are implemented at a low-flow condition, because at those flows the pollution is more concentrated, and therefore more harmful. However, the lowest flow conditions are not always appropriate, depending on the standard and the mechanism of impact. Therefore, the proposed rules also include changes to Minn. R. ch. 7053 to define the flow conditions that the MPCA will use to set effluent limits for the Classes 3, 4A, and 4B standards – both for the numeric standards and through a translation process for the narrative standards.

Another component of implementing water quality standards is the process of gathering data on the level of pollutants in waterbodies, and then comparing that data to the water quality standard through a process known as assessment. Waterbodies that are not meeting water quality standards are designated as impaired and placed on the state's impaired waters list, which is developed biannually and sent to EPA for approval. Plans, known as Total Maximum Daily Load (TMDL) studies must be developed covering each impaired water, to demonstrate how the waterbody may be returned to compliance with the standards.

In conjunction with the biennial preparation of the impaired waters list, the MPCA also updates its guidance on detailed methods for assessment (2019b).

The MPCA does not assess every water quality standard; as described in the guidance manual, the MPCA assesses surface waters for the following beneficial uses:

- Aquatic life (toxicity-based standards, conventional pollutants, biological indicators);
- Drinking water and aquatic consumption (human health-based standards);
- Aquatic consumption (fish-tissue and wildlife-based standards);
- Aquatic recreation (Escherichia coli – E. coli – bacteria, eutrophication); and
- Limited value resource waters (toxicity-based standards, bacteria, conventional pollutants)

To date, the MPCA has not assessed any of the narrative or numeric water quality standards that exist for the Class 3 and 4 beneficial uses. Although Minnesota has a fairly robust surface water monitoring program, monitoring and assessment resources remain limited. As the prime goal of the CWA is "water quality which provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water"(33 USC § 1251(a)(2)), the MPCA believes that resources should be focused on assessing water quality standards for those beneficial uses and those that protect human health (drinking water and aquatic consumption).

That said, a major concern of many commenters is the MPCA's willingness and ability to implement the proposed Class 3 and Class 4A narrative standards; in addition, many of the parameters included in the Class 4B standards are ones of particular interest. Therefore, the MPCA is planning to do some targeted monitoring and assessment of the proposed new Class 3 and 4 water quality standards, if the proposed revisions are approved. The MPCA does not develop monitoring and assessment methodologies in rule. The methodology will be developed in future revisions to the above-referenced *Guidance Manual* (MPCA, 2019b), which is also subject to notice and comment.

6) Documents incorporated by reference

It is standard practice to incorporate documents by reference into rule when they are either too large or too complex to conveniently present as rule language, or when they are of specific but limited application. There are two different scenarios for incorporation by reference. Where a test method or procedure is developed and then incorporated by reference, the agency would incorporate by reference with "as amended" language to ensure that updates to the method can be implemented without future rulemaking. Where the agency would adopt documents by reference that list applicable standards, those documents could not be changed without future rulemaking. Once adopted, documents incorporated by reference have the full effect of a rule. The MPCA is proposing to incorporate two documents by reference in this rulemaking: the separate documents are known as translators, and they detail how to implement protection of the Class 3 and Class 4A narrative water quality standards in facility permits. They include flow charts and other information necessary for implementation, but that cannot be conveniently presented as rule language. The MPCA is proposing to incorporate these documents by reference, as amended.

3. Public participation and stakeholder involvement

The MPCA conducted several outreach activities while developing these rule revisions. This was done not only to comply with the requirements of Minnesota's rulemaking process, but also to notify, engage, and inform potentially interested parties about the revisions to the Class 3 and 4 rules and solicit input on early drafts of the revisions. MPCA has considered these revisions for some time, with early references to the need to change these rules appearing in the 2008 triennial standards review, and a 2009 Request for Comments on multiple potential water quality standard changes. At that time, the MPCA was considering grouping these water quality standards revisions with other revisions. The MPCA later decided that it was more effective to do more specific and focused water quality standards revisions, rather than combining them. Outreach activities specifically focused on these rules began in 2016 and continued into spring 2019. They provided a useful exchange of information and ideas between MPCA staff and other parties with an interest in and knowledge of water quality issues and the application of WQS. The remainder of this section describes the MPCA's public outreach efforts.

A. Webpages

The MPCA maintains the following webpages that are publicly accessible and relevant to this rulemaking.

- Amendments to Water Quality Standards – Use Classifications for Classes 3 and 4 rules at http://www.pca.state.mn.us/water/amendments-water-quality-standards-use-classifications-3-and-4. The MPCA created this rule-specific webpage in 2010 to provide the public with background and other information relevant to this rulemaking, including information about the use designation, supporting detailed technical documents, draft rule amendments, and a target schedule for rule adoption. The webpage has been updated routinely to inform the public of developments related to this rulemaking. The original report developed by the University of Minnesota(S-6), the draft TSD (S-7), comments received during previous request for comment periods (S9, S-10) remain on the webpage, and it now houses recent information relevant to this rulemaking (e.g., a draft of the rule amendments, supporting documents and a target schedule for adoption).
- The MPCA will continue to update the rule webpage to include information about the proposed amendments and rulemaking documents, including the proposed rule language, a final version of this SONAR, and other supporting rulemaking documents. This will ensure that potentially interested parties can continue to participate in the rulemaking process after the MPCA publishes its Notice of Intent to Adopt Rules in the *State Register*.
- The Public Notices at https://www.pca.state.mn.us/public-notices. The MPCA's public notice webpage hosts all of the MPCA's public notices. The MPCA posted two notices of Request for Comments (RFC) for this rulemaking on the public notice webpage on February 8, 2016, and March 11, 2019, the same day the notices were published in the *State Register*.
- The MPCA's rulemaking webpage (https://www.pca.state.mn.us/regulations/minnesota-rulemaking) provides the public with centralized information about current rulemaking projects and the rulemaking process. It also explains how the public can receive notice of rule changes. The MPCA's "Public Rulemaking Docket," updated monthly, is located on this webpage and includes information about this rulemaking. The MPCA posted its RFCs (S-9, S-10) for the planned rule revisions here the same day each RFC was published in the State Register (February 8, 2016 and March 11, 2019). Public notices remain posted for the entire term of the comment period

B. GovDelivery and electronic notifications

GovDelivery is a self-subscription service that MPCA uses to electronically (email) notify interested or affected persons of various updates and public notices issues on a wide range of topics, including administrative rulemakings. People register and choose the notifications they want to receive at the following webpage: https://public.govdelivery.com/accounts/MNPCA/subscriber/new. Also, the Class 3 and 4 revisions webpage has a direct link to sign up for future notifications about the rulemaking through GovDelivery.

In 2016, the MPCA added the Class 3 and 4 rulemaking to the list of topics available for GovDelivery subscribers to select if interested in receiving related announcements and public notices. The MPCA then promoted and encouraged interested persons to subscribe to the list by: (a) posting a related announcement on the Class 3 and 4 revisions webpage; (b) sending a GovDelivery notice, which announced the new list, to persons registered to receive all MPCA rulemaking notifications; and (c) informing those who attended the stakeholder meetings of the availability of the list. Table 3 includes all GovDelivery communications sent regarding this rulemaking.

Table 3. GovDelivery communications sent regarding this rulemaking.

Date	Topic	Recipients	Lists
1/22/2016	New rulemaking: Water use class changes – Class 3 & 4.	4,071, approximately 2,000 of which were members of the New Rulemaking Announcements list	New Rulemaking Announcements plus all additional rulemaking lists
2/8/2016	MPCA Requests Comments on Rule Amendments Regarding Water Quality Standards—Use Classifications 3 & 4	102	Rulemaking: Use class changes for water - class 3; class 4
3/11/2019	Minnesota Pollution Control Agency Amendments to Water Quality Standards Use Classifications 3 and 4 – Request for Comments	908	Rulemaking: Use class changes for water - class 3; class 4
10/9/2020	Rulemaking schedule: Class 3 & 4 Waters	1,264	Rulemaking: Use class changes for water - class 3; class 4
11/4/2020	Draft rule language for the amended Class 3 and 4 water standards	1,278	Rulemaking: Use class changes for water- class 3; class 4

As of November 30, 2020, 1,303 persons are subscribed to the Class 3 and 4 rulemaking GovDelivery list. The MPCA will continue to use GovDelivery to provide notice of public notices, updates, and other relevant information for this rulemaking.

C. Meetings

The MPCA held the meetings listed below. The information is arranged by meeting date, who the agency met with, location of meeting, and the major topics discussed.

1) 2/12/2019; Minnesota Department of Agriculture and Minnesota Department of Natural Resources; Skype meeting; Overview of proposed changes to Class3 and 4 standards.
2) 3/28/2019; Wastewater Operators Annual Conference; Marriott Northwest, Brooklyn Park, MN; Overview of proposed changes to Class 3 and 4 standards.
3) 4/3/2019; Minnesota Environmental Science and Economic Review Board (MESERB); By phone; Specific questions and comments from MESERB.
4) 4/10/2019; Barr Engineering and their clients; Barr Engineering Office, Minneapolis, MN; Overview of proposed changes to Class 3 and 4 standards.
5) 7/9/2019; Minnesota Reservation Technical Staff Environmental Council (MNTEC); Grand Portage Lodge and Casino, Grand Portage, MN; Overview of proposed changes and process for Class 3 and 4 standards.
6) 8/20/2019; Red River Watershed Management Board; Roseau River Watershed District Office, Roseau, MN; Overview of proposed changes and process for Class 3 and 4 standards.

7) 11/6/2019; General rule discussion meeting with Fond du Lac, Grand Portage and Leech Lake bands; MPCA Duluth Regional Office; the major topics discussed were the wild rice rule language and MPCA's changes to the rule based on tribal comments

MPCA staff also generally gave updates on the rule process as needed at standing meetings such as the MPCA's quarterly meeting with mining companies in 2019 and 2020. Additional information related to engagement with Tribal environmental staff is provided in Section 9.

D. MPCA rule development activities

The MPCA's major rule development activities around the Class 3 and 4 revisions began in 2007, when MPCA proposed and then revised the Class 3 standards by changing the default use classification from 3B to 3C, due to the perceived overprotection the 3B standards provided to most waters. In the SONAR for that rulemaking, the MPCA (2007) indicated that further review of the State's salinity related standards was forthcoming, as the standards in Classes 3 and 4 were based on information from the 1960s. In 2010, MPCA contracted with the University of Minnesota's Department of Bioproducts and Biosystems Engineering to develop a report reviewing the current Class 3 and 4 standards and recommending updated standards (S-6).

Publishing an RFC is a legal requirement of the Administrative Procedures Act (Minn. Stat. ch. *14*), and the MPCA published an RFC on February 8, 2016 (40 SR 965, S-11). The RFC requested comments and information about the proposals presented in the U of M's 2010 report in relation to beginning this rulemaking. The MPCA received and reviewed more than 800 comment letters in response to the RFC and posted them on the Class 3 and 4 rulemaking webpage for public review (S-9).

The MPCA refined its analysis based on the feedback received during the 2016 Request for Comment period, and on March 11, 2019, published a second RFC (S-12), along with a Draft (TSD) for the Class 3 and 4 Water Quality Standards Revision (S-7). The Draft TSD presented the results of MPCA's research and analysis of the data reviewed in the literature. The Draft TSD included:

1) Proposed standards – narrative for Class 3 and 4A and numeric for Class 4B;
2) A proposed process for translating the narrative Class 3 and 4A standards to numeric values; and
3) Applicability for where the standards would apply.

The RFC also requested comment on the Draft TSD and the accompanying proposed peer review charge questions. The MPCA also briefed the Minnesota Department of Natural Resources (DNR) and the Minnesota Department of Agriculture (MDA) management and staff and interested legislators. The MPCA received and reviewed more than 700 comment letters in response to the RFC and posted them on the Class 3 and 4 rulemaking webpage for public review (S-10).

As required by Minn. Stat. § 115.035, the MPCA then conducted an independent scientific peer review of the scientific aspects of the Draft TSD. The following experts served as peer reviewers of the Draft TSD:

- Dr. David Franzen, Department of Soil Science, North Dakota State University,
- Dr. Adrian Hanson, Department of Civil Engineering, University of Minnesota,
- Dr. Miranda Meehan, Animal Science, North Dakota State University,
- Dr. Vasudha Sharma, Department of Soil, Water and Climate, University of Minnesota, and
- Dr. Tsutomu Shimotori, Department of Chemical Engineering, University of Minnesota.

The peer review was completed on September 23, 2019. All details – including the peer review charge – can be found in Exhibit S-8.

After reviewing the extensive comments from the public and the comments from the peer reviewers, and as a result of its own policy reassessment, the MPCA revised the Draft TSD. The revised final TSD, (S-2), is a major element in support of the proposed rule revisions and are incorporated as part of this SONAR. Documentation of changes made to the TSD as a result of the peer review can be found in Appendix A of the TSD (S-8).

The revisions included the following:

1. Changes to the Class 3 narrative translator process, including:
    a. Clarified that all downstream tribal, state or provincial water quality standards will be considered first, to ensure protection of downstream water quality standards;
    b. Removed the narrative translator process limitation of only addressing cooling towers;
    c. Changed the process to ensure protection of all downstream industrial users in the narrative translator process rather than just the first downstream industrial user;
    d. Changed the narrative translator process to only include industrial appropriators classified in the DNR appropriation database as appropriating from surface waters with hydraulic connections to upstream wastewater treatment plants;
    e. Changed the process to include all downstream irrigators, considering all appropriations that have been active since November 28, 1975;
    f. Replaced the Calcium Carbonate Precipitation Index (CCPI) with the Calcium Carbonate Saturation Index (CCSI) and clarified preferred CCSI calculation methods;
    g. Referenced DNR low flow rates and explained how they will be used in the translator process; and
    h. Included incorporation by reference of the narrative translator process methods document as part of this rulemaking.
2. Changes to the Class 4A narrative translator process, including:
    a. Clarified that all downstream tribal, state or provincial water quality standards will be considered first, to ensure protection of downstream water quality standards;
    b. The data sufficiency requirements to determine ambient water quality were increased and more clearly defined;
    c. Changed the process to include all downstream irrigators in the narrative translator process, including those that may not be in the DNR appropriation database, and considering all appropriations that have been active since November 28, 1975;
    d. Changed the narrative translator process to only include irrigation appropriators classified in the DNR appropriation database as appropriating from surface waters with hydraulic connections to upstream wastewater treatment plants;
    e. Changed the translator to ensure that usually grown crops are protected and defined the methods to determine usually grown crops near an irrigator;
    f. Updated the TSD and narrative translator process to include protections for turf irrigation; orchards and nurseries;
    g. Included incorporation by reference of the narrative translator process methods document as part of this rulemaking.
3. Decision to apply the Class 4B sulfate standard of 600 mg/L to all waters of the state.
4. Decision to keep unchanged the class 4A numeric 0.5 mg/L boron water quality standard as a numeric value.

5. Updated the TSD to address commenters concerns regarding methyl mercury and sulfate.

E. Pre-proposal comments received

As noted above, the MPCA received many comments from interested parties during the process of developing the Class 3 and 4 amendments. These included comments received in comment letters (S-9; S-10) sent to the MPCA after the two RFCs were published in the State Register on February 8, 2016 and March 11, 2019 (S-11; S-12). The MPCA considered all comments received that were within the scope of the planned Class 3 and 4 rule revisions, many of which were helpful in developing the proposed amendments and supporting documentation.

The written comments received in response to the RFCs were mixed; some were in support of the proposed changes, while others were strongly against the changes. Some identified specific issues or raised questions regarding the revisions, while others were very general.

An overview of the comments received and some changes the MPCA has made based on those comments is provided below. A detailed discussion of tribal comments is provided in Section 9B, so comments from the Fond du Lac and Grand Portage Bands of Lake Superior Chippewa and the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) are not included in the following summary.

1) General comments on proposed Class 3 and Class 4A narrative standards and translation of those standards

Comments on the replacement of numeric standards in Class 3 and 4A with narrative standards varied. Municipalities, industries and the organizations representing them (Coalition of Greater Minnesota Cities (CGMC), Iron Range mayors, mining companies, business/agricultural organizations) expressed support for the use of narrative standards for the Class 3 industrial use and Class 4A irrigation use. Many of these comments characterized the existing numeric standards as outdated and having the potential to cause considerable economic hardship to businesses and communities if implemented through the application of effluent limits in permits. Several of these comments emphasized that the Class 3 and 4 rulemaking should remain a high priority for the agency and that the standards revisions should not address aquatic life uses.

Other commenters (Water Legacy, Minnesota Center for Environmental Advocacy (MCEA), and a number of Minnesota citizens) did not support the use of narrative standards for the Class 3 and 4A beneficial uses. Many expressed concerns about the effects of salts, hardness, and specific conductance on fish and aquatic insects, and did not support the agency moving forward with Class 3 and 4 narrative standards until numeric standards for these parameters were developed for Class 2 aquatic life uses. Trout Unlimited suggested that the MPCA determine the effects to aquatic life and cold-water fish resulting from removal of numeric criteria, and then present the results to the public before proceeding with rulemaking. MCEA commented that the MPCA had not provided evidence that it could generate numeric expressions of the existing Class 2 narrative standard. Others suggested that numeric standards in Class 3 and 4A should be moved to Class 2 as part of the rulemaking.

The MPCA agrees that additional numeric standards are needed to fully protect Class 2 aquatic life beneficial uses from the impacts of certain pollutants—particularly ionic or salty parameters, and the MPCA plans to update these standards in future rulemaking. However, since the current rulemaking focuses on revisions to Class 3 and 4 standards to protect industrial consumption and agricultural beneficial uses, the consideration of aquatic life beneficial use protection is not relevant. The MPCA is currently taking steps related to Class 2 aquatic life and ionic pollutants. For example, the agency has developed an interim approach to protecting aquatic life from the adverse impacts of ionic pollutants, until numeric standards for these pollutants are developed and incorporated through future rulemaking into Minnesota's Class 2 standards. Although not formally a part of the Class 3 and 4 rulemaking, this approach, which uses Minnesota's Class 2 narrative water quality standard to protect aquatic life, was developed in response to comments provided in this rulemaking (S-5).

The MPCA is proposing to the use narrative translators as the method to develop numeric effluent limits in permits based on the narrative standards. As part of the March 2019 RFC (S-12), the agency requested feedback on whether the Class 3 Class 4A translator methods should be included in these rule amendments or developed in collaboration with stakeholders after completion of rulemaking. Almost all who commented expressed strong support for developing the Class 3 and 4A translator methods as part of the rulemaking so that municipalities, environmental organizations, businesses and individuals could comment on the translators when the rule amendments are proposed. Given the broad support for having the Class 3 and 4A translator process developed as part of this rule revision, the MPCA is including the proposed translators as part of the rulemaking and will incorporate them by reference. The proposed translators can be found as Exhibits S-3 and S-4 and at the MPCA incorporation by reference rule webpage at https://www.pca.state.mn.us/regulations/incorporations-reference.

Water Legacy commented that the MPCA's proposed narrative standards and associated translators did not consider downstream standards of other states and Tribal Nations. Under Minn. R. 7050.0150, the agency is required to ensure protection of downstream uses and downstream water quality. The MPCA implements this rule routinely through our water quality programs, including wastewater permitting. The agency ensures that permits contain sufficient requirements so that water quality standards are met in the direct receiving water and in all downstream waters, including any waters under the jurisdiction of another state or tribe and therefore subject to water quality standards that are different than Minnesota's. As the MPCA is not proposing changes to these rules, they were not explicitly discussed in the RFC. However, as a result of this comment and similar comments from Tribal Nations sharing Minnesota's geography, MPCA has ensured that the implementation processes (Class 3 and 4A translators) explicitly call out the need to evaluate whether a discharging facility needs an effluent limit to ensure that any downstream water quality standards (from Tribal Nations or other states) will be met.

Others (Izaak Walton League, Water Legacy) commented that the Class 3 and 4A narrative standards and associated translators were not protective of existing uses because they would only apply to waters with current active appropriators, and that this would not ensure protection of all industrial and agricultural uses of water that have existed since November 28, 1975. To ensure protection of all existing Class 3 and 4A uses, the MPCA has retained the application of the water quality standards to all Minnesota waters. In addition, the implementation procedures have been revised to include all downstream industrial and irrigation appropriators of water, that have been active since November 28, 1975, not just those that are currently active.

Several commenters requested that certain classes of waters be exempt from the Class 3 and 4 standards. The Minnesota Chamber of Commerce (Chamber) and Southern Minnesota Sugar Beet Cooperative (SMSBC) advocated for the removal of Class 3 and 4A use designations from Class 7 limited resource value waters arguing that many of these waters are intermittent and have limited flow. U.S. Steel commented that MPCA should consider removing the Class 3 designated use from wetlands since they are rarely used for industrial consumption. U.S. Steel also suggested that Class 1 trout streams should be exempt from Class 3 and 4 protections.

MPCA is proposing that every water of the state remain designated for industrial consumption and irrigation uses. Having these classes continue to apply broadly is more environmentally protective. It ensures that waters are easily protected for future industrial or agricultural uses, and more clearly ensures that any existing uses are not accidentally removed. Eliminating classes of waters from the designated use has more procedural complications than maintaining the designation for all waters of the state. The MPCA would have to remove the industrial and irrigation uses from each water within each of these classes, via a use and value determination through rulemaking. The amount of work required to demonstrate that the industrial use is not existing or attainable on each waters within these classes would be prohibitive. Removing a beneficial use from a water is best done using the procedures in Minn. R. 7050.0405 on a case-by-case basis.

In addition to these general comments on the narrative standards and their translators, stakeholders had a number of additional comments specific to the proposed Class 3, 4A and 4B standards, and reorganization of standards for wetlands.

2) Additional comments specific to the proposed Class 3 narrative standard and associated translator

Many of the commenters (municipalities, industries) that supported the narrative standards and associated translators also supported the consolidation of Classes 3A-3D into a single Class 3 narrative standard.

WaterLegacy had specific concerns about the validity of the MPCA's 2015 survey of industrial appropriators (S-17) about their water quality needs. Comments included "the DNR selected 45 large appropriators to survey, and 11 of these (less than 25% responded, several more than once… There are serious questions about the methodology of the survey, the small percentage of respondents, the disproportionate representation of major dischargers and pollutants (industrial power plant, ethanol plant, taconite mining operator) and the disparity between MPCA's conclusions and the fact that is survey respondents 'ranked water quality consistency as extremely important" (S-10, p. 166). WaterLegacy further commented that the survey did not represent the universe of business needs for clean water in Minnesota and that MPCA should have attempted to contact businesses that use water under a general permit.

ArcelorMittal commented that the narrative translator should only apply to industrial cooling towers and not other kinds of industry. The MPCA's Class 3 translator (S-3) protects all industrial appropriators of water from the effects of scaling, as this is more in keeping with the description of the beneficial use.

The City of Lakefield had two specific comments about the Class 3 standards and the TSD (S-7):

- Some waters are high in Ca and low in Mg or vice versa. The softening treatment needed for these different waters is different. The TSD says otherwise.
- Softening to 120 mg/L of hardness, as presented in TSD, may not be low enough to satisfy customers. A level of 100 mg/L or less may actually be needed to be able to keep water softeners from people's homes.

3) Additional comments on proposed Class 4A standards

Several parties (U.S. Steel, Chamber, ArcelorMittal) commented that the "used as a guide" language found in the current Class 4A standards language should be retained because it was needed to implement the wild rice sulfate standard. The MPCA does not agree, and is proposing to remove this language from the rule because it creates confusion and can be reasonably be interpreted differently by different people. Moreover, a review of the historical record shows that the "used as a guide" phrase dates back to the 1967 rulemaking and was associated with only irrigation and not the 10mg/L wild rice standard, which was not promulgated into rule until 1973.

ArcelorMittal and U.S. Steel commented that only DNR appropriation agricultural categories should be included when using the translator and that appropriation of water for irrigation of golf courses, cemeteries and athletic fields should not be considered a Class 4A use, therefore this use type should not be considered when using a narrative translator method to determine if an effluent limit is needed within an NPDES permit. MPCA is planning to include these categories of turfgrass appropriators because the Class 4A rule language is not limited to crops but also includes vegetation. Turfgrass irrigation is discussed in Section 4.3.1.4 of the TSD (S-2).

Others commented on the duration and frequency of Class 4A standards. Cleveland-Cliffs commented that the Class 4A standards should apply as seasonal, cumulative standards rather than as never-to =-exceed values. Mesabi Nugget said the Class 4A standard should be applied as seasonal standards.

Several other commenters requested clarification on the $122Q_{10}$ protective flow rate that will be used to develop effluent limits as part of the Class 4A translator. The Minnesota Environmental Science and Economic Review Board (MESERB) commented that "the MPCA should clarify why limits are to be imposed May through October, when the proposed criterion duration is a growing season, the protective flow is June through September. Several other commenters (CGMC, City of Hutchinson, City of Waseca, City of Melrose) asked for clarification about whether the $122Q_{10}$ would be derived from "applicable growing seasons." In response to this comment, the proposed rule language specifies that the $122Q_{10}$ flow must be derived for the June to September period.

A number of comments relating to the Class 4A translator concerned the MPCA's effluent limit calculations. Several commenters (Hutchinson, Waseca, Melrose, CGMC, MESERB) suggested that the MPCA should provide flexibility in using an average wet weather design flow other than the 70th percentile when calculating effluent limitations. ArcelorMittal commented that the MPCA should not use maximum design flow when calculating the need for effluent limitations. The City of Rochester requested clarification of the procedure for RP. The information provided in this SONAR should clarify how the methods will be used. MPCA is providing several examples (S-19) of how the Class 3 translator would be applied in permitting to help clarify these questions.

4) Comments on proposed 4B numeric standards

The MPCA received a few general comments on the proposed Class 4B standards for livestock and wildlife beneficial uses. A number of commenters (mines, CGMC, Iron Range municipalities, and agricultural permittees and organizations) suggested using narrative standards with a translator process or method to develop a numeric effluent limit to protect the 4B livestock and wildlife beneficial use, in the same manner as the MPCA has proposed for the Class 3 and 4A standards. The MPCA thinks numeric standards are appropriate for the Class 4B beneficial use and that those numeric standards should be set to protect the most sensitive species in that beneficial use class. Moreover, developing a narrative standard for livestock and wildlife watering would be extremely difficult in Minnesota given the large number of water bodies, livestock operations and wildlife species, and the lack of specific information about which waters animals use for drinking. (Although there is similar complexity for Class 4A, less data and information is available for Class 4B.)

The United States Department of Agriculture-Superior National Forest comment letter (USDA-FS) commented that the Class 4B standards should be modified to recognize the importance of the integrity of aquatic life, as impacts on aquatic biota can impact wildlife.

The City of Rochester objected to the current rule language for Class 4B that said "additional selective limits may be imposed" because it is "ambiguous and open-ended and makes it challenging for cities to predict and plan for future limits" (S-10, pg. 30). The MPCA agrees that this is ambiguous language and has removed this language from the rule. Should additional Class 4B standards be needed to protect livestock and wildlife in the future, the MPCA can initiate another rulemaking to do so.

In addition to these comments on the MPCA's approach to the Class 4B standards, the MPCA received specific comments on the proposed 3,000 mg/L total dissolved solids standard and the proposed 600 mg/L sulfate standard.

MESERB questioned the need for a total dissolved solids standard in all waters of the state commenting: "The need for a total dissolved solids standard is questionable if the cause of toxicity is from chloride, sulfate and sodium… if these components are not in the water, a restriction on total dissolved solids is not necessary" (S-10, p. 112).

Most of the specific Class 4B comments centered on the proposed 600 mg/L Class 4B sulfate standard. In the RFC, the MPCA had requested comments on whether the agency should adopt a 600 mg/L sulfate standard or adopt a bifurcated standard with a 600 mg/L standard to protect ruminant animals with a high carbohydrate and low fiber diet and a 1000 mg/L limit for ruminants that graze (both livestock and wildlife.)

The USDA-FS supported adoption of the 600 mg/L sulfate standard to ensure protection of sensitive wildlife. The USDA-FS also suggested that the MPCA sponsor additional studies to determine impacts of sulfate on wildlife because information for effects of sulfate on wildlife is limited. Other commenters suggested that 600 mg/L sulfate standard is too high because sulfate harms wild rice and increases mercury methylation. They recommended that the MPCA consider impacts to wildlife from increased mercury availability.

Others (ArcelorMittal, U.S. Steel, Cleveland-Cliffs) supported two sulfate standards: a 600 mg/L sulfate standard for confined animals that applies at the point of appropriation, and a second standard that applies for the rest of the state. Several commenters suggested that if two sulfate standards are adopted, the higher sulfate standard should be higher than 1000 mg/L. Commenters suggested a 1,500 to 2,000 mg/L standard for the rest of the state based on the following information:

- Illinois and Iowa have a standard of 2,000 mg/L, which is based on more up-to-date science than the standard of 1,000 mg/L adopted by Kansas and Canada.
- Patterson et al. (2003) identified that the average dietary sulfate intake was 0.48% of dry matter for cattle drinking water with 1,700 mg/L sulfate. This shows that a limit of 1,500 mg/L sulfate would provide a factor of safety of 0.50% if dry matter intake from sulfur is the protective threshold.
- The literature does not identify issues associated with polioencephomalaia (PEM) and performance until higher sulfate concentrations (> 2,000 mg/L). (ArcelorMittal, U.S. Steel, Cleveland Cliffs).

Using the 600 mg/L value across all 4B waters is the simplest and the most conservative method of protecting the livestock and wildlife use. However, this could be overprotective in situations where there are no ruminants consuming a high carbohydrate diet utilizing a surface water downstream of a permitted facility. Where this value is overprotective, a site-specific standard could be developed via Minn. R. 7050.0220, subp. 7.

MPCA has chosen to implement the more protective value across the state, due to the widespread occurrence of ruminant feedlots. There are more than 25,000 registered feedlots that have housed ruminants as their primary stock (S-2, Section 5.4.4). Feedlots that have less than 50 animal units do not have to register their feedlot, so there may be additional feedlots that are not identified in the database for registered feedlots, and thus not represented in the above-referenced map. Additionally, there are other feedlots that house ruminants, but they are not the primary stock, and not included in the count of over 25,000 registered feedlots with ruminants.

While MPCA can identify where the registered feedlots are located from their registration information, MPCA cannot easily identify the water source used to water the livestock. There are only 1,609 water appropriation permits for livestock watering in the DNR database. Of those 1,609, only 52 are from surface waters. For the livestock operations without appropriation permits, it is unclear where their water is coming from. They may be using city water, or not using enough water to require an appropriation permit. Or, their livestock may be consuming water directly from a surface waterbody. Determining the water source for all feedlots across the state would be an insurmountable effort, especially when also considering historical uses of the water.

Maintaining the standard for all waters at 600 mg/L simplifies the process and ensures that livestock and wildlife are protected from the effects of sulfur. Additionally, it maintains a protective water concentration that allows for future feedlot operations to have a safe water source for their ruminant livestock. Where it can be demonstrated that the waterbody is not being utilized to provide water for ruminants consuming a concentrate diet, a site-specific concentration of 1,000 mg/L could be used. Although commenters have suggested a higher limit of 1,500 to 2,000 mg/L for non-ruminant animals or wildlife, the MPCA thinks this value is too high. Further discussion of the scientific rationale for the 1000 mg/L value can be found in Section 4.4.4 of the revised TSD (S-2).

5) Comments on proposed changes to Class 3D and Class 4C standards

The MPCA received a limited number of comments on the proposed changes to Class 3D and 4C standards. The Minnesota Chamber of Commerce and SMSBC supported the changes to the Class 3D and 4C wetland standards and truShrimp commented that they were uncertain of the impacts of the "inclusion of Class 4C into Classes 4A and 4B" (S-9, p. 143). As described elsewhere, these changes are minor and organizational in nature.

4. Statutory authority

The authority for the MPCA to adopt the proposed rule revisions is found in both state and federal law.

The CWA requires states to establish WQS to meet the goals and objectives of the CWA and to protect designated beneficial uses for water bodies (33 USC § 1313 (a)-(c)). The EPA must approve states' WQS and any revisions to WQS to ensure they meet CWA goals and requirements. Minnesota's WQS are established in Minn. R. chs. 7050 and 7052

In addition, the MPCA has general rulemaking authority "to prevent, control or abate water pollution" under Minn. Stat. § 115.03:

> ***115.03 Powers and Duties.***
>
> *Subdivision 1.* ***Generally****. The agency is hereby given and charged with the following powers and duties:*
>
> *(a) to administer and enforce all laws relating to the pollution of any of the waters of the state;*
>
> *(b) to investigate the extent, character, and effect of the pollution of the waters of this state and to gather data and information necessary or desirable in the administration or enforcement of pollution laws, and to make such classification of the waters of the state as it may deem advisable;*
>
> *(c) to establish and alter such reasonable pollution standards for any waters of the state in relation to the public use to which they are or may be put as it shall deem necessary for the purposes of this chapter and, with respect to the pollution of waters of the state, chapter 116;*
>
> *(d) to encourage waste treatment, including advanced waste treatment, instead of stream low-flow augmentation for dilution purposes to control and prevent pollution;*

(e) to adopt, issue, reissue, modify, deny, or revoke, enter into or enforce reasonable orders, permits, variances, standards, rules, schedules of compliance, and stipulation agreements, under such conditions as it may prescribe, in order to prevent, control or abate water pollution, or for the installation or operation of disposal systems or parts thereof, or for other equipment and facilities:

The MPCA also has general authority to "group the designated waters of the state into classes, and adopt classifications and standards of purity and quality…" under [Minn. Stat. § 115.44]

115.44 Classification of Waters; Standards of Quality and Purity.

Subd. 2. ***Classification and standards.*** *In order to attain the objectives of sections 115.41 to 115.53, the agency after proper study, and after conducting public hearing upon due notice, shall, as soon as practicable, group the designated waters of the state into classes, and adopt classifications and standards of purity and quality therefore. Such classification shall be made in accordance with considerations of best usage in the interest of the public and with regard to the considerations mentioned in subdivision 3 hereof.*

Subd. 3. ***Adoption of classification.*** *In adopting the classification of waters and the standards of purity and quality above mentioned, the agency shall give consideration to:*

(1) the size, depth, surface area covered, volume, direction and rate of flow, stream gradient and temperature of the water;

(2) the character of the district bordering said waters and its peculiar suitability for the particular uses, and with a view to conserving the value of the same and encouraging the most appropriate use of lands bordering said waters, for residential, agricultural, industrial, or recreational purposes;

(3) the uses which have been made, are being made, or may be made of said waters for transportation, domestic and industrial consumption, bathing, fishing and fish culture, fire prevention, the disposal of sewage, industrial wastes and other wastes or other uses within this state, and, at the discretion of the agency, any such uses in another state on interstate waters flowing through or originating in this state;

(4) the extent of present defilement or fouling of said waters which has already occurred or resulted from past discharges therein;

(5) the need for standards for effluent from disposal systems entering waters of the state;

(6) such other considerations as the agency deems proper.

Subd. 4. ***Standards.*** *The agency, after proper study, and in accordance with chapter 14, shall adopt and design standards of quality and purity for each classification necessary for the public use or benefit contemplated by the classification. The standards shall prescribe what qualifies and properties of water indicate a polluted condition of the waters of the state which is actually or potentially deleterious, harmful, detrimental, or injurious to the public health, safety, or welfare; to terrestrial or aquatic life or to its growth and propagation; or to the use of waters for domestic, commercial and industrial, agricultural, recreational, or other reasonable purposes, with respect to the various classes established pursuant to subdivision 2. The standards may also contain other provisions that the agency deems proper.*

The MPCA is proposing rules based on these federal and state authorities. The MPCA has addressed the statutory mandates relating to the proposal.

5. General reasonableness of the amendments

A. Introduction

The proposed revisions are based on research and technical analysis, literature review, peer review, significant internal discussion and review, and conversation with Tribal governments, other state agencies, and stakeholders. Information and explanation of the MPCA's underlying technical research and analysis beyond what is included in this SONAR is in the Revised Final TSD (S-2).

The MPCA's complete justification for the proposed revisions is composed of the general discussions of reasonableness in this section of the SONAR, the discussions in Section 7 (Specific Reasonableness), and the information provided in the TSD.

B. Overview of the general reasonableness of the MPCA's proposal

As discussed in Section 1.B. (Statement of general need), the MPCA found various problems with the existing Class 3 and 4 rules. The following discussion presents the MPCA's justification of how the proposed rule revisions reasonably address the major topic areas of the identified needs.

In this discussion of general reasonableness, the MPCA is addressing the following major topic areas:

- The use of a narrative standard to protect industrial consumption uses. The MPCA is proposing to use a narrative standard rather than numeric standards to protect the industrial consumption beneficial use. The discussion of the general reasonableness of the proposed narrative standard for the beneficial use includes:
  - The change from numeric standards to a narrative;
  - The consolidation of Class 3 into one single use class;
  - Maintaining the applicability of the standard to all waters; and
  - Establishing implementation procedures, including a method for calculating a numeric effluent limit for a wastewater permit based on the narrative standard to protect industrial consumption.
- The use of a narrative standard to protect irrigation uses. The MPCA is proposing to use a narrative standard rather than numeric standards to protect the irrigation beneficial use. The discussion of the general reasonableness of the proposed narrative standard for the beneficial use includes a discussion of:
  - The change from numeric standards to a narrative;
  - Maintaining the applicability of the standards to all waters;
  - Adding language about the factors that need to be considered in determining whether the narrative standard is being met; and
  - Establishing implementation procedures, including a method for calculating a numeric effluent limit for a wastewater permit based on the narrative standard to protect irrigation.
- The proposed numeric standards to protect livestock and wildlife beneficial use. The discussion of the general reasonableness of the proposed numeric standards includes a discussion of:
  - Adding an appropriate duration and frequency; Using livestock data for the most sensitive wildlife species as surrogate data for terrestrial wildlife species;
  - Clarifying that the Class 4B standards are intended to be applied to protect the livestock and wildlife drinking water use;
  - Replacing the current Class 4B salinity standard with a total dissolved solids standard; and

- Adding new numeric standards for nitrate plus nitrite and sulfate.

- Reorganization of rule language for wetlands. The MPCA is proposing revisions relating to the wetland standards found in Classes 3D and 4C.

C. Industrial consumption (Class 3): Narrative standard and implementation procedures

The MPCA is making changes to both the water quality standard to protect industrial consumption and adding detailed procedures for the implementation of the standard, particularly in facility permits. The general reasonableness is therefore divided into those two sections.

1) Water Quality Standard (Minn. R. ch. 7050)

The change from numeric standards to a narrative standard

Replacing the Class 3 numeric standards with a general narrative standard is protective of the industrial consumption designated use and consistent with a modern understanding of industrial water consumption use and needed protections.

The reasonableness of the current Class 3 numeric standards to protect the industrial consumption beneficial use is not apparent when examining prior rule documentation, justification, or literature. Based on our current understanding of the water quality needed for industrial purposes, and particularly without complete justifications from past rulemakings, MPCA cannot make a reasonable argument for why the current Class 3 parameters with numeric standards (pH, chloride, hardness) were selected, or the reasoning for the specific numeric values selected for those parameters.

Industrial water quality needs vary widely based on the type of industry. As an example consider the water quality needs of gravel washing versus the needs of computer chip manufacturing, which essentially bookend the wide range of water quality needs of Minnesota industries. Gravel washing operations do not need high water quality and do not need to treat their appropriated water before they use it, whereas computer chip manufacturers require impurity-free water and extensively treat their water, prior to use, to remove all possible impurities.

Several commenters have indicated throughout this process that water quality standards need to be set to protect the most sensitive use, or the most sensitive component of the use. However, this sensitive use framework is applied only to standards to protect aquatic life or human health, or Section 101(a)(2) uses (CWA) when protection of the most sensitive species is used to ensure protection of all species. For non-101(a)(2) uses, such as industrial consumption, the CWA does not require presumptive protection of the most sensitive component of the use.

In the case of industrial consumption, it is easy to see why the most sensitive component framework is of less value. If all water quality needed to be sufficient to protect computer chip manufacturing, that would require setting the water quality standard as pure H_2O which is not found in nature. It is unreasonable to argue that completely pure H_2O is the appropriately protective numeric water quality standard for all industrial consumers. Industries with unique needs have systems to treat incoming water to their specific needs. Therefore, it is reasonable to consider these water treatment needs when developing industrial consumption water quality standards.

Industrial water consumers make complex decisions about their water treatment needs that involve evaluating intricate trade-offs that are industry- and location-specific. For example, a municipal power plant must be near both the municipality it serves and a waterbody that provides a sufficient quantity of water for their operation; a power plant has no choice but to adapt their water treatment to treat the water quality found in the water from which they appropriate. It follows that a different power plant in a different location would have different treatment needs and would evaluate different trade-offs when deciding on a type of treatment. Developing a singular numeric water quality standard that is appropriately protective of every potential power plant while also considering their individual treatment needs is not possible. Developing a singular numeric water quality standard when the diversity of industries and their individual treatment and water quality needs are also considered is further out of reach.

A major roadblock in developing industrial consumption water quality standards is the lack of quality published information on industrial water treatment needs and specific technologies capable of meeting those needs. The majority of the industrial water treatment knowledge is unpublished and exists within a specific water appropriator's workforce. Limited industries, most notably the food processing industry, are legally required to meet specific water quality targets to protect human health; however, they are the minority. There is no up-to-date compendium of industrial water quality needs. If anything is published at all, it exists as primarily in trade publications, blogs, promotional materials or in patent filings with limited high-quality peer-reviewed studies. There are several reasons for this:

- Most treatment knowledge is the result of substantial investments in site-specific design and testing;
- Publicizing hard earned treatment knowledge is seen as decreasing a company's competitive business advantage;
- Intake water treatment needs are not regulated to the same degree as wastewater treatment, which results in fewer design manuals, standards, conferences and academic studies relative to wastewater treatment; and
- Some industrial water treatment processes are protected as intellectual property.

After performing a literature review, the MPCA has determined that there is insufficient information to appropriately characterize all industrial water quality needs of all of Minnesota's industrial water appropriators.

The MPCA evaluated whether it would be possible to create a multi-factorial numeric equation or conditional tables of numeric water quality standards that protects industrial consumption water quality while simultaneously considering individual treatment needs. This might be possible if the MPCA had perfect knowledge of current and future industrial water quality needs, but the result would still be unreasonably complex. The equation or table would need to simultaneously account for different treatment needs, industrial water quality needs and complex business trade-offs among other potential factors. The conditional table would require thousands of cells in order to account for all the potential factors for just the industries that exist in Minnesota today. The complexity would create uncertainty for wastewater dischargers trying to understand what conditions must be met in their effluent to protect downstream appropriators. Furthermore, it would be difficult to account for future advancements in water treatment that would change treatment needs. Although some may raise similar concerns about a narrative standard, the MPCA finds that the robust implementation framework proposed will provide an appropriate combination of certainty and specificity. A narrative water quality standard is the best way to protect for industrial consumption because it allows for individualized and location-specific considerations and does not make presumptions about industrial consumption water quality treatment needs.

The MPCA conducted a survey that demonstrated that industrial consumers of water in Minnesota do not believe the Class 3 numeric standards provide an essential protective aspect to their industrial water consumption needs (S-17). Several commenters pointed out that the survey's methodology was flawed and inconclusive because the sample response rate was low and skewed towards large industries. Conducting a full census of industrial water consumers is the only way to gain an unbiased understanding of industrial water quality needs in Minnesota, but a conducting a full census is beyond the time and resources of the MPCA for this rulemaking. Therefore, conducting a survey and accounting for the biases that are the unavoidable product of every survey is a reasonable path to understand industrial water quality needs. The survey MPCA conducted represents a snapshot of industrial consumption needs and is evidence that the Class 3 numeric standards for chloride and hardness are not of essential importance to industrial consumers. Three survey respondents did indicate that the Class 3 pH standards are important to them, but there are equivalent pH water quality standards in the aquatic life, limited resource value, and livestock and wildlife designated uses. Since every water of the state is protected by at least one of those three designated uses, there will be no removal of pH protections by changing the pH numeric standards to a general narrative standard for Class 3.

The MPCA could find no evidence that industrial consumers of water use any of the Class 3 numeric criteria as reference values in the design or operation of their water treatment systems. Instead, industrial water appropriators are committed to treating their influent to their specific needs and do not need the current numeric standards to operate their treatment systems effectively. Industrial consumers of water select the water quality parameters they treat for based on evaluations of their specific water quality needs; once their systems are designed and installed, the more important factor is the consistency of the water quality, and that it stay within the parameters that the system was designed for. A narrative standard allows for greater flexibility when considering the wide variety industrial water quality needs and does not make unreasonable presumptions about the specific parameters industrial consumers are concerned about.

It is also worth noting how few industrial consumers of water in Minnesota commented during the RFC period on the planned replacement of the numeric standards with narrative standards. MPCA made special efforts to notify major industrial consumers by emailing every industrial NPDES permit holder – who generally both appropriate and discharge water – to notify them of the draft TSD (S-7). Major industries in Minnesota have a history of monitoring water quality rulemakings closely and commenting on proposed rules they feel are important. The industries that commented on the proposed rule were generally permitted dischargers with Class 3 or 4 effluent limits in their NPDES permits or those with the reasonable potential to require them in the future. Although many of these facilities also take in water, commenters were generally not those industries that might be expected to rely on specific water quality characteristics for water they take in and use. Industrial water appropriators appear to be generally ambivalent about how or whether the current numeric standards protect the industrial consumption beneficial use but keenly interested in how the rulemaking affects wastewater permit limits. For example, the power plant industry is by far the largest volume appropriator of water in the state but no major industrial power plant company commented on the draft TSD. The MPCA spoke with a representative of a Minnesota power plant company who said they had personally read the draft TSD but did not feel the need to submit a comment on the draft TSD because the proposed rulemaking was unlikely to affect their business (this company has active DNR water appropriation permits).

The consolidation of Class 3 into one single use class

There are four subclasses in the Class 3 beneficial use: 3A, 3B, 3C and 3D (Table 4). Under the proposed rule, those four subclasses would be condensed into a single general use class protective of industrial consumption.

Table 4: Class 3 industrial type use.

Class	Industrial Use Type
3A	Use without chemical treatment*
3B	Use with a moderate degree of treatment*
3C	Use for industrial cooling and material transport without a high degree of treatment
3D	Use (of wetlands) with only a moderate degree of treatment*

*Except for food processing.

Water quality standard subclasses are used to provide needed and more specific protections under a broader general class. Subclasses should ideally represent natural groupings based on related protective needs. A good example is aquatic life subclasses that consider warm and cold water fish communities separately. Separating the two distinct subclasses (warm vs. cold fish) is needed and reasonable because the differences between the two subclasses emerge naturally from inherently different water quality needs between the two types of communities.

When evaluating the need for the four Class 3 subclasses, the MPCA evaluated whether the four subclasses emerge from "natural" underlying classification of industrial consumption and whether there were reasonable arguments to support the current four subclasses. The MPCA could find no justification for the current subclasses and could find no example of another state or tribe having subclasses for industrial water quality standards. There is no documentation explaining why these four subclasses were created or clarity on what classes of industries the four different subclasses were trying to protect. From a plain language reading of the rule, it is clear that the subclasses were intended to distinguish the degrees of water treatment required. However, the degrees of treatment referenced (moderate, high, chemical) are not defined or explained, and as a result are so vague as to be meaningless. For example, a large, profitable oil refinery would have a different definition of a "moderate degree of treatment" than a small woolen mill would, and "chemical treatment" could range from using citrus cleaner to clean a single pipe to the continuous addition of high doses of caustic soda. Since there is no clear or reasonable justification for the current subclasses, it is reasonable to eliminate the subclasses and condense them into a single, general class.

An additional benefit for condensing the current Class 3 subclasses into a single class is that it is simpler for the MPCA to administer, as the Agency would no longer have to track and list the subclasses. This will also make the standards easier for the public to understand and for permittees to comply with.

Maintain every water designated as a Class 3 water

Currently every single water of the state is presumptively designated as a Class 3 water, and this rule will maintain that status. Maintaining presumptive Class 3 protections is reasonable because it is simple, maintains the status quo, and creates no new exceptions. The MPCA cannot predict what waters industrial users might want to appropriate water from in the future, so it is prudent to maintain a presumptive Class 3 applicability for all waters to not preclude future industrial users from having industrial consumption water quality protections. It is also difficult to determine if a use is an existing use that cannot be removed.

Commenters requested that the MPCA remove the Class 3 beneficial use from certain classes of waters (trout waters, limited resource value waters, intermittent streams), but after consideration, the MPCA found that it is unreasonable to remove the Class 3 beneficial use from any water of the state in this rulemaking.

The MPCA acknowledges that reasonable arguments exist that limited and specific waters of the state should not be designated as Class 3 waters. However, the arguments required to justify the removal of a

Class 3 beneficial use from a single water of the state are legally complex and require EPA review and approval of waterbody-specific analyses and justification. Analyzing the situation and developing the materials requires extensive MPCA staff resources. Since developing the justification for removing a designated use from a single waterbody is resource-intensive, even when detailed individualized information is available, removing the Class 3 beneficial use from many waters at one time would be even more complex.

Commenters noted that the MPCA could develop generalized criteria (e.g., low flow waters, trout waters, waters used for drinking water appropriation, etc.) to categorize waters that should not also be classified as Class 3 waters. The MPCA considered developing and implementing generalized criteria, but determined that it is most reasonable to maintain the beneficial use on all waters, while developing an implementation approach focused on appropriation locations to provide further refinement.

2) Implementation (Minn. R. ch. 7053)

As described previously, implementation of narrative water quality standards requires additional steps. States must make choices about how to develop numeric effluent limits that can be applied in permits in order to protect the water quality standard. This section discusses the reasonableness of the MPCA's specific choices about implementation, which are designed to comply with Minn. R. ch. 7053, which states requirements for establishing effluent limits and treatment requirements for discharges to waters of the state. Several rule revisions are proposed to provide a framework that reasonably scopes and bounds the proposed implementation methods, and implementation procedures are provided in a methods document that is incorporated by reference in the proposed rule.

The Class 3 narrative translator should be implemented at locations where water is appropriated for industrial consumption (Minn. R. 7050.0205, subp. 7, E)

Defining the locations where the industrial consumption narrative translator evaluates water quality provides needed clarity and aids in protecting existing industrial consumption uses.

While the water quality standard applies to all waterbodies, the MPCA may make reasonable choices to determine which discharging facilities need to have effluent limits applied to ensure that they are not causing or contributing to an exceedance of the standard. The MPCA has determined that it is appropriate to focus implementation on places where water is withdrawn for industrial consumption use.

Industrial consumers appropriate water from fixed locations on surface waters of the state, and it is most important that water quality at those fixed locations is appropriately protected. The fixed locations that industrial consumers of waters appropriate from tend to be on larger bodies of water that drain larger watersheds. The water quality at these fixed locations is an integration of all upstream water quality sources (e.g., agricultural runoff, wastewater, storm water). Industrial consumers of water have adapted their water treatment processes to the typical water quality at their intake structures and are primarily concerned about upstream impacts, such as a new large municipal wastewater discharger, that could significantly change the water quality at their intake structures.

Because there are a limited number of industrial appropriators, they do not change frequently, and they exist in known locations, the MPCA can reasonably implement the strategy to evaluate compliance with the standard at locations where water is appropriated for industrial consumption. The MPCA is including a method, incorporated by reference in rule, to ensure that wastewater treatment plants do not cause an exceedance of the narrative industrial consumption standard. The method will determine whether a wastewater treatment plant would need a numeric effluent limit to meet the narrative standard. The MPCA cannot set those limits without defining which waters need protection. Therefore, including language stating that the narrative standard would be evaluated at locations where water is appropriated for industrial consumption is needed and reasonable because it increases regulatory certainty about which waters will be evaluated in NPDES permitting.

The most reasonable way to define locations where water quality needs to be protected for industrial consumption is to use the Minnesota Department of Natural Resources (DNR) water appropriation permitting database to identify appropriators. The narrative translator method (further explained below) refers to the DNR permitting database. However, the rule language refers only to the point at which water is withdrawn. This allows MPCA to, as needed, consider any industrial appropriators that may be too small to need DNR appropriation permits. If such a situation is brought to MPCA's attention, we will document the location of the appropriator and consider it in the future.

Minn Stat. § 103G.265 requires the DNR to manage water resources to ensure an adequate supply to meet long-range seasonal requirements for domestic, agricultural, fish and wildlife, recreational, power, navigation, and quality control purposes. To manage water resources for water supply, the DNR requires a water use permit for all users withdrawing more than 10,000 gallons per day or 1 million gallons per year. For context, 1 million gallons per year is equivalent to 2,740 gallons per day. A typical Minnesota household of four people uses around 400 gallons of water per day. It is reasonable to assume that industrial consumers would typically use at least seven times more water than a typical household on a daily basis, and so would require a water appropriation permit from the DNR and appear in the database. The DNR database contains permit status, the appropriation location, whether the appropriation is from groundwater or surface water, type of surface water, water appropriation use, annual volumes of water appropriated and the effective start date of the permit among other factors. The database is available publicly and is published annually online. The DNR typically approves fewer than 10 new surface water industrial appropriation permits each year, with the majority of those being sand and gravel washing permits appropriating water from dug pits that are hydrologically isolated from other surface waters of the state. Water appropriation permits are either temporary (expire after 1 year) or continuous (permits remain in good standing as long as annual water usage reporting is completed). The MPCA does not consider it reasonable to consider temporary industrial water appropriation permits as existing uses because of their limited and ephemeral nature.

The MPCA would consider both the locations of active and inactive industrial consumption water appropriation permits as locations that would require industrial consumption narrative standard protections. Protecting inactive permits is needed and reasonable when considered in the context of the federal CWA protections for existing uses and how the DNR database tracks water appropriation permits.

The term existing use is defined in *40 CFR § 131.3(e)*: "Existing uses are those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards."

The EPA has made available a memo clarifying the term "existing use:"

The term existing use has a somewhat different meaning, in the context of the CWA, than one might expect. Rather than actual or current uses, it refers not only to those uses the water body is capable of supporting at present but also any use to which the water body has actually attained since November 28, 1975. Even if the water body is currently not supporting a use attained since November 28, 1975, for purposes of the CWA, it is still an "existing use." Even if there has been no documentation that a use has occurred since November 28, 1975, evidence that water quality has been sufficient to support a given use at some time since November 28, 1975 can be the basis for defining an "existing use" for a water body" (S-16).

If the MPCA were not to consider inactive permits in the narrative translator, it could potentially result in removing an existing use through the absence of protecting it. Since removing an existing use is not allowed under the CWA, the MPCA must continue to provide industrial consumer protections to all waters where industrial consumption is (or potentially is) an existing use.

The DNR water appropriation database tracks the active and inactive status of each permit and the year the permit was initiated but does not track the date when a permit became inactive. Since the DNR database contains inactive water appropriation locations that started prior to 1975, there is no way to verify if any those permits existed on or after November 28, 1975 and would be considered existing uses. The MPCA could perform a location by location analysis and evaluate the individual permitting timeline of the several hundred inactive industrial permits, but that would be an unreasonable amount of effort, and it is unlikely that sufficient documentation of appropriation history still exists. Since there is no way to reasonably know if an inactive permit existed after 1975, it is most protective to consider all inactive permits as equal to active permits when using the narrative translator method. If an entity wants to present evidence that a water appropriation location is not an existing use because it did not exist on or after November 28, 1975, they may contact the MPCA to appropriately document the situation and ensure appropriate protection. Similarly, any industrial users that are not required to have appropriation permits may be documented and added for future consideration.

Several commenters noted that other Midwestern states (Ohio, Illinois, and Indiana) have public water supply standards that only apply at the location where water is withdrawn. The MPCA reviewed standards in these other states and determined the domestic consumption standards are similar in application to the implementation of the industrial consumption standard as proposed, since they are applicable at the location where the water is withdrawn.

Protective flow rate for the Class 3 beneficial use

Effluent limits are developed to ensure that the applicable water quality standard is protected at a critical flow condition – usually a minimum stream flow at which it remains reasonable and appropriate to protect the beneficial use. This is usually a low flow condition, because at times of low flow, there is less water available in the receiving water to dilute the pollution contributed by permitted NPDES discharges. Minn. R. 7053.0205, subp. 7, specifies that all water quality standards must be protected to the $7Q_{10}$ flow except for the parameters of ammonia ($30Q_{10}$ flow) and phosphorus ($122Q_{10}$ or long term summer average).

In order to ensure that an effluent limit protects the water quality standard, an appropriately protective stream flow rate defining the critical flow condition must be determined. This is necessary for the industrial consumption narrative translator method to determine whether an effluent limit is needed in a wastewater permit and, if so, to calculate that limit. The MPCA currently uses the $7Q_{10}$ flow to calculate the need for Class 3 effluent limits in wastewater permits, as the $7Q_{10}$ is defined as the default condition under Minn. R. 7050.0210, subp. 7, and applies unless another flow condition is specified. The $7Q_{10}$ flow represents waterbody flows under extreme low flow drought conditions because on average $7Q_{10}$ flows occur in a waterbody less than one to three percent of the time. Protecting water quality down to the $7Q_{10}$ flow is appropriately protective of the aquatic life designated use but is inappropriately protective of industrial consumption for reasons explained more below. The MPCA has acknowledged that using the $7Q_{10}$ flow to protect the Class 3 designated use is inappropriately protective, but because the current rule is unambiguous, the MPCA is obligated to use the $7Q_{10}$ flow when setting Class 3 effluent limits in wastewater permits.

Defining an appropriately protective waterbody low flow for the Class 3 designated use is needed and reasonable for a number of reasons. First, it allows a tailored and accurate protection of the industrial consumption designated use. Second, it provides needed clarity on an essential input in the limit setting process, and this clarity will reduce future disagreements about how to calculate the need for Class 3 limits in wastewater permits. Third, it harmonizes the current differences between how DNR and MPCA protects industrial water consumption at low flows and ensures that DNR maintains statutory authority to define flow conditions that protect industrial water appropriation.

The MPCA is proposing to use the low flow rate DNR has determined to be protective of the watershed in which the industrial appropriator is found. In Minn. Stat. § 103G.285, subd. 2, the commissioner of the DNR has the ability to limit water appropriations under low flow conditions. Minn. Stat. § 103G.285, subd. 2 does not specify a numeric flow rate that should be used. The DNR (2019) has developed a guidance document to interpret Minn. Stat. § 103G.285, subd. 2, and it contains the minimum numeric flow value to allow appropriations in a watershed. DNR's guidance indicates that once flows reach the specified low flow within a watershed basin, consumptive industrial water appropriations should stop, prioritizing continued use for those who appropriate water to maintain public health and welfare (such as for public or private drinking water supply).

At this time, the flow rate specified by the DNR is generally the annual Q90 exceedance flow, which represents the tenth percentile low flow rate. The DNR guidance document specifies limited locations where the Q_{90} flow rate may not be appropriately protective. For example, specific dammed lakes are best protected using the ordinary high water level, and a Q_{90} flow rate may not be appropriately protective in ground water management areas where there is a high degree of connectivity between groundwater and surface water. The DNR has authority to develop location-specific water appropriation allocation plans, subject to public comment, to determine protective flow rates if there is conflict over whether the low flow rate is appropriately protective. Using the specific flow rate the DNR has determined to be appropriate is reasonable because it is protective of the lowest flow that could be utilized for the industrial consumption designated use. When stream flows are at or below the protective low flow at a designated gage on these waterbodies DNR could make the decision to suspend of surface water appropriation permits in all contributing watersheds upstream of the designated main stem river gage.

The MPCA has the technical capability to calculate Q90 or applicable low flow values at every location in the state. However, because the DNR has specific authority based on low flow conditions, it is best to reference that authority to promote consistency and avoid confusion in the future about what low flow value should be used. The DNR (2019) has calculated Q90 values applicable to every watershed in the state and some lakes, and re-calculates those values every five years. Those values are easily accessible, providing certainty to wastewater dischargers about the flow rates that the MPCA will use.

Developing an industrial consumption narrative translator method and incorporating it into rule

Narrative translator methods are a key way that states ensure that wastewater dischargers do not cause or contribute to a violation of any narrative water quality standards. Narrative translator methods allow states to convert the protective goals of narrative standards into enforceable numeric wastewater effluent limitations that protect the intended designated use. Including an effluent limit to achieve a state's narrative standards is specifically referenced in the CWA rules under 40 CFR 122.44(d)(1)(vi)(A) whenever a state adopts a new narrative standard. The most common narrative translator methods used by states relate to protecting aquatic life and recreation beneficial uses and their associated narrative standards for nutrients.

As discussed in Section 3.D. of the SONAR, the MPCA solicited comments about the proposed industrial consumption narrative translator method and whether to include it in rule or have a taskforce of stakeholders develop the narrative translator method outside of this rulemaking. Commenters generally preferred that the MPCA develop an industrial consumption narrative translator method as part of this rulemaking and make it available for public comment. Several commenters specifically requested that

MPCA ensure that the translator method be included in a format that ensures clear and legally-defensible future use of the translator method in wastewater permitting.

The best way to include the narrative translator method in rule is to incorporate it by reference. The primary reason the MPCA proposes to incorporate the narrative translator method by reference is to avoid including lengthy, detailed, and complex calculation procedures directly in rule. The proposed narrative translator is a method that requires calculations too complex to write in a format that would read well in rule. For example, the industry standard for calculating a key parameter in the translator method, the calcium carbonate saturation index (CCSI), is to use one of a number of computer programs (American Public Health Association [APHA], 2018; de Moel et al., 2013). The computer programs rely on the same fundamental mathematics but have slightly different graphical user interfaces, and writing prescriptive calculation methods in rule for a variety of different software programs is not reasonable. There are longhand methods to calculate the CCSI, but they are lengthy, complex, require references to tables of thermodynamic constants, and require more discretionary decisions than computerized methods do; thus it is not reasonable to include the longhand methods directly in rule, and it is reasonable to direct the implementation to rely on a computer program. In addition, updates to underlying data tables used to answer sequential questions for permits that are pending, or awaiting reissuance, can be implemented in determinations as soon as the information is loaded onto the agency website.

Incorporating the industrial consumption narrative translator method by reference allows the MPCA to more conveniently make changes if they are needed, though the MPCA expects changes to be infrequent. The narrative translator will be stored on the MPCA webpage dedicated to storing incorporations by reference not available through other sources (primarily MPCA-created documents) (https://www.pca.state.mn.us/regulations/incorporations-reference) .

There is no existing industrial consumption narrative translator method in Minnesota rule, and the MPCA has never previously attempted to develop or use an industrial consumption narrative translator method in NPDES permitting. EPA has published no guidance documents related to industrial consumption narrative translator methods, and the MPCA could find no example of another state or tribe using an industrial consumption narrative translator method in NPDES permitting. Since there is no existing precedent to consider, the MPCA proposes an industrial consumption narrative translator method to ensure that industrial consumers of water have consistent water quality with regard to the potential for severe calcium scaling at the point(s) where they withdraw water.

The MPCA recognizes that a narrative translator method must strike a balance between protecting the designated use, providing clarity and consistency around limit calculations, and usability for regulated parties and MPCA staff. The MPCA acknowledges that wastewater permitting decisions are sometimes so specialized in their complexity that wastewater permit holders feel they need to retain permitting consultants to get appropriate advice. Permitting consultants are not inexpensive; for example, consulting fees of $50,000 to $100,000 would be an expected fee for a consulting firm to shepherd a medium-sized and non-controversial municipal NPDES discharger through a permit expansion requiring an antidegradation assessment. Larger wastewater dischargers are more likely to afford the resources required to hire in-house or external permitting resources than smaller wastewater permit holders like small towns or low-revenue industrial dischargers. The MPCA does not want to create a narrative translator method that is so complex that it would be unusable for the typical permittee, and would therefore require permittees to retain the services of a permitting consultant with every NPDES permit re-issuance. Creating such a process would not only unreasonably burden every permit holder, but also disproportionately burden those permit holders with the least capacity to afford permitting counsel.

The proposed narrative translator was constructed to minimize permitting complexity while also ensuring that existing water quality is protected at the locations where industrial consumers withdraw water. This was done by structuring the calculations sequentially to have increasing levels of complexity, so that the most complicated calculation (i.e., for CCSI) is only performed if simpler calculations cannot demonstrate that water quality is protected for industrial consumption.

Several commenters requested that MPCA provide examples of how the narrative translator method will be used in NPDES permitting. It was clear that the commenters' underlying interest was in knowing whether a specific permitted facility would receive an effluent limit. The method document and descriptions of the steps provide the details of how effluent limits will be derived. In the regulatory analysis section, the MPCA has provided information on the likelihood that every wastewater discharger would receive a limit under the current and proposed rule and projected the probable costs of complying. Including this level of detail fulfills the need and reasonableness requirements in Minn. Stat. § 14.131 and is consistent with the purpose of the Administrative Procedures Act in Minn. Stat. § 14.001 to increase access to governmental information and to allow for informed public participation.

Reasonableness of structuring the narrative translator method in the format of a flowchart

It is reasonable to structure the narrative translator process in the format of a flowchart because it improves clarity and increases consistency. A flowchart is the best way to ensure that the user is prompted to sequentially consider all relevant factors that could affect industrial consumption water quality (S-4).

General reasonableness of the components of the translator method

The Class 3 Narrative Translator Methods document (S-3) focuses on reviewing new or expanded dischargers for their potential to increase the hardness of the waters appropriated for industrial use in such a way as to increase the potential that the water quality would cause calcium scaling.

As noted previously, and supported by the survey of industrial water users (S-17), the goal of most industrial appropriators is to have water of consistent quality coming in to their processes. That allows the industrial facility to design and operate appropriate systems that make the water quality suit their purposes, and ensures those systems continue to work as designed and expected. When consistency is the main the goal, it is reasonable to evaluate actions that might serve to substantially change water quality – in this case, an increase (though the construction of a new source or expansion of an existing source) in pollutants added to the waterbody that might interfere with an industry's ability to use that water in their processes. Therefore, the first questions asked in the narrative translator are whether a new or expanding discharging facility is likely to cause a net increase in loading of hardness to the surface water. Hardness is a measure of dissolved minerals - largely calcium and magnesium. The question of a net increase in loading of any pollutant is already asked as part of the permitting process. Hardness is the appropriate parameter to consider because the existing Class 3 numeric standards include the parameter of hardness. For the current rule changes, hardness is a reasonable proxy for the constituents of water quality that could cause problems for industrial users.

If a permitted facility discharge will cause an increase in hardness, the narrative translator calls for that facility to receive additional evaluation. The further evaluation focuses on the increase of calcium ions being discharged and whether those might increase the downstream potential for calcium scaling to levels that could negatively affect existing industrial appropriators of water. (The MPCA currently has no indications that any surface water appropriators are experiencing calcium scaling at levels of concern.) Excess scale formation is a phenomenon known to most homeowners in areas of hard water, and is a problem in industrial processes because it can cause blocked pipes, among other issues. Therefore, it is reasonable to prioritize focusing on excess scale formation in the narrative translator.

The proposed narrative standard includes protections for severe fouling and corrosion in addition to protections for severe scaling. The MPCA evaluated developing narrative translator methods to protect industrial consumption for severe fouling and corrosion but ultimately found it would be unreasonably complex to do so. Fouling and corrosion are not specific terms from a water chemistry perspective, and they require site- and industry-specific interpretations. For example, severe fouling could occur for a nearly infinite number reasons - ranging from zebra mussels to petroleum products to leaves clogging an industrial water intake – including many that are not related to discharges from permitted sources. Similarly, the physical and chemical mechanisms that cause severe corrosion vary widely based on the material used in the industrial process (e.g. steel vs concrete vs plastic), flow conditions, microbiology, water chemistry, etc. Since there is no way to broadly define severe fouling or corrosion across the range of industrial water uses in Minnesota, the MPCA did not attempt to develop universal definitions and a translator method to protect those definitions. Protecting severe corrosion and fouling is best accomplished on a site-specific basis within the context of a specific industrial water appropriator and waterbody of concern; the narrative language will allow the MPCA to make such specific decisions as needed. It is reasonable to focus broad implementation steps on the most common pollutant discharged by permitted facilities that is specifically linked to a water quality condition of concern included in the narrative standard.

Further information on the reasonableness of each step in the narrative translator methods is provided in the specific reasonableness section.

D. Irrigation (Class 4A): Narrative standard and implementation procedures

The MPCA is making changes to both the water quality standard to protect irrigation uses and adding detailed procedures for the implementation of the standard, particularly in facility permits. The general reasonableness is therefore divided into those two sections.

1) Water quality standard (Minn. R. ch. 7050)

The change from numeric standards to a narrative standard for most pollutants

The proposed rule replaces the current numeric irrigation standards for bicarbonates, pH, specific conductance, total dissolved salts, and sodium with a general narrative standard. These parameters (with the exception of pH) are salinity-related parameters and are discussed together in this general reasonableness section. In general, salts are a key parameter for irrigation water quality because of the potential of high salt content to harm plants directly or to contribute to an increase of salts within the soil (soil salinization), eventually becoming problematic for the plant roots (See S-2, Section 4.2.). However, the impact of salts is highly variable, based on specific factors that are discussed below. The proposed rule would leave the current numeric standards for boron, sulfates applicable to water used for production of wild rice, and the narrative radioactive materials standard unchanged.

As noted in the section on the need to amend the rules, there is limited information supporting the existing Class 4A numeric standards. It appears that the values were based on what is needed for arid regions that are very different than Minnesota.

This derivation of values more applicable for other regions is especially important because irrigation water quality needs are site-specific. They require the evaluation of critical local factors such as crop type, soil type, soil drainage, irrigation methods, climate and economic factors such as agronomic profitability. These critical factors are not consistent across Minnesota and vary substantially even within one farm field. For example, limited soils in Minnesota are naturally saline; saline soils require a higher irrigation water quality (with lower salt content) than 'not saline' soils, all other factors beings equal. The appropriate irrigation water quality is inextricably linked to these critical local factors, particularly soil salinization risk. The TSD (S-2, section 4.2) explains these critical local factors in detail, with supporting technical justification about why they are the critical factors to consider for irrigation. A narrative standard to protect irrigation water quality is needed and reasonable because a narrative standard does not presume that a single numeric value is appropriately protective on a statewide basis. Instead, it provides a framework for tailored implementation that considers local conditions.

The MPCA evaluated whether it would be possible to create a multi-factorial numeric equation or conditional tables of numeric water quality standards that protects agricultural water quality while simultaneously considering critical local factors. In theory this is possible, but in practice, it would create a standard that is unreasonably complex. The equation or table would need to simultaneously account for different crop types, soil types, drainage, irrigation methods, etc.. The conditional table would have at least 750 individual cells in order to account for all the potential critical local factors for just the major crops grown in Minnesota. Each value in the table would require a similar justification to the proposed protective values in the narrative translator method. The complexity would raise major concerns for wastewater dischargers, who would have difficulties understanding what conditions they need to meet in their effluent to protect downstream appropriators, creating ideal conditions for future arguments and litigation. Although some may raise similar concerns about a narrative standard, the MPCA finds that the robust implementation framework proposed will provide an appropriate combination of certainty and specificity.

A single protective numeric irrigation water quality standard will likely be either under-protective or over-protective of the irrigation designated use for the specific irrigation use in question. While no water quality standard is perfectly protective at all conditions, the variability for irrigation is much higher than other standards. Despite the lack of documentation, the fact that the current standards include language stating that "the following standards shall be used as a guide in determining the suitability of waters" for irrigation, seems to indicate that the original writers of the Class 4A standards understood that singular numeric irrigation water quality values are sometimes inappropriately protective. The MPCA is proposing to remove the "used as a guide" sentence because it is ambiguous and could be reasonably interpreted by different people in different ways, making the rule unclear ("Things to Know before You Start to Draft," 1997). The "used as a guide" language creates unneeded confusion about whether the current numeric values are strict never-to-be-exceeded values or should be evaluated in conjunction with critical local factors and an understanding of modern irrigation science. Interpreting the numbers as values not to be exceeded is more consistent with the way MPCA develops and implements water quality standards today. However, the plain language intention of the "used as a guide" language appears to be to encourage a site-specific irrigation water analysis and use modern science when protecting water quality. The most reasonable way to encourage irrigation water suitability analysis and the use of modern science is to develop a narrative standard with a robust implementation framework that considers critical local factors and uses the best available science.

Several commenters suggested that MPCA should choose a single conservative numeric water quality standard that protects irrigation under the most sensitive irrigation conditions that could occur in Minnesota. The MPCA evaluated this option and found it to be unreasonable . The commenters generally seem to be relying on the requirement under the CWA that water quality standards developed to protect aquatic life or human health – the CWA aquatic life and recreation uses (33 U.S.C. 1251(a)(2)) require protecting the most sensitive species. This is appropriate in the context of an aquatic community with multiple organisms living together, some of which may be more sensitive, and in the case of human populations, where some life stages are more sensitive. In these cases, you likely cannot effectively separate or tailor protection for the sensitive uses. But the CWA does not require presumptive protection of the most sensitive species for developing non-101(a)(2) use water quality standards. And in the case of agricultural crops, the way they are grown means that protection can be appropriately tailored to ensure sensitive species are protected while not using the most conservative value, which would be overprotective of the vast majority of usually-grown crops and soil conditions. Sensitive soil types do not change over time, and the types of crops grown in any given location are relatively stable within a given crop rotation. In addition, the most sensitive species tend to be those that are less commonly grown (such as strawberries or blackberries) and grown in specific locations on an ongoing basis.

Minnesota Rules have no defined procedures for how to develop an irrigation water quality standard, and the required protections of sensitive species in the aquatic life designated use are not applicable to the irrigation designated use. As such, and given the availability of data, the MPCA's proposed approach provides an appropriate level of tailored protection for irrigated crops of all types.

It is also worth noting that no farmers or groups representing farm interests commented during the RFC period on the planned replacement of the numeric irrigation standards with narrative standards, despite notification on a GovDelivery e-mail listserv that included agricultural interest groups. The MPCA was unable to identify ever receiving a single comment from a farmer or farm group about their irrigation water quality. Farmers and groups that represent farm interests in Minnesota have a history of monitoring water quality rulemakings closely and commenting on proposed rules they feel are important, and the fact that they did not comment on this rule is a sign that the current numeric values are not critical to support their use of the water for irrigation. In addition, the MPCA engaged with the Minnesota Department of Agriculture – both through an early meeting during rule development and through the required notice of rules that impact farming operations – and they did not raise major concerns.

The MPCA could find no evidence that Minnesota irrigators use any of the Class 4A numeric criteria as reference values in their farming and irrigation operations. Instead, they manage their irrigation practices for their crops, soils, and source of water.

Maintaining standard for Boron

While it is not necessary to justify maintenance of existing standards, the status of the boron standard came up during peer review, and so it is briefly discussed here. Based on U of M Agricultural Extension Service information and academic literature, there is no evidence that elevated boron is a major irrigation problem in Minnesota. In fact, the literature primarily provides Minnesota farmers with information and resources on how to apply additional boron to soils as fertilizer. This differs from arid regions of California where boron in soils, groundwater, and surface water is naturally high, and farmers need regulations and resources to manage elevated boron.

From a scientific perspective, there is sufficient information to show that the 0.5 mg/L boron standard is overprotective of irrigation water quality for some crops and soils in Minnesota. However, boron science is complex and requires consideration of individual crop boron sensitivities, soil boron organic matter interactions, boron redox chemistry, and speciation and solubility, among other factors. Due to the chemical complexity of boron, irrigation water quality suitability for boron requires an additional level of scientific complexity that is above and beyond what is needed for the other Class 4A parameters.

After reviewing comments on the draft TSD, consulting with peer reviewers, and compiling all available boron water quality data, the MPCA determined there was insufficient data to pursue a change to the water quality standard. Because of this, MPCA modified its initial directions with respect to the numeric boron standard, and now proposes to keep the current Class 4A 0.5 mg/L numeric boron standard magnitude unchanged until more data can be gathered.

Maintain every water designated as a Class 4A water

The proposed rule maintains every water of the state as a presumptively designated as Class 4A. Maintaining presumptive Class 4A protections is reasonable because it is simple, defensible, and maintains the status quo. The MPCA cannot predict which waters irrigators might want to appropriate water from in the future, so it is prudent to maintain a presumptive Class 4A applicability not to preclude future agricultural users from having irrigations water quality protections. It is also difficult to fully determine if a use has occurred in a water since November 28, 1975 and thus is an existing use that must be maintained.

Commenters requested that the MPCA remove the Class 4A beneficial use from certain classes of waters (trout waters, limited resource value waters, intermittent streams), but after consideration, the MPCA found that it is unreasonable to remove the Class 4A beneficial use from any water of the state in this rulemaking.

The MPCA acknowledges that reasonable arguments exist that limited and specific waters of the state should not be designated as Class 4A waters. However, the arguments required to justify the removal of a Class 4A beneficial use from a single water of the state are legally complex and require EPA review and approval of waterbody-specific analyses and justification. Analyzing the situation and developing the materials requires extensive MPCA staff resources. Since developing the justification for removing a beneficial use from a single waterbody is resource-intensive, even when detailed individualized information is readily available, removing the Class 4A beneficial use from many waters at one time would be even more complex and difficult to accomplish.

Commenters noted that the MPCA could develop generalized criteria (such as low flow waters, trout waters, waters used for drinking water appropriation, etc.) which could be used to categorize waters that should not also be classified as Class 4A waters. The MPCA considered developing and using these generalized criteria but ultimately determined that maintaining the use on all state waters is appropriately protective, while focusing implementation on areas of appropriation provides a reasonable further refinement.

2) Implementation (Minn. R. ch. 7053)

As described previously, implementation of narrative water quality standards requires additional steps. States must make choices about how to develop numeric effluent limits that can be applied in permits in order to protect the water quality standard. This section discusses the reasonableness of the MPCA's specific choices about implementation, which are designed to comply with Minn. R. ch. 7053 which states requirements for establishing effluent limits and treatment requirements for discharges to waters of the state. Several rule revisions are proposed to provide a framework that reasonably scopes and bounds the proposed implementation methods, and Implementation procedures are provided in a methods document that is incorporated by reference in the proposed rule.

The Class 4A narrative translator method should be implemented at locations where water is appropriated for irrigaton (Minn. R. 7050.0205, subp. 7, D)

Defining the locations where the irrigation narrative evaluates water quality provides needed clarity and aids in protecting the irrigation use based on site-specific factors.

While the water quality standard applies to all waterbodies, the MPCA may make reasonable choices to determine which discharging facilities need to have effluent limits applied to ensure that they are not causing or contributing to an exceedance of the standard. The MPCA has determined that it is appropriate to focus implementation on places where water is withdrawn for irrigation use. The MPCA is including a method, incorporated by reference in rule, to ensure that wastewater treatment plants do not cause an exceedance of the narrative irrigation standard. The method will determine whether a wastewater treatment plant would need a numeric effluent limitation that protects the narrative standard. A needed input in that wastewater effluent limit setting process is defining which waters need to be protected. Therefore, including language stating that the narrative standard would be evaluated at locations where water is appropriated for industrial consumption is needed and reasonable because it increases regulatory certainty about what waters will be reviewed in NPDES permitting.

Farmers that use surface water for irrigation appropriate water from fixed locations on surface waters of the state, and it is most important that water quality at those fixed locations is appropriately protected.

Protecting and defining the location where irrigation water drawn from surface water resources will be applied to crops ultimately allows the translator process to classify a given location as 'sensitive' or 'not sensitive' with respect to the protective level of irrigation water quality. This process starts with defining the location where water is appropriated for irrigation. Most irrigation water is applied to crops no further than two miles distant from the point at which the water is withdrawn from surface water or groundwater (See S-2, Section 4.3.1.6).

The MPCA can reasonably implement applying the standard at locations where water is appropriated for irrigation because the overwhelming majority of irrigators hold a DNR water appropriation permit, due to the volume of water needed to irrigate large farm fields. All major watersheds in Minnesota (Mississippi, Minnesota, Red River, Rainy, St. Louis) have irrigators located on the downstream reaches of the major rivers that drain them. MPCA can easily identify those users of the water using the DNR water appropriation permit database. Because there may be users of the water that do not need a DNR water appropriation permit, due to the low volume of water needed to irrigate smaller fields, MPCA wants to ensure that even small irrigators are protected using the narrative translator method. These small irrigators are not tracked in a computerized database and are very difficult to locate without on-the-ground knowledge. In order to protect their irrigation water quality needs, the MPCA would need to be informed of their existence. In the public notice for the intent to issue or reissue NPDES permits, the MPCA will request that any irrigators provide the Agency with any relevant information about existing irrigation appropriations from surface waters downstream of the permitted facility.

If there were no way to define the location where irrigation might occur, then the MPCA would have to make unreasonable assumptions about irrigation water quality needs. Starting from the point at which water is withdrawn and considering the crops and soils within two miles allows the MPCA to leverage detailed datasets of water quality and crop and soil types to make site-specific decisions.

Protective flow rate ($122Q_{10}$)

Effluent limits are developed to ensure that the applicable water quality standard is protected at a critical flow condition – usually a minimum stream flow at which it remains reasonable and appropriate to protect the beneficial use. This is usually a low flow condition, because at times of low flow, there is less water available in the receiving water to dilute the pollution contributed by permitted NPDES discharges. Minn. R. 7053.0205, subp. 7, specifies that all water quality standards must be protected to the $7Q_{10}$ flow except for the parameters of ammonia ($30Q_{10}$ flow) and phosphorus ($122Q_{10}$ or long term summer average).

In order to ensure that the effluent limits protect the beneficial use at relevant conditions, an appropriately protective stream flow rate defining the critical flow condition must be determined. This is necessary in the wastewater permit limit-setting process used to determine whether an effluent limit is needed in a wastewater permit. The MPCA is currently obligated to use the $7Q_{10}$ flow to calculate the need for Class 4A effluent limits in wastewater permits, as the 7Q10 is defined as the default critical flow conditions under Minn. R. 7050.0210, subp. 7 and applies unless another flow condition is specified.

Minn. R. 7053.0205, subp. 7, specifies that all water quality standards must be protected to the $7Q_{10}$ flow except for the parameters of ammonia ($30Q_{10}$ flow) and phosphorus ($122Q_{10}$ or long term summer average).

The $7Q_{10}$ flow represents waterbody flows under extreme low flow drought conditions because on average $7Q_{10}$ flows occur in a waterbody less than one to three percent of the time. Protecting water quality down to the $7Q_{10}$ flow is appropriately protective of the aquatic life designated use but is inappropriately protective of the irrigation use for reasons explained more below. The MPCA acknowledges that using the $7Q_{10}$ flow to protect the Class 4A designated use is inappropriately protective of irrigation, but because the current rule is unambiguous, the MPCA is obligated to use the $7Q_{10}$ flow when setting Class 4A effluent limits in wastewater permits.

The MPCA is proposing to define the protective flow rate for the Class 4A designated use water quality standards (except for wild rice) as the $122Q_{10}$. The "122-day ten-year low flow" or "$122Q_{10}$" means the 122-day June to September average flow with a one-in-ten year recurrence interval. The $122Q_{10}$ is comparable to the recurrence interval used for other flow rates, such as general toxics ($7Q_{10}$) and ammonia ($30Q_{10}$) in the sense that a one-in-ten year recurrence interval is used; however, the averaging period is expanded to an 122-day period to reflect the irrigation season average duration. A $122Q_{10}$ is derived using the same methods to derive a $7Q_{10}$, and the guidelines regarding period of record for flow data and estimating a $7Q_{10}$ apply equally to determining a $122Q_{10}$ as described in Minn. R. 7053.0135, subp.3. The $122Q_{10}$ calculation methodology would apply to streams, rivers and lakes.

Defining the appropriately protective waterbody low flow for irrigation as the $122Q_{10}$ is needed and reasonable for a number of reasons. First, it allows for a more tailored and accurate protection of the irrigation beneficial use. Second, it provides needed clarity on an essential input in the limit-setting process, and this clarity will reduce future disagreements about how to calculate the need for Class 4A limits in wastewater permits. Third, the $122Q_{10}$ is protective of water quality and flow rates during the summer growing season when irrigation occurs. Fourth, the $122Q_{10}$ flow rate is already defined in rule and was included in rule because it is a protective flow rate of the average summer waterbody conditions. Fifth, the $122Q_{10}$ flow rate is consistent with the intended summer average duration and frequency of the irrigation criteria.

Irrigation in Minnesota typically occurs during the growing season (May to October) and irrigation from surface waters is unlikely to occur when soil is frozen, frost is likely or sunlight is low. The $122Q_{10}$ is based on the 122-day period of between the start of June to the end of September which is shorter than the 184-day May to October growing season period. The MPCA evaluated developing a $184Q_{10}$ but declined to do so for several reasons. First, the 184-day period includes May, which is a very high river flow month in Minnesota and including May forces the $184Q_{10}$ high and as a result the $184Q_{10}$ is less protective of irrigation than the $122Q_{10}$. Second, the $122Q_{10}$ is already defined in rule and thus requires introducing no new flow rate definitions. Third, irrigation is least likely to occur in May and October because in May soils are typically still saturated from winter snowmelt and in October farmers rarely irrigate because drier soils makes for easier harvesting. The MPCA also considered using the flow rates the DNR specifies to limit surface water appropriations (i.e. the Class 3 protective flow rate) but declined to do so because using these flow rates would require including flow rates measured during winter months, which is an inappropriate match for the irrigation standard.

Developing an irrigation narrative translator and incorporating it into rule

Narrative translators are a key way that states ensure that narrative water quality standards are protected from wastewater dischargers. Narrative translators allow states to convert the protective goals of narrative standards into enforceable numeric wastewater effluent limitations that protect the intended designated use. Developing a narrative translator process is a federal requirement (40 CFR 122.44(d)(1)(vi)(A)) whenever a state adopts a new narrative standard.

As discussed under Section 3.D. of the SONAR, the MPCA solicited comments about the proposed irrigation narrative translator and whether to include it in rule or have a taskforce of stakeholders develop the narrative translator method outside of this rulemaking. Commenters generally preferred that the MPCA develop an irrigation narrative translator as part of this rulemaking and make it available for public comment. Several commenters specifically requested that MPCA ensure that the translator method be included in a format that ensures clear and legally defensible future uses of the translator in wastewater permitting.

The best way to include the narrative translator in rule is to incorporate it by reference. The primary reason the MPCA is proposing to incorporate the narrative translator by reference is to avoid including lengthy, detailed, and complex calculation procedures directly into rule. The proposed narrative translator is a method that requires assembling and mapping data in a way that would be too complex to write in a format that would read well in rule.

Incorporating the irrigation narrative translator guidance by reference allows the MPCA to more conveniently make changes if they are needed, though we expect changes to be infrequent. The narrative translator will be stored on https://www.pca.state.mn.us/regulations/incorporations-reference, the MPCA webpage housing documents incorporated by reference and not available through other sources.

There is no existing irrigation narrative translator method in Minnesota rule. The MPCA has never previously attempted to develop or use one in NPDES permitting, as the MPCA has not added or revised narrative standards in recent years. EPA has published no guidance documents related to irrigation water quality translators, and the MPCA could find no example of another state or tribe using an irrigation narrative translator in NPDES permitting. Most examples of translator relate to water quality standards for nutrients to protect aquatic life and recreational uses. Since there is no existing precedent to consider, the MPCA is proposing an irrigation narrative translator that considers primarily soil and crop and crop types to ensure that water quality at the point(s) where it is withdrawn for irrigation does not harm crops either directly or through soil salinization.

A narrative translator must strike a balance between protecting the designated use, providing clarity and consistency around limit calculations and not being so complex as to be unusable to regulated parties and MPCA staff. The MPCA acknowledges that wastewater permitting decisions are sometimes so specialized in their complexity that wastewater permit holders feel they need to retain permitting consultants to get appropriate counsel. Permitting consultants are not inexpensive;, for example, consulting fees of $50,000 to $100,000 would be a reasonable amount for a consulting firm to shepherd a medium sized and non-controversial municipal NPDES discharger through a permit expansion that requires an antidegradation assessment. Larger wastewater dischargers are more likely to be able to afford the resources required to hire in-house or external permitting resources than smaller wastewater permit holders such as small towns or low revenue industrial dischargers. The MPCA does not want to create a narrative translator process that is so complex that it would be unusable for the typical permittee and therefore require the services of a permitting consultant with every NPDES permit re-issuance. Creating such a process would not only unreasonably burden every permit holder but also disproportionately burden those permit holders with the least capacity to afford permitting counsel.

The proposed narrative translator method (S-4) was constructed to minimize permitting complexity while also ensuring that water quality is protected.

Several commenters requested that MPCA provide examples of how the narrative translator method will be used in NPDES permitting. It was clear that the commenters' underlying interest was in knowing whether a specific permitted facility would receive an effluent limit. The method document and descriptions of the steps provide the details of how effluent limits will be derived. The MPCA has created a detailed Tableau report that pulls together the data and maps that support effluent limit review under the Class 4A narrative standard. The Tableau report, accessible at the MPCA's webpage (S-14), estimates the likelihood that every wastewater discharger would receive a limit under the proposed rule. This Tableau page will be maintained and updated to provide information to permittees. In the regulatory analysis section, the MPCA has provided information on the likelihood that every wastewater discharger would receive a limit under the current and proposed rule and projected the probable costs of complying. Including this level of detail fulfills the need and reasonableness requirements in Minn. Stat. § 14.131 and is consistent with the purpose of the Administrative Procedures Act in Minn. Stat. § 14.001 to increase access to governmental information and to allow for informed public participation.

Reasonableness of structuring the narrative translator in the format of a flowchart

It is reasonable to structure the narrative translator process in the format of a flowchart because it improves clarity and increases consistency. Irrigation water quality assessments require evaluation of multiple factors (soil quality, water quality, appropriation locations, crop types, etc.) and a flowchart is the best way to ensure that the user is prompted to sequentially consider all relevant factors that could affect irrigation water quality.

The flow chart is structured in a step wise manner that ends at the decision on whether or not to include WQBELs in the NPDES permit in question. The flowchart contains actions (rectangles) and decisions (diamonds) that always flow into actions and was structured to have binary yes or no answers as a way to minimize vagueness. The flowchart appears in the Class 4A Translator Methods document that is proposed to be incorporated by reference, which contains all the steps for implementation (S-4).

General reasonableness of components of the Class 4A narrative translator

The Class 4A narrative translator methods document (S-4) focuses on protecting water quality so that the levels of specific conductance and sodium absorption ratio (SAR) are such as to ensure that crops are not exposed to levels of salts in irrigation water that are harmful either directly or by contributing to soil salinization. The translator looks at site-specific factors related to crops and soils and their sensitivity to salts. The TSD discusses the importance of site-specific factors (S-2).

The translator considers specific conductance and SAR in order to protect irrigation water quality from excess total salinity (specific conductance) and sodium ions that contribute to total salinity (SAR).

Specific conductance was chosen to evaluate irrigation water quality for excess salinity because it is widely accepted and commonly used in the irrigation water quality literature as the industry standard measurement of salinity (Wallender & Tanji, 2011; Ayers & Wescot, 1994). Furthermore:

- Specific conductance is the most convenient way to measure salinity in water and soils. It is cheap, easy, and reliable, can be measured in the field, and provides instantaneous results.
- Specific conductance is predictive of total salinity with a high degree of certainty (ASAM 2011, FAO 1994). It is widely accepted as a surrogate for total dissolved salts or total salinity.
- MPCA has collected sufficient ambient water quality data to characterize water quality for specific conductance.
- Soil salinity has been characterized using specific conductance in Minnesota.
- Specific conductance has been used in the literature to characterize the sensitivity of usually grown crops in the area with respect to excess salinity.

The sodium adsorption ratio (SAR) was chosen to protect irrigation water quality from specific ion effects associated with excess sodium. SAR is widely accepted and used in the irrigation water quality literature as the industry standard measurement that protects crops and soils from excess sodium (Wallender & Tanji, 2011; Ayers & Wescot, 1994). Furthermore:

- The SAR is built on the idea that sodium damage to crops and soils varies as a ratio of the amount of hardness in the water.
- Soil SAR has been characterized for soils in Minnesota.
- MPCA has collected sufficient ambient water quality data to characterize water quality for SAR.

E. Livestock and wildlife (Class 4B): Numeric standards

The rationale for why the specific Class 4B total salinity and pH numeric values were chosen was not well-documented during the original 1967 Class 4B water quality standards rulemaking. Because of this, and simply because of the length of time since these values were promulgated, it is reasonable to conduct a review of the appropriate parameters and concentrations to be included in Class 4B, to ensure the WQS are based on the most up-to-date science. Based on that review, the MPCA proposes to replace the current Class 4B salinity standard with a total dissolved solids standard, retain the current numeric pH standards, add new numeric standards for sulfate and nitrate + nitrite, and retain the current narrative standards. The MPCA will also add duration and frequency components for the Class 4B numeric standards. The general reasonableness of the proposed changes are discussed in the sections below.

Maintaining Class 4B livestock and wildlife uses on all waters of the state

The MPCA proposes that every water of the state remain designated for livestock and wildlife use. Limiting the applicability of the livestock and wildlife drinking water use to certain waters is not reasonable, because wildlife has the potential to use all waters of the state. Limiting the livestock designated use to where feedlot operations occur, as some commenters suggested, would require removing the designated use from every water of the state not currently used for feedlot consumption; this would be thousands of waters. Removing a designated use (as described in previous sections of this SONAR) requires substantial effort for each water so designated. Finally, the livestock and wildlife designated use protects waters for current and future use by terrestrial animals. The MPCA cannot predict what waters feedlot operators might want to appropriate water in the future. Therefore, it is reasonable and prudent to maintain the livestock and wildlife designated use for every water in the state.

Adding an appropriate duration and frequency; a 30-day averaging period, not to be exceeded.

The duration and frequency of the standards are not clearly defined for the Class 4B use. Prior to the CWA, it was common practice not to specify the duration and frequency of the standards and to only include the magnitude in rule. The Class 4B standards do have an implied frequency component in rule, as shown in the statement, “The standards for substances, characteristics, or pollutants given below shall not be exceeded in the waters of the state.” Therefore, the current standards for 4B have a “never to exceed” component for frequency, but lack a duration component—though “never to exceed” is often interpreted as an instantaneous measurement. All of these factors have contributed to the lack of certainty in these standards. The MPCA is proposing a 30-day averaging period for the livestock and wildlife standards because the effects of the Class 4B parameters are generally exhibited after long-term exposure to the parameters. A short-term exposure to these contaminants will not result in extensive adverse effects. Most studies evaluating these contaminants demonstrated effects between 30 and 120 days (see S-2, Section 5.4.7). Therefore, a 30-day averaging period with a never to exceed frequency is reasonable for the Class 4B standards. It is reasonable to add a duration component and clarify the frequency of the Class 4B standards because this will modernize the standards and aid in implementation.

Using livestock data for the most sensitive livestock species as a surrogate data for wildlife species

Most data related to effects of water quality on terrestrial animals are centered on livestock or laboratory species, rather than wildlife species. The MPCA is proposing to use the information available for livestock species as surrogate data for terrestrial wildlife species. Where wildlife data was available, this information was used as well. Given that the data available for wildlife species is limited, it is reasonable to use these livestock data as surrogates for wildlife data. The MPCA is reasonably choosing a value that protects the most sensitive livestock species. The recommended guidance for the amount of total dissolved solids in drinking water varies with the species of interest, with poultry and dairy cattle as the most sensitive. The toxicity of saline water to birds differs among species. Birds that are associated with aquatic environments appear to be less sensitive to saline waters than typical nonaquatic poultry species (See S-2, Section 5.4 for discussions and references) Ruminant (animals with multi-chamber stomachs) livestock species such as cattle and goats are most sensitive to sulfate and nitrate in the water.

Clarifying the language that Class 4B standards are intended to be applied to protect the livestock and wildlife drinking water use.

The State of Minnesota established the Class 4B water quality standards in 1967 and made revisions in 1973 and 1981; these standards have not been updated since that time. Only limited supporting documentation exists to explain the basis for these standards, including a good definition of the beneficial use that was intended to be protected. The Class 4B standards lack information that explains how they are intended to be applied to protect the livestock and wildlife drinking water use. It is reasonable for the MPCA to add language to the rule clarifying that these standards protect livestock and wildlife for the consumption of drinking water.

Changing the current Class 4B salinity standard to a standard based on total dissolved solids

Total salinity is an outdated measure of salts in the water. No current monitoring is done measuring total salinity. Total dissolved solids is more frequently used to measure the dissolved salts in water. Total dissolved solids is the measure of the sum of the inorganic and organic solids in water that are smaller than two microns, often used in fresh water as a measure of salinity and water quality. Commonly, the ionic makeup of total dissolved solids includes the cations calcium, sodium, magnesium and potassium, as well as the anions chloride, sulfate, nitrate, and carbonates; but all dissolved ions present in the water contribute to total dissolved solids (U.S. EPA Office of Water Regulations and Standards, 1986; Weber-Scannel & Duffy, 2007.) Total dissolved solids is a quantitative measure of all dissolved constituents, and does not differentiate between any individual ions that make up the total solids. While an assessment of individual ion toxicity would be ideal, there is a general lack of data for individual ions with most research being conducted only based on total dissolved solids (Raisbeck et al., 2008.) Therefore, it is reasonable to replace the current salinity standard with one based on total dissolved solids to provide protection for livestock and wildlife uses.

Maintaining the current pH numeric standards

The MPCA is proposing to maintain the current numeric standards for pH (minimum and maximum of 6.0 and 9.0 respectively). No conclusive studies exist in the literature that indicate a change in this pH range in needed to protect livestock and wildlife. More acidic waters (lower pH) would likely be acceptable and tolerated by livestock and wildlife. However, because lower pH can cause leaching of toxic substances, such as metals, from water distribution pipes, a pH of 6 is being maintained for this use class. Therefore, it is reasonable to maintain the current numeric standards for pH.

Adding new numeric sulfate and nitrate + nitrite standards

During the review of information about effects of pollutants on livestock and wildlife, some common parameters were noted to have effects after consumption through water. While there were other parameters that may produce adverse effects in livestock and wildlife, the parameters of sulfate and nitrate + nitrite were chosen for development of new numeric standards, based on data availability, and the pervasiveness of these parameters in Minnesota. Sulfate can cause neurological disorders and reduction in performance, thereby impacting the designated use. There is limited wildlife information, but using livestock as a surrogate and using the most sensitive livestock species should protect wildlife. High intake of nitrate + nitrite can cause methemoglobinemia, potentially leading to death and thus, impacting the designated use.

F. Wetlands Use: Reorganization of Rule language

The wetland standards currently in Class 3D and 4C were added in 1993. The SONAR written for that rulemaking gives background on why the standards were chosen, and it is apparent that most of the standards were not put in place with the intention of protecting the industrial consumption and agricultural designated uses, but rather to protect the known or perceived quality of the wetland itself. Therefore, in revising the Class 3 and 4 standards, MPCA is proposing changes to Class 3D and 4C that reflect the appropriate protections necessary for the designated uses. This, in some cases, involves moving standards to Class 2D, which protects wetlands for “a healthy community of aquatic and terrestrial species indigenous to wetlands, and their habitats.” The protections in Class 3D and 4C that are related to maintaining natural wetland conditions are better suited in Class 2D, where the standards are intended to protect wetland habitat and species. Wetlands will maintain their uses in Class 3, 4A, and 4B as being protected for use for industrial consumption, irrigation, livestock and wildlife, respectively, but the organization of the standards will be slightly different to more clearly define wetland designated uses. More detail and information about the changes to wetlands can be found in S-2, Section 6 I.) and in the section on specific reasonableness of the rule changes.

G. Other beneficial uses

Several commenters have raised concerns that the MPCA’s entire proposal is unreasonable because it does not ensure the protection of water quality necessary to support the other beneficial use classes in Minnesota’s water quality standards. These comments have particularly been raised by Tribal Nations in Minnesota as a major concern and impediment to the adoption of the rules.

Although none of the commenters have provided specific citations, they appear to rely on the language of 40 CFR § 131.6, which lays out the elements that must be included in water quality standards submitted to EPA for review and approval.

§131.6 Minimum requirements for water quality standards submission.

The following elements must be included in each State's water quality standards submitted to EPA for review:

> *(a) Use designations consistent with the provisions of sections 101(a)(2) and 303(c)(2) of the Act.*
>
> *(b) Methods used and analyses conducted to support water quality standards revisions.*

(c) Water quality criteria sufficient to protect the designated uses.

(d) An antidegradation policy consistent with §131.12.

(e) Certification by the State Attorney General or other appropriate legal authority within the State that the water quality standards were duly adopted pursuant to State law.

(f) General information which will aid the Agency in determining the adequacy of the scientific basis of the standards which do not include the uses specified in section 101(a)(2) of the Act as well as information on general policies applicable to State standards which may affect their application and implementation.

The MPCA has met the requirements of 40 CFR § 131.6. This SONAR and the TSD (S-2) lay out the methods and analyses conducted to support the revisions, and the narrative standard (criteria) adopted is sufficient to protect the specific designated uses defined by this revision – the industrial and agricultural uses.

The Clean Water Act (40 CFR § 131.11) requires states to adopt water quality standards that protect the beneficial uses for each use classification. The specified use and the related criteria or standard are fundamentally paired. The water quality standards developed for Class 3 and 4 only ensure that the intended designated use is protected (i.e., industrial consumption, irrigation, livestock or wildlife). A water quality standard in one class does not protect for a designated use in another class. Minn. R. 7050.0140 and 40 CFR § 131.10 intentionally require distinct designated uses to ensure that tailored water quality protections are developed that are specific only to the designated use.

A primary driver of these comments is clearly a belief that the removal of the existing Class 3 and 4A numeric standards will results in increases of the levels of pollutants of concern – such as specific conductance and sulfates – in Minnesota's waters. The MPCA has stated throughout development of the rule that we do not expect that the rule changes will result in increases in the pollutants at issue (those that currently have numeric Class 3 and 4 standards, because of the detailed implementation procedures. Comments from Grand Portage state that this seems inconsistent with other MPCA statements about data showing an increase in salt concentrations in Minnesota's waters.

The MPCA is concerned about the levels of salts in Minnesota's waters, and we do know that salts/ionic pollutants cause problems for aquatic life – including macroinvertebrates and plants. But because of the implementation procedures being established, we do not expect permitted dischargers to increase their discharge of ionic pollutants. Most of MPCA's statements about increased salt concentration refers specifically to one salt, chloride, which overwhelmingly enters Minnesota's waters through de-icing salt or from municipal wastewater plants that receive water from homes that are using water softeners. Minnesota has a Class 2 water quality standard for chloride that protects the beneficial uses of aquatic life and recreation. The Class 2 chloride standard is not changed in this rulemaking.

The mechanism for ensuring aquatic life is protected is through the Class 2 aquatic life standards. To address concerns, the MPCA has put forward a detailed implementation procedure for the Class 2 aquatic life biological standard that is designed to review the potential for salty parameters to harm invertebrates, and should also protect aquatic plants.

6. Specific reasonableness of the amendments

The discussion in Section 5 of the SONAR provides the MPCA's justification for major concepts and general topic areas of the proposed revisions that required extensive discussion. The following discussion identifies each of the proposed rule amendments and either provides a justification for it or directs the reader to the section of the SONAR that provides a more complete discussion of the reasonableness of that requirement.

The proposed amendments will result in renumbering or changes to the lettering of several items and subitems in Minn. R. chs. 7050 and 7053. Formatting changes are made through the authority of the Revisor under Minn. Stat. § 3C.10, and the MPCA is not required to provide a statement of reasonableness for those changes. Additionally, minor language changes to Minn. R. chs. 7050 and 7053 to conform to the standard formatting practices of the Revisor will not be justified.

A. Chapter 7050, Waters of the State

1) 7050.0186 Wetland standards and mitigation

This part establishes standards applicable to wetlands and relevant mitigation.

Subp. 1. Subpart 1 establishes the policy of the state with respect to wetlands and their beneficial uses. The MPCA is proposing changes to move language from other areas of Minn. R. ch. 7050 to more closely associate the beneficial uses with agricultural or wildlife uses, reflect changes to other applicable rule parts, and minor formatting changes to adhere to the standard formatting practices of the Revisor.

The changes proposed in this subpart reasonably reorganize the location of the wording that maintains wetland functions of erosion control, groundwater recharge, low flow augmentation, storm water retention and stream sedimentation. These functions of wetlands are currently listed in the narrative in Minn. R. 7050.0224, subp. 4, but are not strictly associated with agricultural or wildlife beneficial uses. Instead, they are general functions of wetlands that could impact many different beneficial uses. Therefore, including these functions in this subpart and joining them with the existing sentence, which also characterizes the functions of wetlands to be protected, is a reasonable change that does not alter the protections given to wetlands.

The MPCA is also amending relevant cross references to Minn. R. 7050.0223 and 7050.0224 to reflect the changes discussed under those parts below. The word “shall” is being replaced with “must” to conform to the standard formatting practices of the Revisor.

2) 7050.0210 General standards for waters of the state

Part 7050.0210, subp. 7 establishes the minimum stream flow for point and nonpoint sources of water pollution. The MPCA is proposing to amend this subpart to add a cross reference to proposed requirements under Minn. R. ch. 7053.

The changes proposed in this subpart reasonably add Minn. R. ch. 7053 as a location that contains appropriate minimum stream flow conditions for controlling point sources of water pollution. Minimum stream flow conditions that differ from the $7Q_{10}$ have been listed in Minn. R. 7053.0205, subp. 7, and the MPCA is proposing to add further minimum stream flow rates to that subpart in this rulemaking. See SONAR part 5.D. for the discussion on why it is reasonable to propose these additional minimum stream flow rates. The MPCA also proposes minor language changes under Minn. R. 7050.0210, subp. 7 to conform to the standard formatting practices of the Revisor.

3) 7050.0218 For toxic pollutants: Definitions and methods for determination of human health-based numeric standards and site-specific numeric criteria for aquatic life, human health, and fish-eating wildlife

Part 7050.0218, subp. 4, item B. is being amended to reflect changes in cross-references. (Minn. R. 7050.0430 and 7050.0425 now point to 7050.0415)

4) 7050.0220 Specific water quality standards by associated use class

This part establishes specific water quality standards by associated use classes.

Part 7050.0220, subp. 1. The MPCA is proposing to simplify the beneficial use classes by condensing and removing certain subclasses and amending cross references to reflect changes to Minn. R. ch. 7050. In addition, the MPCA is proposing minor formatting changes to adhere to the standard formatting practices of the Revisor.

Items A to D. The MPCA is proposing removing the subclasses 3A, 3B, 3C, and 3D, condensing them into a single Class 3 use. Additionally, the MPCA is removing the Class 4C subclass for wetlands, and designating those wetlands as Class 4A and 4B instead. The reasonableness of these changes is fully explained in the general reasonableness section. Because of the removal of these subclasses, subpart 1, items (A) to (D) have been updated to reflect those changes in how the beneficial uses are classified.

Subp. 2. This existing subpart establishes background and relevant information necessary to interpreting use class tables. The changes in this subpart reflect the changes to the standards in Classes 3 and 4.

Item D. This item defines abbreviations and acronyms used throughout the use class standards listed under subparts 3a, 4a, 5a, and 6a. The MPCA is proposing to delete references to "IC" under item D. IC in the table header "means industrial consumption, class 3 waters". Because the Class 3 beneficial use will no longer have numeric standards, it is reasonable to remove the Class 3 use from the tables. Therefore, the explanation of the table header "IC" is no longer needed.

Item F. This item states that when multiple standards exist, the most stringent standard applies, per Minn. R. 7050.0450. The MPCA is proposing to repeal Minn. R. 7050.0450, which explains how multiple beneficial use classifications apply to a single waterbody, and move the language to the new Minn. R. 7050.0415. However, the statement that the most stringent standard applies reasonably stands alone, without need to reference any other rule parts. This item also describes that classes without associated numeric standards are not included in the tables. Prior to the proposed rulemaking this only applied to the Class 6 beneficial use. The MPCA is proposing to have the Class 3 beneficial use not have numeric standards, so the agency is proposing to add Class 3 to the existing Class 6 reference in this item. These changes are reasonable because they clearly demonstrate which beneficial uses apply.

Items A, B, and C. In items A, B, and C, all of the table headers include "IR" under the 4B heading. This is an error in the tables, because "IR" stands for irrigation, and Class 4B protects for livestock, not irrigation. This error is being reasonably corrected by replacing "IR" with "LS" for livestock in all headers of the tables for Class 4B.

The tables in items A, B and C are also being updated to reflect the changes being made to the Class 3 and 4 standards (see Table 5). Because the water quality standard for Class 3 (industrial consumption) is becoming a narrative standard and will no longer have associated numeric values, that column (headed 3A/3B IC) is removed from the tables. The Class 4A irrigation standards will retain only numeric values for boron and sulfate where wild rice is present. In the cases of bicarbonates, hardness, salinity, sodium, specific conductance, and total dissolved salts, the pollutant listed is removed from the table since the only numeric values exist in Class 3 or 4, and there will no longer be a numeric value associated with it. Subsequent items are therefore renumbered. For nitrate + nitrite, sulfate, and total dissolved solids, values are being added to the table in item A to include the numeric standards being added to Class 4B for those pollutants (see specific reasonableness for part 7050.0224 for the reasoning for adding those numeric values).

Table 5. Part 7050.0220, subp. 3a(A). Miscellaneous Substance, Characteristic, or Pollutant (Abbreviated table excluding (1) amendments that are simply renumbering, or (2) unamended text).

2A CS	2A MS	2A FAV	1B DC	3A/3B IC	4A IR	4B ~~IR~~ LS	5 AN
~~(3) Bicarbonates (HCO_3, meq/L~~ ~~230~~	-	-	-	-	5	-	-
~~(5)~~ (4) Chloride, mg/L 230	860	1,720	250(S)	~~50/100~~	-	-	-
~~(16) Hardness, Ca+Mg as $CaCO_3$, mg/L~~ ~~-~~	-	-	-	~~50/250~~	-	-	-
~~(18)~~ (16) Nitrate as N, mg/L -	-	-	10	-	-	- 100	-
~~(24)~~ (22) pH minimum, su 6.5	-	-	6.5(S)	~~6.5/6.0~~	6.0 -	- 6.0	6.0
~~(25)~~ (23) pH maximum, su 8.5	-	-	8.5(S)	~~8.50/9.0~~	8.5 -	9.0	9.0
~~(27) Salinity, total, mg/L~~ -	-	-	-	-	-	~~1,000~~	-
~~(28) Sodium, meq/L~~ -	-	-	-	-	~~60% of total cations~~	-	-
~~(29) Specific conductance at °25C,~~ -	-	-	-	-	~~1,000~~	-	-
~~(30)~~ (25) Sulfate, mg/L -	-	-	250(S)	-	-	- 600	-
~~(33) Total dissolved salts, mg/L~~ -	-	-	-	-	~~700~~	-	-
~~(34)~~ (27) Total dissolved solids,mg/L -	-	-	500(S)	-	-	- 3,000	-

Subp. 4a. This subpart establishes standards applicable to cool and warm water aquatic life and habitat, drinking water, and associated use classes. The MPCA is proposing amendments to reflect changes to the beneficial use classes.

The MPCA is removing the subclasses 3A, 3B, 3C and 3D, condensing them into a single Class 3 use. The tables in items A, B and C are being updated to reflect the changes being made to the Class 3 and 4 standards (see Table 6). Because the water quality standards for Classes 3 and 4A are becoming narrative standards and will no longer have numeric values associated with them, except for boron, the columns for Class 3 are being removed from the tables. In the cases of bicarbonates, hardness, salinity, sodium, specific conductance, sulfates (where there is wild rice present), and total dissolved salts, the pollutant is removed from the table since the only numeric values exist in Class 3 or 4, and there will no longer be a numeric value associated with it. For nitrate + nitrite, sulfate, and total dissolved solids, values are being added to the table in item A to include the numeric standards being added to Class 4B for those pollutants (see specific reasonableness for part 7050.0224 for the reasoning for adding those numeric values).

Table 6: Part 7050.0220, subp.4a(A). Miscellaneous Substance, Characteristic, or Pollutant (Abbreviated table excluding (1) amendments that are simply renumbering, or (2) unamended text).

2Bd CS	2Bd MS	2Bd FAV	1B/1C DC	~~3A/3B~~ IC	4A IR	4B LS	5 AN
~~(3) Bicarbonates (HCO_3), meq/L~~ -	-	-	-	-	~~5~~	-	-
~~(5)~~(4) Chloride, mg/L 230	860	1,720	250(S)	~~50/100~~	-	-	-
~~(16) Hardness, Ca+Mg as CaCO3, mg/L~~ ~~-~~	-	-	-	~~50/250~~	-	-	-
~~(18)~~ (16) Nitrate as N, mg/L -	-	-	10	-	-	- 100	-
~~(24)~~ (22) pH minimum, su 6.5	-	-	6.5(S)	~~6.5/6.0~~	~~6.0~~	6.0	6.0
~~(25)~~ (23) pH maximum, su 9.0	-	-	8.5(S)	~~8.5/9.0~~	~~8.5~~	9.0	9.0
~~(27) Salinity, total mg/L~~ ~~-~~	-	-	-	-	-	~~1,000~~	-
~~(28) Sodium, meq/~~L -	-	-	-	-	~~60% of total cations~~	-	-
~~(29) Specific conductance at 25 °C, µmhos/cm~~ ~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~1,000~~	~~-~~	~~-~~
~~(30)~~ (25) Sulfate, mg/L -	-	-	250(S)	-	-	- 600	-

2Bd CS	2Bd MS	2Bd FAV	1B/1C DC	~~3A/3B~~ IC	4A IR	4B LS	5 AN
~~(33) Total dissolved salts, mg/L~~ ~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~700~~	~~-~~	~~-~~
~~(34)~~ (27) Total dissolved solids, mg/L -	-	-	500(S)	-	-	3,000	-

Subp. 5a. This subpart establishes standards applicable to cool and warm water aquatic life and habitat, drinking water, and associated use classes. The MPCA is proposing amendments to reflect changes to the beneficial use classes.

Items A, B, and C. The MPCA is proposing to remove subclasses 3A, 3B, 3C, and 3D, condensing them into a single Class 3 use. The tables in items A, B and C are being updated to reflect the changes being made to the Class 3 and 4 standards (see Table 7). Because the water quality standard for Class 3 (industrial consumption) is becoming a narrative standard and will no longer have associated numeric values, that column (headed 3A/3B IC) is being removed from the tables. The Class 4A irrigation standards will retain only numeric values for boron and, where wild rice is present, sulfate. In the cases of bicarbonates, hardness, salinity, sodium, specific conductance, and total dissolved salts, the pollutant listed is removed from the table since the only numeric values exist in Class 3 or 4 and there will no longer be a numeric value associated with it. Subsequent items are therefore renumbered. For nitrate+nitrite, sulfate, and total dissolved solids, entries are being added to the table in item A to include the standards being added to Class 4B for those pollutants (see specific reasonableness for part 7050.0224 for the reasoning for adding those numeric values). To account for the adjustments to the wetland standards, an entry for settleable solids is being added to the table in item A, and the information for chloride is being edited in item A. See the specific reasonableness for part 7050.0222 for information about the inclusion of chloride and settleable solids in Class 2D.

Table 7: Part 7050.0220, subp. 5a(A). Miscellaneous Substance, Characteristic, or Pollutant (Abbreviated table excluding (1) amendments that are simply renumbering, or (2) unamended text).

2B&D CS	2B&D MS	2B&D FAV	~~3A/3B/3C~~ ~~IC~~	~~4A~~ ~~IR~~	4B LS	5 AN
~~(2) Bicarbonate (HCO3), meq/L~~ ~~-~~	-	-	-	5	-	-
~~(3)~~ (2) Chloride, mg/L 230 See item F	860	1,720	~~50/100/250~~	-	-	-
~~(9) Hardness, Ca+Mg as CaCO3, mg/L~~ ~~-~~	-	-	~~50/250/500~~	-	-	-

2B&D CS	2B&D MS	2B&D FAV	~~3A/3B/3C IC~~	~~4A IR~~	4B LS	5 AN
(9) Nitrate as N, mg/L -	-	-	-	-	100	-
~~(13)~~ (12) pH minimum, su 6.5 See item E	-	-	~~6.5/6.0/6.0~~	~~6.0~~	6.0	6.0
~~(14)~~ (13) pH maximum, su 9.0 See item E	-	-	~~8.5/9.0/9.0~~	~~8.5~~	9.0	9.0
~~(16) Salinity, total, mg/L~~ ~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~1,000~~	-
(15) Settleable solids, mL/L See part 7050.0222, subpart 6	-	-			-	-
(17) Sodium, meq/L -	-	-	-	~~60% of total cations~~	-	-
~~(18) Specific conductance at 25 °C, μ mhos/cm~~ ~~-~~	~~-~~	~~-~~	~~-~~	~~1,000~~	~~-~~	~~-~~
~~(19)~~ (16)~~-~~Sulfate, mg/L -	-	-	-		600	-
~~(20)~~ (17) Temperature, °F See item ~~G~~ H	-	-	-	-	-	-
~~(21) Total dissolved salts, mg/L~~ ~~-~~	~~-~~	~~-~~	~~-~~	~~700~~	~~-~~	~~-~~
(18) Total dissolved solids, mg/L -	-	-			3,000	-
~~(22)~~ 19 Total suspended soli+ds (TSS), mg/L See part 7050.0222, subpart 4	-	-	-	-	-	-

Proposed item F. Item F was added to clarify that the chloride standard associated with Class 2D waters (wetlands) differs from the Class 2B standard listed in the table. The phrase "See item F" is being added to the entry for chloride under the 2B&D column, to direct the reader to item F, where the chloride standard for Class 2D waters is given. This is reasonable, as it follows the existing format as pH in the same table. The pH value for Class 2B waters is given, but the entry also directs the reader to item E to find the pH standard for Class 2D waters. The reasonableness of the chloride standard for Class 2D waters is provided below in the section for Minn. R. 7050.0222, subpart 6.

Subp. 6a. This subpart establishes use classes for limited resource value waters. The MPCA is proposing amendments to reflect changes to the beneficial use classes.

Item A. As described below, the MPCA is removing the subclasses 3A, 3B, 3C and 3D, condensing them into a single Class 3 use. Additionally, because the water quality standard for Class 3 is becoming a narrative standard and will no longer have associated numeric values, the columns for Class 3 are being removed from the table in item A (seeTable 8). In the cases of bicarbonates, boron, chloride, hardness, salinity, sodium, specific conductance, and total dissolved salts, the pollutant listed is removed from the table since the only numeric values exist in Class 3 or 4 and there will no longer be a numeric value associated with it. Subsequent items are renumbered. For nitrate + nitrite, sulfate, and total dissolved solids, entries are being added to the table to include the numeric standards being added to Class 4B for those pollutants (see specific reasonableness for part 7050.0224 for the reasoning for adding those numeric values).

Table 8: Part 7050.0220, subp. 6a(A). Limited resource value waters and associated use classes (Abbreviated table excluding (1) amendments that are simply renumbering, or (2) unamended text).

7 **Limited resource value**	**3C** **1C**	**4A** **IR**	**4B** **LS**	**5** **AN**
~~(1) Bicarbonates (HCO_3), meq/L~~ ~~-~~	~~-~~	~~5~~	~~-~~	~~-~~
~~(2)~~ (1) Boron, µg/L -	-	500	-	-
~~(3) Chloride, mg/L~~ ~~-~~	~~250~~	~~-~~	~~-~~	~~-~~
~~(4)~~ (2) *Escherichia (E.) coli* bacteria, organisms/100mL See item B	-	-	-	-
~~(5) Hardness, Ca+Mg as $CaCO_3$, mg/L~~ ~~-~~	~~500~~	~~-~~	~~-~~	~~-~~
(4) Nitrate as N, mg/L -			100	-
~~(8)~~ (6) pH minimum, su 6.0	6.0	6.0	6.0	6.0

7 **Limited resource value**	**3C** **1C**	**4A** **IR**	**4B** **LS**	**5** **AN**
~~(9)~~ (7) pH maximum, su 9.0	9.0	8.5	9.0	9.0
~~(11) Salinity, total, mg/L~~ -	-	-	~~1,000~~	-
~~(12) Sodium, meq/L~~ -	-	~~60% of total cations~~	-	-
~~(13) Specific conductance at 25 °C, μmhos/cm~~ -	-	~~1,000~~	-	-
(9) Sulfate, mg/L -			600	-
~~(15) Total dissolved salts, mg/L~~ -	-	~~700~~	-	-
(10) Total dissolved solids, mg/L -			3,000	-

5) 7050.0222 Specific water quality standards for Class 2 waters of the State; aquatic life and recreation

This part establishes and lists the water quality standards for the Class 2 beneficial use, which includes aquatic life and recreation. The changes in this part relate to the wetlands beneficial use subclass.

Subp. 6. This subpart establishes specific water quality standards for Class 2D waters (wetlands).

Item A. The MPCA proposes to move chloride and settleable solids standards to subpart 6, item A to better protect wetlands. The standards for chloride and settleable solids to protect wetlands are being moved to Class 2D from Classes 3D and 4C, respectively (see Table 9). This is being done to better protect the intended designated use, which is the wetland community. Additional language is also being added to the chloride standard to clarify the original intent of establishing this standard.

- *Standard for chloride.* The Class 3D standard for chloride of "maintain background" was originally included in Class 3D to account for the fact that at least one prairie pothole wetland (Salt Lake) in far western Minnesota has chloride values far higher than the typical low numeric values in the rest of the state. Limiting wetlands to a specific value for chloride could result in harming the wetland community by reducing chloride to a level that would functionally change the wetland community. The SONAR for the rule that added the wetland standard for chloride makes clear that this standard was developed to protect the wetlands, not the industrial use (MPCA, 1993; see section 6 in TSD, S-2, for further discussion). Therefore, the MPCA plans to move the chloride Class 3D standard to Class 2D. The Class 2 beneficial use class is better to protect wetland communities as a kind of aquatic life, and all unlisted wetlands are designated Class 2D. Moving the "maintain background" standard to Class 2D allows the protection afforded in Class 3D to remain, so no protections would be lost by removing this standard from Class 3D. Because there are existing chloride numeric standards in Class 2B, the protection for high-chloride wetlands is still potentially needed for any wetlands with natural background concentrations higher than the Class 2B standard. The MPCA is also clarifying the intent of the standard, by changing the standard to read: "If background is higher than the Class 2B chloride standard, maintain background." The intent of the existing standard was not to maintain all wetlands at background concentrations, but to prevent wetlands that naturally exceeded the industrial use standards from being held to those lower, specific numeric standards. Therefore, it must be changed to reflect this understanding.

- *Standard for settleable solids.* This narrative standard, currently included in Class 4C, states that concentrations should not "create the potential for significant adverse impacts on one or more designated uses." This language indicates that settleable solids can impact multiple designated uses, but it is unclear as to why it was placed in Class 4C (see section 6 , S-2 for further discussion). All unlisted wetlands are designated Class 2D, so it is reasonable to put the narrative in that class, since increased solids could clearly cause adverse effects to aquatic life. Moving this standard to Class 2D also retains all existing protections. The word "shall" is being replaced with "must" to bring the rule language up to date with the current practice of the Revisor.

Table 9: Part 7050.0222, subp. 6(A) (Abbreviated table excluding (1) amendments that are simply renumbering, or (2) unamended text).

Substance, Characteristic, or Pollutant	Class 2D standard
Chloride (Cl)	If background is greater than the class 2B chloride standard, maintain background
Settleable solids	Must not be allowed in concentrations sufficient to create the potential for significant adverse impacts on one or more designated uses

6) 7050.0223 Specific water quality standard for class 3 water for the State; industrial consumption

Part 7050.0223, establishes standards for Class 3 waters (industrial consumption).

Subp. 1. The MPCA is proposing changes to subp. 1 to conform to the formatting standards of the Revisor. In addition, the agency is moving language on the narrative standard to subp. 2.

The MPCA is proposing to eliminate the numeric values, so this section does not need to refer to the numeric water quality standards. The grammar was corrected accordingly. The last sentence was moved to subp. 2 and altered to aid in describing the narrative standard. This makes a description of the beneficial use the focus of subp. 1.

Subp. 2. This subpart establishes the narrative and numeric standards for industrial consumption. The MPCA is proposing changes to the narrative standard and removal of the numeric values.

The MPCA is editing the narrative standard and eliminating the numeric values. This subpart, which currently contains language on the Class 3A subclass and related standards, will contain the entirety of the Class 3 standards, as the Class 3 subclasses have been deemed unnecessary and are being deleted. The designation of Class 3 subclasses was not done to protect specific industrial consumers or uses, but was rather likely done presumptively in conjunction with the assignment of aquatic life or drinking water designated uses. For example, waters that are protected for cold water communities (trout waters) also have a Class 3A or 3B designation. This protective designation was not given to those waters because industries needed greater protection for the water they were consuming, but rather to further protect those sensitive, unique aquatic life communities (TSD section 2.3.1). The MPCA finds that kind of protection is better placed in Class 2 standards. The narrative standard in the updated subpart 1 will apply to all waters, and account for differences in needs for different industries, rather than having waters assigned to different subclasses.

The specific language for the narrative standard is being altered to include language from subparts 3 and 4 that is important to the overall narrative standard (see discussions in sections below). The word "shall" is being replaced with "must" to bring the rule language up to date with current rule language requirements.

Subp. 3. Subp. 3 currently describes the quality needed for Class 3B waters to support general industrial purposes.

The MPCA is deleting most of this subpart to eliminate the separate subclasses of Class 3. The designation of Class 3 subclasses was not done to protect specific industrial consumers, but was rather likely done presumptively in conjunction with the assignment of aquatic life or drinking water designated uses (see previous discussion). MPCA is retaining the reference to "general industrial purposes" to ensure that the narrative standard protects the same components of the designated use: general industrial purposes from the Class 3B language and industrial cooling from the Class 3C language. All of the language retained from the three subparts will be combined into 7050.0223, subp. 2.

Subp. 4. Subp. 4 currently describes the quality needed for Class 3C waters to support industrial cooling and materials transport. The MPCA is proposing various changes to accommodate the condensing of subclasses, retaining all the important components of the standards.

The MPCA is deleting this subpart to eliminate the separate subclasses of Class 3, as described in the previous section. However, MPCA is retaining and shifting some of the narrative language into subpart 2, which contains the beginning of the narrative standard. Retaining the language about avoiding severe fouling, corrosion or scaling is important, because this language clearly describes the appropriate properties of Class 3 waters. It also ensures that the original benficial use is still being protected. The phrase "or other unsatisfactory conditions" was removed because it is vague and is hard to define what would constitute an unsatisfactory condition because different industries would define the word unsatisfactory differently. This provides additional clarity to the rule language, and so it is reasonable to make this change.

Subp. 5. This subpart establishes protections for wetlands. The MPCA is proposing various changes to accommodate the condensing of subclasses and to ensure that the established standards are appropriately linked to the right beneficial use.

The MPCA is deleting this subpart to eliminate the separate subclasses of Class 3. The designation of Class 3 wetland standards was not done to protect industrial consumers, but was rather done to protect wetlands with natural levels of chloride, hardness and pH that exceeded any of the Class 3 standards. For example, a wetland with naturally low pH would not be suitable to use for industrial processes, because low pH could corrode pipes. Maintaining background low pH protects the natural wetland community, not the industrial designated use. The narrative standard in the updated subpart 1 will apply to all waters, including wetlands, account for differences in needs for different industries, and protect the appropriate designated use.

Wetlands have "maintain background" standards for pH already in place in Class 2D. The "maintain background" standard for chloride is being moved to Class 2D, where it more appropriately protects the aquatic life designated use for wetlands (see the discussion for part 7050.0222). For hardness, unlike chloride and pH, there are no other hardness standards in rule that could inappropriately result in a high hardness wetland being held to a lower hardness standard. So, as considered for this rulemaking, if the Class 3A, 3B, and 3C hardness numeric values are removed, there will no longer be standards that would cause an inappropriate hardness standard for a high hardness wetland. Therefore, the "maintain background" standard for hardness can reasonably be removed. Effects of hardness to the industrial use are being addressed by the narrative standard for Class 3 waters, which include wetlands.

Subp. 6. This subpart establishes that additional limits may be imposed on waters of the state and contains a prohibition on the discharge of wastes in a manner that would prevent the Class 3 waters of the state for being usable as a source of industrial water supply. The MPCA is proposing to delete this subpart. The ability to impose "additional selective limits" represents a degree of agency discretion that is no longer considered appropriate in water quality standards. If additional requirements are needed to protect the Class 3 beneficial use, the MPCA would impose those through rulemaking or a site-specific standard process. (Site-specific standard authority exists in Minn. R. 7050.0220, subp. 7). The language relating to the prohibition of discharges that prevent the attainment of the beneficial use has been reasonably moved to subp. 2 to connect with the narrative standard, which describes the conditions that support the beneficial use.

7) 7050.0224 Specific water quality standards for class 4 waters of the State; agriculture and wildlife

Part 7050.0224 establishes water quality standards for Class 4 waters of the state.

Subp. 2. This subpart establishes both narrative and numeric water quality standards for Class 4A waters. The MPCA is proposing to revise the language in this subpart to retain the narrative water quality standard and to remove numeric standards, as described in the general reasonableness section. The specific changes are:

- Replacing "shall" with "must". The word "shall" is being replaced with "must" to conform to the formatting practices of the Revisor.
- Deleting ", including truck garden crops" from existing language. This language is unnecessary, because truck garden crops would be included in "any crops" and does not add any additional clarity to the rule language. It is reasonable to remove this phrase, which does not change the substance or intent of the rule.
- Deleting "The following standards shall be used as a guide in determining the suitability of the waters for such uses, together with the recommendations contained in Handbook 60 published by the Salinity Laboratory of the United States Department of Agriculture, and any revisions, amendments, or supplements to it." This language included in the Class 4A narrative is unique to this use classification. No other use classifications include language indicating that the "standards shall be used as a guide" and citing a specific publication to consider when determining the "suitability of the waters" for irrigation use. The intent of this language is unknown, as documentation from the adoption of standards in the 1960s does not exist. Regardless of the intent of the existing language, the lack of clarity on how to interpret values or use the recommended handbook to determine whether a water is meeting its designated uses or if an effluent limit is needed to protect those uses creates unnecessary ambiguity in the rule. This is discussed in the general reasonableness section of this SONAR. Because of the ambiguity of this language, MPCA is planning to remove the entire sentence and explain implementation of the irrigation narrative standard in a narrative translator method incorporated by reference. Therefore, removing the ambiguous language and replacing it with more robust implementation

language and methods is reasonable to provide more certainty in MPCA's process for determining whether the designated uses are being attained.

- Addition of language stating "In addition, the following standards apply". This language is added after the narrative standard and before the remaining numeric standards. Because the language "the following standards shall be used as a guide" is being removed, without the addition of this language it is not clear what the status of the numeric values are. Therefore it is reasonable to simply state that the following standards apply.
- Removal of the numeric and narrative standards provided in the subpart (see Table 10), excluding sulfate and boron. The numeric values for bicarbonates, pH, specific conductance, total dissolved salts, and sodium are being removed from this subpart because single numeric values can be either overprotective or underprotective, depending on the local conditions. Irrigation water quality that is protective of a given location depends on several factors, including, but not limited to, constituents in the water, climate, the chemical and physical properties of the soil, crop type, and any irrigation practices (S-2 section 4.2.3). These attributes can vary widely across the state. No single value could provide a reasonable amount of protection for every location, because at any given location, the protective value would be over- or under-protective at other locations. While no water quality standard provides perfect protection, the disparity is greater here than in other cases and can more easily be remedied with the application of data and information.
- Because of this, the MPCA is replacing the numeric irrigation water quality standards with a narrative standard and adopting implementation methods for how to translate the narrative standard into an appropriately protective numeric value for that location. The MPCA can then use the translator methods to determine whether a wastewater facility is likely to impact the designated use, and assign WQBELs, if necessary. The reasonableness of the translator method is described extensively in the discussion of the specific reasonableness of the parts of Minn. R. ch. 7053.

Table 10: Part 7050.0224, subp. 2(A) (Abbreviated table excluding (1) amendments that are simply renumbering, or (2) unamended text).

Substance, Characteristic, or Pollutant	Class 4A Standard
~~Bicarbonates (HCO3)~~	~~5 milliequivalents per liter~~
~~pH, minimum value~~	~~6.0~~
~~pH, maximum value~~	~~8.5~~
~~Specific conductance~~	~~1,000 miromhos per centimeter at 25 °C~~
~~Total dissolved salts~~	~~700 mg/L~~
~~Sodium (Na)~~	~~60% of total cations as milliequivalents per liter~~
~~Sulfates (SO4)~~	~~10 mg/L, applicable to water used for production of wild rice during periods when the rice may be susceptible to damage by high sulfate levels.~~

Items A and B. The MPCA is proposing to add language in Items A and B about implementing the Class 4A standard. Therefore, proposed changes to subp. 2. contain language introducing the items, stating that "Items A and B apply to the quality of class 4A waters of the state, with the exception of the numeric sulfate standard applicable to waters used for production of wild rice." Class 4A contains a subclass of waters, described as "waters used for production of wild rice". While all Class 4A water quality standards apply to waters used for production of wild rice, there is a 10 mg/L sulfate standard that applies only to those waters for that beneficial use, and not to the majority of Class 4A waters for the support of the general irrigation beneficial use. The MPCA's clearly stated intention in this rulemaking has been not to change the wild rice water quality standard; that standard is contentious, complex, and requires separate rulemaking processes. However, the language related to the wild rice subclass is so entwined with the overall Class 4A language that amendments are necessary to differentiate the two. The following language does not apply to the sulfate standard for water used for production of wild rice, and this language reasonably makes that distinction clear.

Item A. New item A provides information on the factors that must be considered when determining if the narrative standard is being met in the waterbody. It states that "determining whether irrigation water quality would cause significant damage or adverse effects must consider the following items in the area where the water is applied for irrigation: crop types, soil types, climate, and irrigation practices." The reasonableness of these factors is explained in the general reasonableness section. It is reasonable to specifically list these factors here as they are critical to the implementation of the standard.

Item B. New item B provides the duration of the new narrative standard by stating that that irrigation water quality must be protected over the growing season as an average. The choice of the growing season is described in the TSD and general reasonableness. It is important and reasonable to put these implementation factors in the rule language for adequate clarity.

Subp. 3. This subpart establishes both narrative and numeric water quality standards for Class 4B waters. The MPCA is proposing the following changes to the requirements below:

- *Adding "livestock and wildlife watering" to existing language.* Adding this phrase adds clarity that the standards in this subpart protect for the livestock and wildlife beneficial use, and provides consistency between the titles for all of the different classifications. Most titles for classifications already include phrases like this to indicate what the classification protects. It is reasonable to add clarifying titles to classifications without that language in this rulemaking to provide consistency within the rule language.
- *Replacing "shall" with "must".* The word "shall" is being replaced with "must" to conform to the formatting practices of the Revisor.
- *Adding "for watering" to existing language*. Existing part 7050.0140, subp. 5, already establishes that Class 4 waters "…may be used for any agricultural purposes, including stock watering and irrigation…" Because existing language indicates that Class 4 waters are intended for stock watering, it is reasonable to include that language in the narrative for Class 4B, which is the subclass that protects livestock. This does not change the intent of the rule, it makes a reasonable clarification of the designated use.
- Deleting the following sentence: "Additional selective limits may be imposed for any specific waters of the state." The ability to impose "additional selective limits" represents a degree of agency discretion that is no longer considered appropriate in water quality standards. If additional requirements are needed to protect the Class 4B beneficial use, the MPCA would impose those through rulemaking or a site-specific standard process. (Site-specific standard authority exists in Minn. R. 7050.0220, subp. 7).
- Additionally, the clarification that Class 4B standards are intended to protect for wildlife water consumption aids in distinguishing the protection provided in this class from that afforded to wildlife under Class 2. Wildlife are afforded protections under the Class 2 designation for aquatic life and recreation. Minn. R. 7050.0150, subp. 3 provides narrative protections for aquatic biota, which is defined to include "other aquatic-dependent organisms that require aquatic systems for food…such as amphibians and certain wildlife species." This rule language demonstrates that

wildlife that consume organisms from aquatic systems are protected under the Class 2 designation, and protecting wildlife for the consumption of aquatic organisms again in Class 4B is redundant. Additionally, the food items that are consumed by wildlife are also protected by the Class 2 designation, so having standards in Class 4B that protect against toxic effects to aquatic organisms as a food source to wildlife is unnecessary. Minn. R. 7050.0217, subp. 1 reinforces this idea, saying: "The listed numeric standards for toxics…protect Class 2 waters for…the consumption of aquatic organisms by wildlife" among other protections. Rule language makes clear that Class 2 protects both consumption of organisms by aquatic-dependent wildlife and the aquatic organisms consumed by wildlife. Direct consumption of water by wildlife is not protected under Class 2, so protecting that use in Class 4B is reasonable, along with the protection of livestock drinking water.

- Because rule language already designates stock watering as a Class 4 use and establishes wildlife protections (and protections for their food) in Class 2, it is reasonable to clarify that the standards in Class 4B are intended to protect the consumption of water for livestock and wildlife.
- *Adding "as a 30-day average" to existing language*. Addition of this language clarifies the duration for the numeric standards in this subpart. One component of numeric standards is the duration, or the time over which the in-stream concentration of a pollutant is considered for comparison with the magnitude of the standard (also sometimes referred to as the averaging time). The current rule language does not clearly define the appropriate averaging time of the Class 4B standards, while other standards, such as Class 2 standards, have averaging times clearly spelled out in rule. It is reasonable to add this language to provide this clarification for Class 4B to align with other standards. See the TSD (S-2) for the technical justification for this specific averaging period.
- *Remove total salinity standard* (see Table 11). Total salinity is a measure of the total dissolved salts in water, but it is a term more commonly used when referring to seawater salt concentrations. The MPCA does not measure total salinity when monitoring the state's waters, so there are no data about the concentrations of total salinity in Minnesota. A related measure, total dissolved solids is often measured instead of salinity. Total dissolved solids is the measure of all dissolved solid material, including salts. MPCA does collect total dissolved solids measurements, and could therefore use those data to compare to the standard. Additionally, the scientific studies conducted and published in peer-reviewed literature generally report concentrations of dissolved solids (including dissolved salts) in water as total dissolved solids. When MPCA reviewed the scientific literature, it was apparent that a standard was needed for the effects due to dissolved solids in the water, but rather than using total salinity, the MPCA decided to use total dissolved solids. Therefore, it is reasonable to remove the standard for total salinity, because, as the next paragraph discusses, MPCA is replacing the standard for total salinity with a standard for total dissolved solids (Snoeyink & Jenkins, 1980).
- *Addition of standard for total dissolved solids* (see Table 11). Extensive research has been done on the effects of total dissolved solids to livestock, and MPCA chose a concentration for total dissolved solids that should be protective of livestock species. The limited information about effects to wildlife indicated that wildlife species would be protected by this standard as well. A detailed description about the effects of total dissolved solids to livestock is provided in the TSD (S-2). Because total dissolved solids can impact livestock growth and production, and 3,000 mg/L is protective of livestock and wildlife, this standard for total dissolved solids is reasonable.
- *Addition of standard for nitrate + nitrite* (see Table 11). Research has been done on the effects of nitrate and nitrite to livestock, and MPCA chose a concentration for nitrate and nitrite that

should be protective of livestock species. The limited information about effects to wildlife indicated that wildlife species would be protected by this standard as well. A detailed description about the effects of nitrate and nitrite to livestock is provided in the TSD (S-2). Because nitrate can impact livestock growth and reproduction, and 100 mg/L is protective of livestock and wildlife, this standard for nitrate is reasonable.

- *Addition of 600 mg/L standard for sulfate for livestock and wildlife water* (see Table 11). There is no existing Class 4B standard for sulfate; the MPCA is proposing a new standard of 600 mg/L for livestock and wildlife watering. Extensive research has been done on the effects of sulfate on livestock, and MPCA chose a concentration for sulfate that should be protective of livestock species. The limited information about effects on wildlife indicated that wildlife species would be protected by this standard as well. A detailed description about the effects of sulfate on livestock is provided in the TSD (S-2, Section 4.4). The sulfate ion (SO_4^{2-}) is the most common form of sulfur in water, while sulfides may also exist in some waters. Sulfate naturally occurs from the weathering of rocks, from which it runs off into waterways (Raisbeck et al., 2008). Sulfur is the toxic component of sulfate to livestock and wildlife. However, because sulfate is the most prevalent form of sulfur in water and is commonly measured, a water quality standard based on sulfate is being proposed here to provide protection for livestock and wildlife. In addition to drinking water sources, sulfur is also introduced to livestock and wildlife through dry, supplemental feeds. Because of this, total dietary sulfur must be considered, not just the component coming from drinking water (Drewnoski et al., 2014)

  Sulfur is necessary to maintain animal health, but in excess, sulfur becomes toxic. Toxicity in studied livestock species indicate that ruminants are more sensitive to the toxic effects of sulfur than monogastric species due to the processing of inorganic sulfur (such as sulfate) in the rumen, creating the toxic chemical hydrogen sulfide (H2S). Ruminants are capable of synthesizing sulfur-based amino acids from inorganic sulfur sources, but the process involves first reducing inorganic sulfur to H2S. When sulfur intake is excessive, large quantities of H2S are produced, and the toxic gas produced can escape the rumen, resulting in poisoning. Monogastric animals cannot produce sulfur-based amino acids from inorganic sulfur, and are therefore less sensitive to the toxic effects of the reduction of inorganic sulfur to H2S (Raisbeck et al., 2008).

  The proposed protective value of 600 mg/L is based on livestock that consume a high carbohydrate diet low in fiber, which would typically be observed in animal feeding operations, where the animals have limited or no access to forage. The protective percentage of sulfur in the diet for those animals is 0.30% sulfur. For those animals that consume greater than 40% forage, sulfur is not converted as rapidly to sulfide, so those ruminants can tolerate up to 0.50% sulfur in their diet (NRC, 2005). Therefore, a less protective value may protect ruminants that graze, including both livestock and wildlife. For a complete discussion of sulfur in the diets of livestock, please see Section 4.4 of the TSD (S-2).

  Using the 600 mg/L value across all 4B waters is the most conservative and simple method of protecting the livestock and wildlife use. This could be overprotective in situations where there are no ruminants consuming a high carbohydrate diet utilizing a surface water downstream of a permitted facility. Where this value is overprotective, a site-specific standard could be developed via the process and authorities in Minn. R. 7050.0220, subp. 7. MPCA has chosen to implement the more protective value across the state, due to the widespread occurrence of ruminant feedlots. As seen in Figure 1, there are more than 25,000 registered feedlots that have housed ruminants as their primary stock. Feedlots that have less than 50 animal units do not have to register their feedlot, so there may be additional feedlots that are not identified in the database for registered feedlots, and thus not represented in the map in Figure 1 Additionally, there are other feedlots that house ruminants, but they are not the primary stock, and are therefore not included in the count of over 25,000 registered feedlots with ruminants.

While MPCA can identify where the registered feedlots are located from their registration information, MPCA cannot easily identify the water source used to water the livestock. There are only 1,609 water appropriation permits for livestock watering in the DNR database. Of those 1,609, only 52 are from surface waters. For the livestock operations without appropriation permits, it is unclear where their water is coming from. They may be using city water, or not using enough water to require an appropriation permit. Or, their livestock may be consuming water directly from a surface waterbody. Determining the water source for all feedlots across the state would be an insurmountable effort, especially when also considering historical uses of the water. Maintaining the standard for all waters at 600 mg/L simplifies the process and ensures that livestock and wildlife are protected from the effects of sulfur. Additionally, it maintains a protective water concentration that allows for future feedlot operations to have a safe water source for their ruminant livestock. Where it can be demonstrated that the waterbody is not being utilized to provide water for ruminants consuming a concentrate diet, a site-specific concentration of 1,000 mg/L could be used. Because sulfate can impact livestock growth and production, and 600 mg/L is protective of livestock and wildlife, this standard for sulfate is reasonable.

Figure 1. Locations of registered feedlots that currently or previously housed ruminants as the primary stock in 2019.

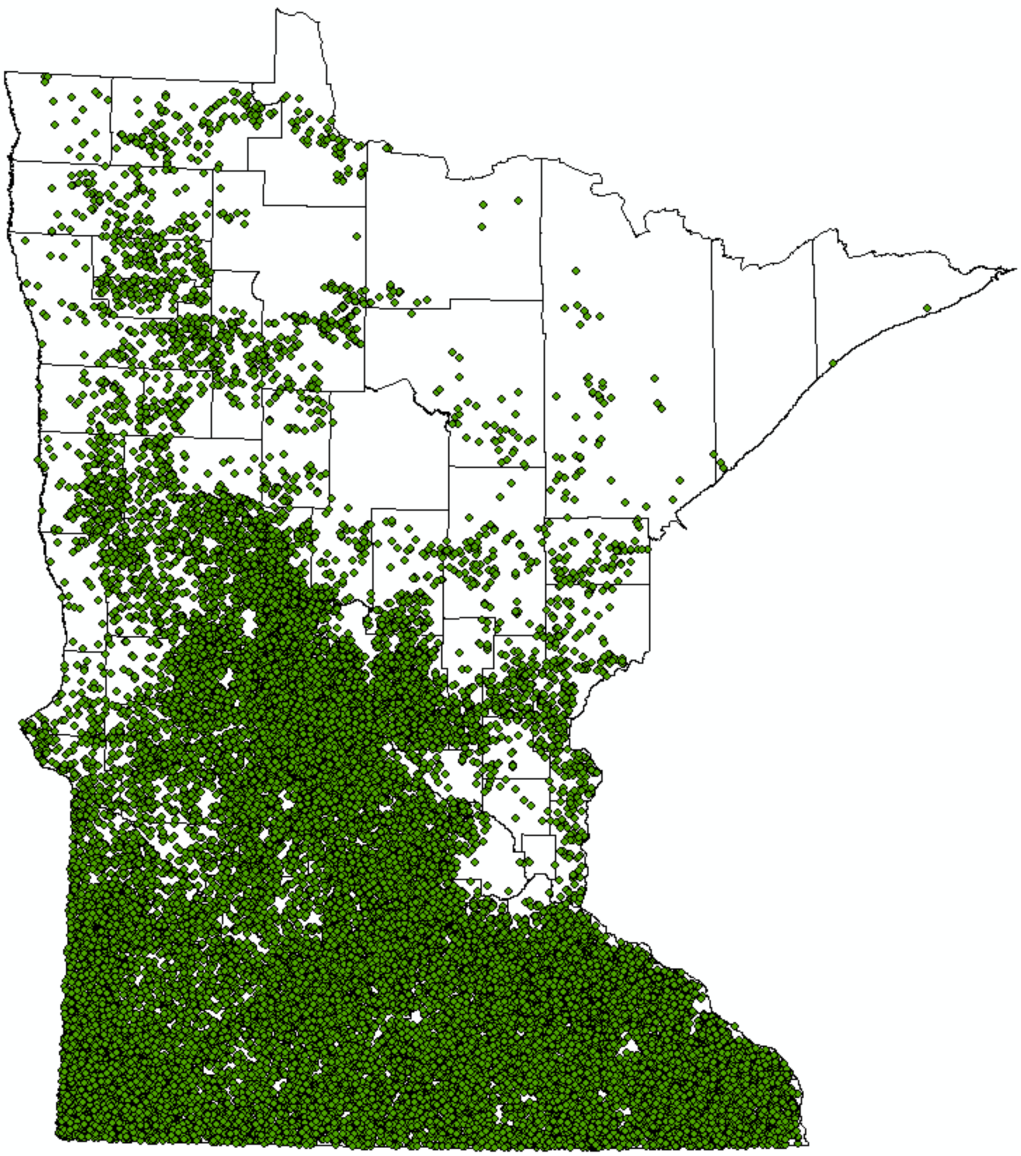


Table 11: Part 7050.0224, subp. 3. Class 4B Substance, characteristic, or pollutants (Abbreviated table excluding (1) amendments that are simply renumbering, or (2) unamended text).

Substance, characteristic, or pollutant	Class 4B standard
~~Total salinity~~	~~1,000 mg/L~~
Total dissolved solids	3,000 mg/L
Nitrate (as NO_3-N)	100 mg/L
Sulfate (SO_4)	600 mg/L

Subp. 4. The MPCA is proposing to move or delete existing requirements to other parts of the rule for the reasons described below. The proposed changes render this subpart obsolete and the MPCA is reasonably deleting this subpart.

- "The quality of class 4C wetlands shall be such as to permit their use for irrigation and by livestock and wildlife without inhibition or injurious effects…" Class 4C will be eliminated, but it is reasonable to remove it when in other sections of rule, all wetlands will be designated as Classes 4A and 4B, rather than 4C. These narrative protections in subpart 4 are included in Classes 4A and 4B, so when designated as 4A and 4B, wetlands will have the same narrative protections that would be given by maintaining this language.
- "…and be suitable for erosion control, groundwater recharge, low flow augmentation, storm water retention, and stream sedimentation." The language is reasonably being moved Minn. R. 7050.0186, subpart 1. The functions of wetlands listed in Minn. R. 7050.0224, subp. 4 are not exclusively tied to agricultural and livestock beneficial uses. The functions are associated with protections for multiple beneficial uses (S-2). Moving these wetland functions to Minn. R. 7050.0186, subp. 1 is reasonable because it provides the same protections to wetlands, but places the narrative protections in a rule location that is more logical given that these functions are more general in nature, and not specifically tied to agricultural and livestock beneficial uses.
- *"The standards for classes 4A and 4B waters shall apply to these waters..."* Class 4C will be eliminated, but in other sections of rule, all wetlands will be designated as Classes 4A and 4B, rather than 4C. This reasonably affords wetlands the same Class 4A and 4B protections that would be given by maintaining this language.
- *Standard for pH.* The Class 4C narrative standard of "maintain background" for pH was included to protect wetlands' natural variability, not the agriculture or wildlife use. Therefore, having them in Class 4C is inappropriate because it is not protective of the agriculture or wildlife use. Maintaining background pH could actually harm irrigation and livestock/wildlife uses, if natural pH levels are very acidic or basic. Additionally, "maintain background" for pH is already included in the Class 2D standards that apply to all unlisted wetlands, so these protections already exist. Removing the 4C use class and this associated standard is reasonable because no protections will be lost, and the standard will be in a more appropriate beneficial use class.
- *Standard for settleable solids.* This narrative standard indicates concentrations should not "create the potential for significant adverse impacts on one or more designated uses." This language indicates that settleable solids can impact multiple designated uses, but it is unclear as to why it was placed in Class 4C (S-2). All unlisted wetlands are designated Class 2D, so it is reasonable to put the narrative in that class, since effects to aquatic life could clearly result from increased solids. Moving this standard to Class 2D also retains all protections given to wetlands by including in Class 4C.

8) 7050.0410 Listed waters

Minn. R. 7050.0410 describes the classifications of "listed waters". The MPCA is proposing to repeal this part as the language regarding the classifications applicable to listed waters is now provided in proposed Minn. R. 7050.0415, supbparts 2 and 3.

9) 7050.0415 Designated beneficial uses of waters and wetlands.

Part 7050.0415. The MPCA is proposing this new part with the goal of gathering already applicable requirements currently contained in Minn. R. 7050.0410 to 7050.0450 with some minor language changes in one location to make the interpretation easier for the user.

Subp. 1. The language in this subpart was moved directly from the current Minn. R. 7050.0450, which is proposed to be repealed in this rulemaking. The MPCA included some minor language changes intended to clarify the rule, but the changes do not affect the original intent.

Subp. 2. The MPCA is proposing to add language in this subpart to clarify that many waters have a general set of classifications, unless different classifications are specified in other parts of rule. The MPCA believes that such information aids readers that are not familiar with the regulations. Aiding the reader in interpreting requirements will increase correctly interpreting applicability and compliance, and thus is a reasonable addition to the rules.

Subp. 3. The language added in this subpart, in addition to changes to Minn. R. 7050.0470, are intended to simplify the rules. Currently, the waters listed directly in the rule text of Minn. R. 7050.0470, only have their Class 1, 2, or 3 classifications listed. These are primarily lakes. Waters, primarily rivers and streams, which are listed through an incorporation by reference in this part, are listed in tables that contain all beneficial use classes. Particularly for the waters listed directly in rule, someone reading the rules would need to know to also read Minn. R. 7050.0410 to determine the additional classifications assigned to those waters. This makes the rules less accessible to the majority of citizens looking to determine use classes of a water. Therefore, in the changes to rule language for this rulemaking, it is reasonable that all use classes of a listed water have been added, and are explicitly spelled out in the rule language in Minn. R. 7050.0470.

The language added to this subpart replaces what is currently in Minn. R. 7050.0410. Part 7050.0410 is repealed, and this subpart is instead used to indicate that those waters listed in Minn. R. 7050.0470 have the classifications assigned to them in that part.

Subp. 4. Most of the language added in this subpart is moved directly from the current language in parts 7050.0425 and 7050.0430, describing the use classes of waters that are not listed in Minn. R. 7050.0470. The language is restructured into a single subpart, but the language remains the same with two exceptions. First, the removal of the letter associated with the Class 3 subclasses, as all subclasses are being removed from Class 3 during this rulemaking. Secondly, the class designations for the Boundary Water Canoe Area Wilderness (BWCAW) and Voyageurs National Park (VNP) have been changed to fix an error that was made in an earlier rulemaking.

The classifications for the BWCAW and VNP were originally in Minn. R. 7050.0470, with their class 1, 2 or 3 designations listed. Because they were listed in Minn. R. 7050.0470 (listed waters), additional classifications assigned to listed waters were found in Minn. R. 7050.0410. Those additional classifications were class 3C, 4A, 4B, 5, and 6 for non-wetlands; and wetlands had additional classifications of 3D, 4C, 5, and 6. In 2016, the waters got moved from Minn. R. 7050.0470 to part 7050.0430, and the text was moved unchanged, including only the Class 1, 2 and 3 designations. The language in part 7050.0430 that assigns the additional use classes (Classes 3C, 4A, 4B, 5, and 6) to unlisted waters, which the BWCAW and VNP waters became, specifically excludes the subparts that contain the BWCAW and VNP waters. Because of this, the classifications for all 3C, 4A, 4B, 5, and 6 uses were accidentally removed from BWCAW and VNP waters during that rulemaking.

The SONAR from the 2016 tiered aquatic life uses rulemaking only mentions this change briefly, with no discussion of intentionally removing the Class 3C, 4A, 4B, 5, and 6 classifications. If those use classes were intentionally removed, a discussion in the SONAR would have been required. It even mentions retaining the information about the classification of those waters:

> "The information formerly located at the end of Minn. R. 7050.0470, subps. 1 and 2, regarding the streams, lakes and wetlands in the Boundary Waters Canoe Area Wilderness and the information at the end of Minn. R. 7050.0470, subp. 2, regarding the lakes and wetlands in Voyageurs National Park are relocated to this part... Incorporating

the lists by reference eliminates the language specific to the Boundary Waters, which will not be included in the documents incorporated by reference. In order to retain this information about the classification of those waters, it is reasonable to move those listings to Minn. R. 7050.0430" (MPCA, 2016).

Because the removal of those use classes from BWCAW and VNP waters was unintentional, and in error, those uses are reasonably being added to the list of use classifications for those waters.

10) 7050.0420 Cold water habitat waters

Part 7050.0420 establishes beneficial use subclasses for cold water habitats and describes how the MPCA will determine that waters are cold water habitats.

Item D. The MPCA is proposing to amend the language in this item to reflect the fact that the subclasses of Class 3 are being removed. While this change is indicated, the MPCA does intend to make further changes to item D. As this SONAR is being drafted, rulemaking to update part 7050.0420 is complete as part of the WQS: Class 2 and 7 rulemaking that became effective on June 8, 2020. The revised WQS: Class 3 and 4 language here reflects what is currently in rule, and does not indicate the changes that are being proposed in the WQS: Class 2 and 7 rulemaking. However, MPCA does anticipate making changes to the new rule language related to the WQS: Class 2 and 7 rules. The MPCA anticipates moving the adopted WQS: Class 2 and 7 language, mostly unchanged, to the newly drafted part 7050.0415, as subpart 5. This will keep all the rule language about classifications (aside from Minn. R. 7050.0470, which assigns classifications to specific waters) in a single part of rule, part 7050.0415.

11) 7050.0425 Unlisted wetlands and 7050.0430 Unlisted waters

Minn. R. 7050.0425 describes the classification of "unlisted wetlands", and Minn. R. 7050.0430 describes the classification of "unlisted waters". These two parts are proposed to be repealed as the language regarding the classification applicable to unlisted waters is now provided in proposed Minn. R. 7050.0415, subparts 2 and 4.

12) 7050.0450 Multiclassifications

Minn. R. 7050.0450 describes that all surface waters of the state have more than one use class assigned to them, and that all relevant water quality standards apply. These rules are proposed to be repealed as the language has been moved to Minn. R. 7050.0415, subpart 1, so that the description of the framework of multiple classifications comes prior to the descriptions of what classifications apply to which waters.

13) 7050.0470 Classifications for surface waters in major drainage basins

Part 7050.0470 establishes classifications for surface waters in major drainage basins.

Subparts 1, 2, 3, 4, 5, 6, and 8. The MPCA is proposing changes to water classification uses that span subparts 1, 2, 3, 4, 5, 6, and 8. All waters that are specifically listed with their designated use classes in rule shall be updated to clarify all applicable designated uses for the water. First, if a Class 3 use is listed for the water in Minn. R. 7050.0470, the A, B, C or D designation that is associated with the Class 3 use is removed. Additionally, the use classes that are already assigned to waters listed in Minn. R. 7050.0470 via the rule language in part 7050.0410 (Listed Waters) are added to each entry in rule. For example, a water currently listed as "1B, 2A, 3B" is changed to "1B, 2A, 3, 4A, 4B, 5, 6."

In the changes to part 7050.0223, the MPCA is proposing to eliminate the separate subclasses of Class 3 (see the discussion of reasonableness of that change in the section for part 7050.0223 above). Because of the removal of the subclasses, it follows that all subclass indicators of A, B, C or D must be eliminated from the language in rule for the Class 3 designation.

Currently, the waters listed in Minn. R. 7050.0470 only list in rule the Class 1, 2 and 3 designations for waters, and classifications for streams are listed in a separate location – in tables *incorporated by reference*. The tables incorporated by reference list out all of the designated use classes associated with the reaches that are included in the tables. This makes it much more convenient to understand what the designated uses are for a water body, without having to have extensive knowledge of the rules in Minn. R. ch. 7050. It is not intuitive to look at the listed waters in Minn. R. 7050.0470 and know that they also have additional designated uses, beyond what is listed in the rule language. Adding these default designated uses to the lakes, wetlands and fens included in the rule language in Minn. R. 7050.0470 makes the rule language clearer and more accessible to the general public who may not know to go back and check part 7050.0410 to find the additional use classifications given to all waters listed in Minn. R. 7050.0470.

Also, because wetlands will have the same default use classes as other waters due to the changes made to part 7050.0410 in this rulemaking, the same additions apply to all the waters with classifications listed in rule, regardless of wetland or non-wetland.

Subparts 1 through 9. In the paragraph at the beginning of each subpart, the sentence "See parts 7050.0425 and 7050.0430 for the classifications of waters not listed." is included. This sentence is being changed to "See part 7050.0415 for the classifications of waters not listed."

In the changes to parts 7050.0410 through 7050.0430, the MPCA is proposing to condense all of the unlisted waters classifications into one subpart, part 7050.0415. Therefore, this is the appropriate rule subpart to refer to in all of the subparts of Minn. R. 7050.0470, and this is a reasonable change.

The MPCA notes that the tables that are incorporated by reference will be updated once rule changes are adopted.

B. Chapter 7053, State waters discharge restrictions

1) 7053.0135 General definitions

Part 7053.0135 establishes general definitions that apply to Minn. R. ch. 7053.

Subp. 4a. The $122Q_{10}$ definition currently exists under part 7053.0255, subp. 2(A), and the definition applies to that part (which refers to implementation of effluent limits for phosphorus only) . The MPCA is proposing to move the definition, unchanged, to part 7053.0135, which contains general definitions that apply to all of ch. 7053. For the reasons discussed above in the general reasonableness section, 5.D.2), the flow rate is being utilized as the minimum stream flow rate for the Class 4A effluent limit reviews; thus, the term $122Q_{10}$ is being added to rule language in other parts of Minn. R. ch. 7053. For these reasons, MPCA believes it is reasonable to move the existing definition from part 7053.0255 to the general definitions section under part 7053.0135 to avoid duplicating language within Minn. R. ch. 7053.

Subp. 5a. The MPCA is proposing to include a definition for "control document" under proposed changes to Minn. R. ch. 7053. The definition simply references an existing definition for consistency. It is reasonable to include the definition to provide agency staff and regulated parties consistency with the use of terms. The term is used under proposed parts 7053.0260 and 7053.0263. The reasonableness of using the term is more fully discussed under those relevant parts of the SONAR.

2) 7053.0205 General requirements for discharges to waters of the State

Part 7053.0205 establishes general requirements for discharges to waters of the state.

Minn. R. 7053.0205 establishes the minimum stream flow for implementing water quality standards through controlling permitted facility discharges. It is reasonable to add the appropriate stream flow for the industrial consumption and irrigation water quality standards in this part, along with the clarification that the stream flow is measured at a point of appropriation. This rule part also establishes that the point of appropriation will be the location at which water quality is evaluated under the narrative translator methods for compliance with the water quality standards. It is reasonable to establish that point of evaluation to provide clarity for dischargers and appropriators. The reasonableness of the chosen minimum flow rates added as new items D and E is discussed in D.2) of the general reasonableness section. The MPCA is also making minor changes to item A to update the cross reference.

3) 7053.0255 Phosphorus effluent limits for point source discharges of sewage, industrial, and other wastes

Subp. 2(A). The definition in existing item A was reasonably moved to part 7053.0135, unchanged. The $122Q_{10}$ definition as currently in rule only applies to this part. However, this flow rate is being utilized as the minimum stream flow rate for the Class 4A effluent limit reviews, and the $122Q_{10}$ is being added to rule language in other parts of Minn. R. ch. 7053. Therefore, this definition was reasonably moved up to Minn. R. 7053.0135, which contains general definitions that apply to all of Minn. R. ch. 7053. This prevents MPCA from having to define the $122Q_{10}$ for a second time in Minn. R. ch. 7053. This simplifies the rule language by only defining this term once in Minn. R. ch. 7053. The definition for 122Q10 is the same as the definition that already exists in Minn. R. 7050.0150, subp. 4.

Subp. 2. Relettered item F. The definition for reservoir was updated to clearly indicate where the definition for the $122Q_{10}$ can be located. Also, the phrase "a $122Q_{10}$ for summer months" was reasonably removed because the phrase was redundant and added ambiguity to the rule. The time period was already defined, as the flows for the months of June through September, or the summer months. The extra phrase was not needed for the definition to be clear.

Subp. **2**. **Relettered item G**. The MPCA is proposing minor language changes to conform to the formatting practice standards of the Revisor. The changes do not change the meaning of the existing language.

4) 7053.0260 Effluent limits for point source discharges of sewage, industrial, and other wastes to protect industrial consumption

Part 7053.0260 is new language that is being added to define the procedures to use to determine effluent limits appropriate to protect the Class 3 industrial consumption designated use.

Subp. 1. This subpart establishes the scope of this part. It is reasonable to establish a scope to ensure that readers understand that limits established under part 7053.0260 apply in addition to other applicable limits. In addition, the agency informs the reader that the most stringent requirement applies in all cases of conflicts between part 7053.0260 and other applicable regulations.

Subp. 2. This subpart establishes the definitions used in this part, and refers to definitions in both Minn. R. ch. 7050 (which contains the water quality standard) and Minn. R. ch. 7053 (which contains implementation procedures). It is reasonable to establish definitions to ensure that readers have a common understanding of the use of terms. It is also reasonable to refer back to the water quality standard, which is the key foundation of the implementation procedures found in this part.

Subp. 3. This subpart establishes how effluent limits to protect industrial consumption will be developed.

Item A. This item defines that the procedures laid out in the method incorporated by reference must be used to determine if a discharger would cause or contribute to an exceedance of the industrial consumption narrative water quality standard. This is reasonable because it clearly defines how the

MPCA will implement, through permits, the narrative standard included in this rulemaking. Early public comments generally supported inclusion of the method into rule. It is reasonable to incorporate the method by reference as the method is more easily understood when presented in a flow chart form. The reasonableness of individual components of the method are presented in the specific reasonableness section.

Item B. This item states that the flow rate to use in evaluation of the potential for exceeding the Class 3 industrial consumption narrative standard is a low flow rate established by the Commissioner of the Minnesota Department of Natural Resources, under the terms of Minn. Stat. 103G.285, Subd. 2. This item also clarifies that the evaluation of whether an effluent limit is needed to be protective is conducted at the point at which the water is withdrawn for industrial consumption. The reasonableness of these choices is fully explained in the General Reasonableness section.

Item C. This item requires MPCA to assign an effluent limit when the discharge could impact the industrial consumption designated use, as determined through the use of the method incorporated by reference. This language is reasonable to ensure that MPCA is required by rule to assign limits if a discharge would impact the designated use.

Item D. The MPCA is proposing to incorporate by reference a document that explains the methodology to be used to determine whether effluent limits are needed for a discharger, and how to develop those limits if needed. The document is being incorporated "as amended," allowing for future changes to the guidance to be conducted without rulemaking. A more complete discussion of the narrative translator method for development of effluent limits included in the document incorporated by reference is provided in section 7.B.5).

5) Class 3 narrative translator method.

The following sections explain the reasonableness of each question within the translator flowchart method.

Q1: Does a downstream provincial, state or tribal water quality standard need to be protected using effluent limitations?

It is reasonable to include this decision in the translator process because it clarifies the MPCA's responsibility to ensure that NPDES dischargers do not cause or contribute to the violation of any downstream WQS. (This responsibility is already established at 40 CFR § 131.10(b) and 40 CFR 122.4(d) and in Minnesota rules under the construction of the Class 6 beneficial use at Minn. R. 7050.0140, subp. 7. and in Minn. R. 7050.0155) If the NPDES permittee discharges to waters of the state that ultimately flow into the sovereign waters of another state, a tribe, or a province, then the MPCA must ensure (through a permit limit or WQBEL) that the NPDES discharger does not cause or contribute to a violation of any applicable water quality standards promulgated by that state, tribe, or province. Including this language emphasizes existing CWA permitting obligations and ensures that future users of the translator will consider all downstream water quality standards WQS when developing NPDES permits.

It is unreasonable and unnecessary for the MPCA to include specific procedures to protect any possible downstream WQS. The provision requiring such protections are already applicable in rule, and the procedures are naturally going to be specific to the form and construction of the applicable WQS. In general, the MPCA's approach is to protect the WQS in the same manner that the establishing state would do so, in terms of the magnitude, duration, and frequency of the standard. The CWA provides procedures for downstream states or tribes to use if they feel that the actions of an upstream state are not adequately protective.

If a limit is needed to protect the WQS of a downstream state, and that limit relates to the parameters covered in the translator (hardness), it is possible to consider how complying with downstream state limit will also ensure that water quality is protected for industrial consumption. If compliance will be ensured, performing the rest of the analysis is not needed and no additional effluent limit is required to protect industrial water quality.

Q2: Does the NPDES permit result in a net increase in loading of hardness?

The goal of this analysis is to protect the designated use by ensuring a consistent water quality for industrial appropriation downstream of a wastewater discharge. Ensuring that water quality is consistent is important because industrial water appropriators consider a consistent water quality to be of primary importance for their needs (S-17).

The "net increase in loading" concept is an essential part of Minnesota's antidegradation policy for wastewater treatment plants. "Net increase in loading" is defined in part 7050.0255, subp 26 and is further explained with examples in MPCA's (2019c) antidegradation guidance document that are specific to wastewater dischargers. Antidegradation is a foundational part of the CWA that ensures that existing uses and the level of water quality necessary to protect existing uses shall be maintained and protected.

Industrial consumers appropriate water from fixed locations on surface waters of the state and it is important that water quality at those fixed locations is appropriately protected, as previously discussed. The water quality at these fixed locations is an integration of all upstream water quality sources (agricultural runoff, wastewater, storm water, etc.). Industrial consumers of water have adapted their water treatment processes to the typical water quality and are primarily concerned about upstream wastewater impacts that could significantly change the water quality at their intake structures. The existing Class 3 numeric standards include the parameter of hardness, and for the current rule changes hardness (which is a measure of dissolved minerals - calcium and magnesium) is a reasonable proxy that is easily measured and commonly understood for the constituents of water quality that could cause problems for industrial users. It is thus reasonable to use in this earlier, more screening level analysis portion of the translator methods. If there is no new increase in hardness loading upstream of the industrial appropriator, then is it reasonable to conclude that no relevant water quality change could occur and no further effluent limit analysis is needed. Therefore, it is not necessary to examine existing hardness concentrations with every regular NPDES permit reissuance but to instead focus on NPDES permit reissuances where a net increase in loading might occur that could change downstream water quality from current levels.

Requiring this question poses no new burden to the MPCA or the permit holder because answering "Will there be a net increase in loading of any parameter?" is part of the standard internal permitting checklist required for every NPDES permit issuance to ensure antidegradation statutes are protected.

Q3: Has there ever been a DNR surface water appropriation permit for an industrial appropriator anywhere downstream of the WWTP?

This question defines the locations on waterbodies where surface water quality needs to be evaluated and protected for industrial water appropriation. This question ensures that all industrial appropriators that could be impacted by the NPDES permit in question will be considered and as a result protected during the translator process. The reasonableness of using the DNR database of surface water appropriations was discussed previously.

Q4: Will the net increase in calcium loading cause degradation with respect to calcium scaling potential at any downstream industrial appropriators?

The goal of this question is to protect the industrial consumption designated use by ensuring that a net increase in loading of calcium from a NPDES permit does not increase the downstream potential for calcium scaling to levels that could negatively affect existing industrial appropriators of water. (The MPCA currently has no indications that any industrial appropriators are experiencing calcium scaling at levels of concern.)

Industrial water appropriators would be negatively affected if water quality changed enough that new treatment technologies would need to be installed to manage hardness and calcium scaling. The MPCA has chosen to focus the translator on the scaling portion of the narrative standard. The existing Class 3 numeric standards include the parameter of hardness. It is likely that hardness was included in rule in 1967 as a way to ensure that severe calcium scale would not form in industrial processes. Excess scale formation is a phenomenon known to most homeowners in areas of hard water, and is a problem in industrial processes because it can cause blocked pipes, among other issues. Since the current hardness criteria have a significant but imperfect relationship with scale formation, it is reasonable to prioritize focusing on excess scale formation instead of the surrogate of hardness (in this narrative translator.

There is one form of scale, calcium carbonate, which is thermodynamically most likely to form over other common forms of scale owing to calcium carbonate's low solubility (Snoeyink & Jenkins, 1980). By focusing protections on of the most common type of scale to form, calcium carbonate, water quality will be protected for industrial consumption from severe scaling. Protecting for calcium carbonate provides incidental protections from other forms of scale as well. For example, limiting calcium carbonate scale reduces the likelihood that other calcium and carbonate containing scales such as calcium sulfate (gypsum) or magnesium carbonate (magnesite) could form.

The primary way increased hardness surface water concentrations could impact industrial water appropriators is by increasing the potential for calcium scaling to levels that would negatively affect their processes. Calcium scale is a solid calcium carbonate mineral (i.e. $CaCO_3$, calcite, chalk or limestone) that can precipitate out of solution when the solution is oversaturated with dissolved calcium and carbonate. Carbonate, a dissolved species of carbon dioxide gas, is naturally present in in all surface waters exposed to the atmosphere. Calcium carbonate scale can build up over time in pipes and water intake structures to levels that physically impede water flow. Calcium carbonate scaling is especially concerning for water used for heating or cooling, because calcium carbonate precipitates to a greater degree as water temperature increases.

Water chemists have developed standardized calculations, called saturation indices, which predict the chemical conditions when solid calcium scale will precipitate out of water. Calcium Carbonate Saturation Indices (CCSI) can be calculated multiple ways, ranging from methods developed prior to personal computers (Ryznar and Langlier indices) to computerized chemical models. The free water chemistry modeling program PHREEQc has emerged as the industry standard to calculate the calcium carbonate saturation index (APHA, 2018; de Moel et al., 2013). When the CCSI is positive, the water is oversaturated and calcium carbonate has the tendency to precipitate, and when the CCSI is negative the water is undersaturated and calcium carbonate has the tendency not to precipitate.

While the CCSI is a water quality parameter of key importance for industrial appropriators, it is not one they frequently measure or calculate. This is because rigorously calculating the CCSI requires measuring multiple water quality parameters, an advanced understanding of water chemistry modeling, and a thoughtful evaluation of the meaningfulness of the CCSI for the intended water use (i.e. high temperature boilers vs heat exchangers vs general piping, etc.). Instead, industrial appropriators most commonly evaluate the CCSI in the same way that residential owners of dishwashers evaluate calcium scaling on their dishes after installing a dishwasher in a new home. In this example, if the dishware has noticeable scale on it after dishwashing then calcium scale formed and the CCSI was by definition greater than zero, although not measured as such. To manage calcium scaling the dishwasher owner might choose to install an in-home water softener, use a detergent that minimizes scaling, or simply decide that the scale is fine and nothing needs to be done. Different users would make different choices based on their individual needs and preferences. Residents in areas where municipal drinking water has already been softened to avoid scale formation would make different decisions than users who receive naturally hard water that forms scale or naturally soft water where scale does not form. Residential scale management strategies are ‘set it and forget’ in the sense that once a strategy is set up, a resident can expect that strategy to continue to work because of consistent water quality provided to their home.

In important ways, the experience of the typical dishwasher owner is similar to the typical industrial water appropriator in terms of managing calcium scale formation. Different industries will make different decisions based on their individual water quality needs, where they exist in the state, how much they want to invest in treatment, and whether or not scale formation is a problem for them. Industrial surface water appropriators also expect that once they have a treatment system established, that treatment system will continue to appropriately treat their water in the future.

Industrial appropriators have adapted their water treatment needs to the typical water qualities that define the CCSI of the surface waters they appropriate from. Industrial water appropriators can manage calcium scaling using a variety of technologies that widely range in cost and complexity. The most common scale management strategy employed by industrial appropriators is none at all or passive treatment. Industrial appropriators use passive treatment if they do not expect unwanted scale to form. If suitable, industry would prefer to use passive treatment because it costs nothing and could not be simpler to operate. Passive CCSI management is unsuitable for some industrial needs and active treatment would be required in those cases. Active treatment technologies to manage CCSI can range from the relatively simple and cheap addition of low dose chemical additives to very complex and expensive technologies such as lime softening, reverse osmosis (RO) or ion exchange. All active industrial appropriator, whether formally or informally, budgets CCSI management (either active or passive) into their business model. If an industrial appropriator had to increase spending on CCSI management because of water quality degradation, that would reduce the viability of the business, especially if the industrial appropriator had to transition from passive (no cost) to active treatment (some cost). Transitioning from passive to active treatment always requires engineering design and permitting work which would further increase the total cost and complexity of active treatment.

The term degradation is defined in Minn. R. 7050.0255, subp. 11, as seen below:

> *"Degradation" or "degrade" means a measurable change to existing water quality made or induced by human activity resulting in diminished chemical, physical, biological, or radiological qualities of surface waters. For municipal sewage and industrial waste discharges, degradation is calculated at the edge of the mixing zone upon reasonable allowance for dilution of the discharge according to part 7053.0205, subparts 5 to 7.*

The term measurable change is then defined in Minn. R. 7050.0255, subp. 24:

> *"Measurable change" means the practical ability to detect a variation in water quality, taking into account limitations in analytical technique and sampling variability.*

Neither of the above definitions are parameter-specific and do not numerically define what a “measurable change” is or what a “diminished…quality” would be for any individual parameter. The general definition of degradation is intentionally broad to allow for appropriate consideration of a wide variety of chemical, physical and biological parameter properties, analytical detection methods and other site-specific factors. Numerically defining degradation in the context of this narrative translator is needed and reasonable because it improves clarity, reduces complexity and simplifies using the translator in the future.

The MPCA proposes to define degradation, within this document and only in the context of industrial consumption, numerically as described below. This definition ensures that NPDES dischargers do not increase CCSI to levels that would impair downstream industrial consumption by forcing an industrial appropriator to install new active treatment technologies. If a net increase in loading of hardness from an NPDES discharge is less than this value, then the designated use will be protected because there would be no diminished quality of water with respect to industrial consumption and CCSI:

> In the context of hardness, degraded water quality would be defined as an increase in the average calcium concentration, by greater than 10 mg/L as CaCO3, at the location where water is appropriated for industrial consumption at the minimum stream flow defined in part 7053.0205, subpart 7(E).

The definition above uses calcium as a surrogate for CCSI. This is reasonable because calcium is a key input in the CCSI and when calcium is increased CCSI increases proportionally (Figure 2; Moulin & Roques, 2003). Calcium is much less expensive and easier to measure than CCSI because it can be measured in a lab for around $15 per sample and requires no computer modeling to interpret. Defining the location and flow rate at which the measurable increase will be calculated is needed and reasonable because it defines the mixing zone and dilution capacity which are essential components of the general degradation definition.

The 10 mg/L as CaCO3 numeric threshold was derived by performing a series of water chemistry simulations. First, the CCSI was calculated across a broad theoretical range of potential water chemistries that might be found in Minnesota (Figure 2). In Figure 2, the water was made to be calcium and alkalinity dominant because calcium and alkalinity dominant waters have the greatest potential for calcium carbonate precipitation. Waters with less relative abundance of calcium and alkalinity would always have lower CCSI than the values in Figure 2, because with less calcium and alkalinity in solution, less calcium carbonate can form.

In the second part of the simulation, calcium hardness was added to the solutions in Figure 2 and the resulting change in CCSI was quantified (Figure 3). After a range of simulations, adding 10 mg/L as CaCO3 of calcium hardness was determined to be a reasonably protective value of the CCSI for waters with low alkalinities. Very low calcium or alkalinity waters (< 25 mg/L as CaCO3) have small buffering capacities and low CCSIs and when greater than 10 mg/L as CaCO3 of calcium is added to the water CCSI could become greater than zero or saturated. When solution alkalinity or calcium is elevated (> 25 mg/L as CaCO3), adding 10 mg/L as CaCO3 of calcium has a minimal and non-significant effect on CCSI (< 0.2 CCSI increase). In fact, waters that have a highly buffered carbonate system (i.e. alkalinity > 100 mg/L as CaCO3), could absorb much greater than a 10 mg/L as CaCO3 increase in calcium without a significant or notable change in CCSI.

It is needed and reasonable to prioritize protecting low alkalinity waters in this translator because they have the greatest potential to experience measurable changes in CCSI in response to an increase in calcium hardness. Protecting low alkalinity waters is conservatively protective of higher alkalinity waters as well. Low alkalinity waters are primarily found in far northeastern Minnesota in the northern lakes and forest and northern Minnesota wetlands ecoregions. Alkalinity generally increases in concentration in a gradient from northeast to southwestern Minnesota (

Figure 4). In high calcium and alkalinity waters, a calcium increase greater than 10 mg/L as CaCO3 would not significantly change the CCSI. In these waters, site-specific chemical modeling could be used to demonstrate that the proposed increase that is greater than 10 mg/L would not significantly increase the CCSI.

Figure 2. Calcium carbonate saturation index (CCSI) as a function of solution pH and hardness in calcium carbonate dominant waters.

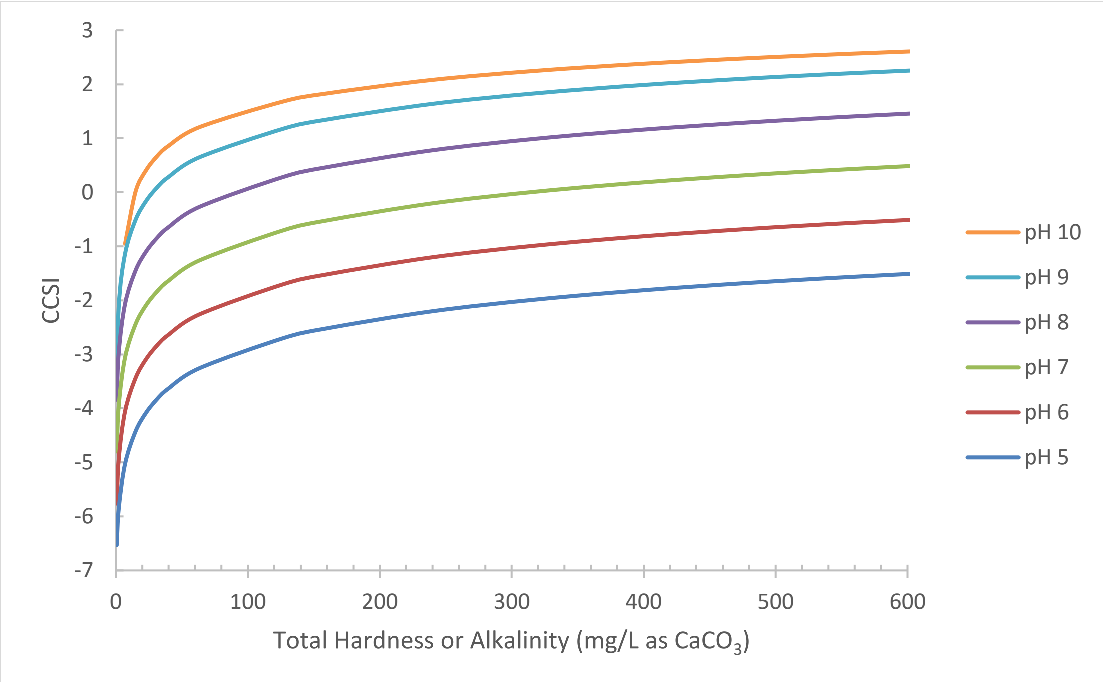


Figure 3. Calcium carbonate saturation increase when 10 mg/L as CaCO3 of calcium hardness is added to the solution as a function of pH and total hardness in calcium carbonate dominant solutions.

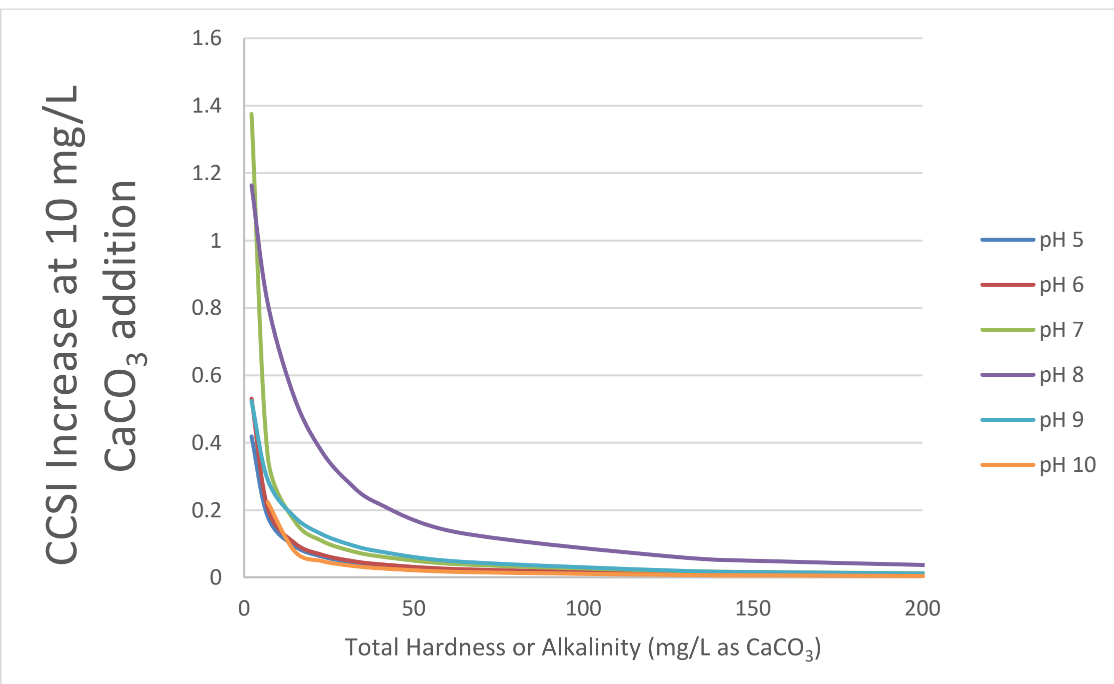
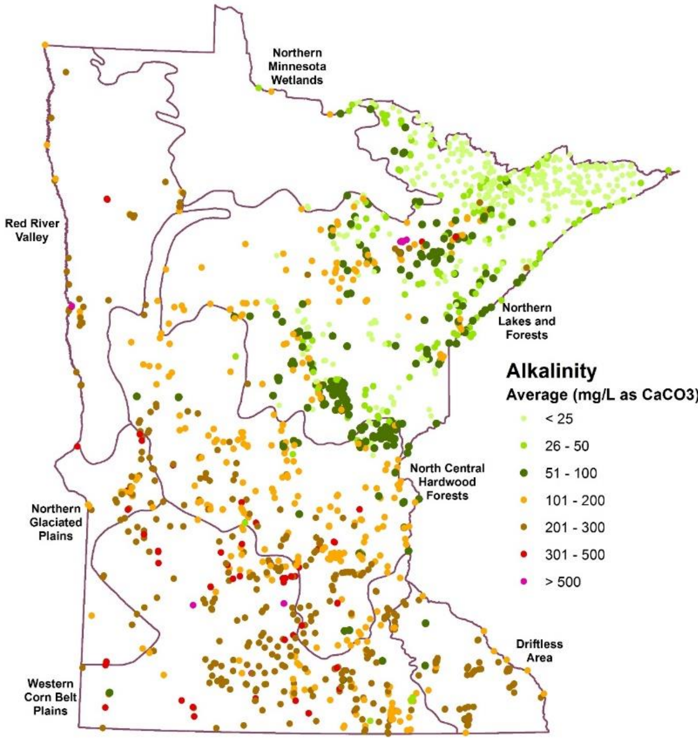


Figure 4. Locations where alkalinity has been sampled and stored in the MPCA surface water quality database. Each point represents the average of alkalinity measured at that location.



Q5: Will the net increase in hardness loading cause severe calcium scale formation potential at any downstream industrial appropriator?

The goal of this question is to ensure that a net increase in loading from a NPDES discharger does not degrade water quality to a degree that would cause severe calcium scaling for any downstream industrial appropriator. If a NPDES discharger were to discharge calcium at levels that would cause severe scaling, then that would be considered an impairment of the industrial consumption designated use. To protect the industrial consumption designated use, the MPCA is proposing the numeric definition of severe scaling. Defining severe scaling numerically is needed and reasonable because a numeric definition allows for the calculation of the need for numeric effluent limits protective severe scaling.

The user of the translator would only reach this point after proceeding through the previous questions without reaching box 7. This question is structured last because it requires formally calculating the CCSI instead of using the simpler surrogate of hardness or calcium concentrations. As previously stated, calculating the CCSI is complex and requires specialized knowledge, and the MPCA intentionally put this question last to minimize the need for formally calculating CCSI. Due to the complexity of calculating the CCSI, the MPCA expects that very few NPDES permit holders would have the in-house technical capacity to calculate the CCSI. The overwhelming majority of permit holders would have to hire expensive water quality consultants to calculate the CCSI. Normally, the MPCA expects permittees to perform this type of calculation themselves, but in this case the MPCA would be willing to perform the calculation for permittees. If a permittee reaches this stage of the translator, they need only ask and the MPCA will help them with the calculation.

The MPCA is proposing the following definition of severe scaling, within this rule:

A CCSI increase to above 2.0, attributable to a net increase in loading of hardness, at the location where water is appropriated for industrial consumption at the minimum stream flow defined in part 7053.0205 subpart 7(E).

The 2.0 CCSI threshold was determined by considering drinking water engineering scale management references since the MPCA could only find incomplete references relevant to CCSI and industrial water treatment. There are peer reviewed references that evaluate calcium scaling indices for specific industries such as oil and gas (Kan & Tomson, 2012) boilers and burners (Basu et al., 2012) cooling towers (Puckorius & Brooke, 1991) and solar hot water systems (Ahmed et al., 2016). The literature on calcium scaling by industry is not comprehensive because the MPCA could find no relevant literature specific to every Minnesota industry (i.e. no relevant CCSI literature for snowmaking, wood products processing, nuclear power, etc.).

Since the literature is not sufficient to develop an industry-specific CCSI value for every industry in Minnesota, the MPCA chose to rely on the generalized protections developed for drinking water scale management. Managing calcium carbonate scale formation is an essential component of minimizing corrosion in drinking water distribution networks and is very well studied. Not managing scale formation appropriately can lead to either unwanted corrosion of pipes or excess scale forming that can plug pipes (2014 Flint, MI water crisis; MN Rural Water Association, 2020; Pieper et al, 2017). Drinking water references recommend a slightly positive (0 – 0.5 CCSI) value for drinking water because a slightly positive CCSI can cause a fine (but not severe) calcium scale to form on pipes which creates a physical barrier that prevents galvanic corrosion (Minnesota Rural Water Association, 2020; Sigler & Bauder, n.d.). Every single drinking water reference the MPCA reviewed cautioned that maintaining a "ideal" CCSI is an important but incomplete part of managing scale and that scale needed to be analyzed holistically in conjunction with other metrics and site-specific evaluations. This is because the CCSI predicts whether scale could theoretically form over an infinite geological time scale but cannot guarantee whether the scale would actually form over human timescales (Snoeyink & Jenkins, 1980) . For example, waters with supersaturated CCSI values above 2.0 could precipitate no calcium carbonate under rare thermodynamics (i.e. no turbulence and no nucleation sites for crystal formation and low temperatures and phosphate inhibitor), and waters with 0.1 CCSI could quickly precipitate large amounts of calcium carbonate under rare thermodynamics, i.e. high turbulence and high calcium and alkalinity and lots of nucleation sites and high temperature and no inhibitors (Snoeyink & Jenkins, 1980). Quantifying the rate or kinetics of calcium scale formation is substantially more complex than just calculating the CCSI because it requires bench top studies, PhD levels of water chemistry knowledge and it is not always possible to apply findings from one specific water chemistry to another specific chemistry.

It is unreasonable to include formal kinetic rate analyses of calcium carbonate scale formation within this translator because it would require an unreasonable amount of effort, would require laboratory and academic knowledge the MPCA does not have, and an equivalent level of protection can be achieved with less complexity. Fortunately, engineers have developed guidelines for CCSI that internalize the kinetics of scale formation (Table 12). When the CCSI is above 2.0, scale is likely to form at severe levels and rates that would cause unwanted plugging of pipes. Maintaining the CCSI less than 2.0 ensures that industrial water appropriators would not have severe calcium scaling on their water intake structures and that the water quality would be suitable for general industrial use including any further degree of treatment the appropriator might choose to employ. The 2.0 CCSI value was derived by consulting Table 12. The 2.0 value was selected because it was the low bound of the treatment advisable treatment category and was therefore a reasonably conservative threshold below which severe scale is unlikely to form in industrial water intake structures. The 2.0 CCSI value would be implemented as a never to be exceeded value.

The MPCA chose to not include a low bound on CCSI because this question is only reached after demonstrating that a net increase in calcium hardness has occurred in the surface water of concern. Since CCSI can only increase in response to increased hardness, there is no need to protect for the lower bound of CCSI management.

Table 12. The calcium carbonate saturation index (CCSI) in relation to corrosion levels in piping and recommended treatment levels. Adapted from Wilkes University Center for Environmental Quality.

CCSI	Description	Treatment Recommendation
-4	Severe Corrosion	Treatment recommended
-3	Moderate Corrosion	Treatment recommended
-2	Moderate Corrosion	Treatment may be needed
-1	Mild Corrosion	Treatment may be needed
-0.5	No Corrosion	Probably no treatment
0	No Corrosion	No treatment
0.5	Some Faint Coating	Probably no treatment
1	Mild Scale Coating	Treatment may be needed
2	Mild to Moderate Coating	Treatment may be needed
3	Moderate Scale Forming	Treatment advisable
4	Severe Scale Forming	Treatment advisable

Depending on the outcomes of the Box 5 evaluation, the Agency will either 1) develop and include an effluent limit for hardness in the NPDES permit (box 6), or 2) determine there to be no narrative translation and thus no inclusion of a hardness limit in the permit (box 7).

Box 6: No effluent limit is needed to protect industrial consumption.

If this box is reached, the analysis has demonstrated that the industrial consumption designated use is protected and that no effluent limit is needed.

Box 7. An effluent limit is needed to protect industrial consumption.

If this box is reached, the analysis has demonstrated that the industrial consumption designated use is not protected and that an effluent limit is needed. The effluent limit should ensure that the CCSI is not above 2.0, at the location where water is appropriated for industrial consumption at the minimum stream flow defined in part 7053.0205 subpart 7(E). The limit should be expressed in units of calcium as mg/L as $CaCO_3$ and should be included in the permit as a kg/day mass limit with a limit frequency not to be exceeded on a daily basis.

6) 7053.0263 Effluent limits for point source discharges of sewage, industrial, and other wastes to protect water quality for irrigation

Part 7053.0263 is new language that is being added to define the procedures to use to determine effluent limits appropriate to protect the Class 4A irrigation designated use.

Subp. 1. This subpart establishes the scope of this part. It is reasonable to establish a scope to ensure that readers understand that limits established under part 7053.0263 apply in addition to other applicable limits. In addition, the agency informs the reader that the most stringent requirement applies in all cases of conflicts between part 7053.0260 and other applicable regulations.

Subp. 2. This subpart establishes the definitions used in this part, and refers to definitions in both Minn. R. ch. 7050, which contains the water quality standard, and Minn. R. ch. 7053, which contains implementation procedures. It is reasonable to establish definitions to ensure that readers have a common understanding of the use of terms. It is also reasonable to refer back to the water quality standard, which is the key foundation of the implementation procedures found in this part.

Subp. 3. This section is being added to define the procedures to use to determine effluent limits appropriate to protect the Class 4A irrigation designated use.

Item A. This item defines that the procedures laid out in the method incorporated by reference must be used to determine if a discharger would cause or contribute to an exceedance of the irrigation narrative water quality standard. This is reasonable because it clearly defines how the MPCA will implement, through permits, the narrative standard included in this rulemaking. Early comments generally supported inclusion of the method into rule. It is reasonable to incorporate the method by reference as the method is more easily understood when presented in a flow chart form; the method is too complicated and extensive to add to the rule language directly. The reasonableness of individual portions of the method are presented in the general reasonableness section.

Item B. This item reiterates that the critical low flow to use in evaluation of the potential for exceeding a standard is the $122Q_{10}$ flow rate. The reasonableness of using the $122Q_{10}$ flow is explained in the General Reasonableness section. This item also clarifies that the evaluation of whether an effluent limit is needed to ensure the narrative standard will be met is conducted at the point at which the water is withdrawn for irrigation purposes. The reasonableness of this choice is explained in the general reasonableness section.

Item C. This item requires MPCA to assign an effluent limit when the discharge could impact the irrigation portion of the agricultural designated use, as determined through the use of the method incorporated by reference. This language is reasonable to ensure that MPCA is required by rule to assign limits if discharge would impact the designated use.

Item D. The MPCA is proposing to incorporate by reference a document that explains the methodology to be used to determine whether effluent limits are needed for a discharger, and how to develop those limits if needed. The document is being incorporated “as amended”, allowing for future changes to the guidance to be conducted without rulemaking.

7) Class 4A translator methods

The following sections explain the reasonableness of each question within the translator flowchart method.

Q1: Is there reasonable potential for an exceedance of a water quality standard for a downstream waterbody?

It is needed and reasonable to include this decision in the translator method because it clarifies MPCA’s responsibility to ensure that NPDES dischargers do not cause or contribute to the violation of any downstream water quality standard. (This responsibility is already established at 40 CFR § 131.10 (b) and 40 CFR 122.44(d) and in Minnesota rules under the construction of the Class 6 beneficial use at Minn. R. 7050.0140, subp. 7. and in Minn. R. 7050.0155. If the NPDES permittee discharges to waters of the state that ultimately flow into the sovereign waters of another state, a tribe, or a province, then the MPCA must ensure (usually by establishing a WQBEL) that the NPDES discharger does not cause or contribute to a violation of any applicable water quality standard promulgated by that state, tribe, or province. Including this language emphasizes existing CWA permitting obligations and ensures that future users of the translator will consider all downstream water quality standards when developing NPDES permits. This step will be revisited with every five-year permit reissuance and as needed during permit issuance.

It is unreasonable and unnecessary for the MPCA to include specific procedures to protect any possible downstream WQS. The provisions requiring such protections are already applicable in federal and state rule, and the procedures will be specific to the form and construction of the applicable WQS. In general, the MPCA's approach is to protect the WQS in the same manner that the establishing state would do so, in terms of the magnitude, duration, and frequency of the standard. The CWA provides procedures for downstream states or tribes to use if they feel that the actions of an upstream state are not adequately using effluent limitations in NPDES permits to protect water quality standards.

If a limit is needed to protect the WQS of a downstream state, tribe, or province, and that limit relates to the parameters covered in the translator method (chloride, specific conductance, and SAR), it is reasonable for the translator method to direct consideration of how complying with a downstream state limit will also ensure that water quality is protected for irrigation of sensitive crops. If compliance will ensure that discharge water quality for specific conductance and SAR is always below the values protective of irrigation of sensitive crops, then the discharge is assured of protecting water quality to levels sufficient for all downstream irrigators of sensitive and non-sensitive crops. If this is the case, performing the rest of the analysis is not needed and no additional effluent limit is required to protect irrigation water quality.

Q2: Does the NPDES discharge have a high sodium and chloride content?

The narrative translator method focuses on the concentrations of salty parameters, especially SAR and specific conductance. However, in order to make more efficient decisions, earlier components of the narrative translator method rely on simpler questions, which are protective, but which do not require complex calculations. As described in the chloride linkage (S-20), the MPCA is able to make specific assumptions about the relationship between chloride effluent limits and protective irrigation water quality values for specific conductance and SAR, and to ensure protection of irrigation water quality using these assumptions. The general assumption is that when sodium chloride content is high, then specific conductance and SAR are also likely to be high, and they could be at levels high enough to cause irrigation problems for sensitive soils or crops.

These assumptions only hold true when the sodium and chloride concentrations in a discharge are high. High sodium and chloride content is defined using two criteria – both of which need to be met. The criteria are:

1) Sodium or chloride have been measured in the discharge at least once above 100 mg/L, which represents an elevated chloride content indicative of significant amounts of anthropogenic sodium chloride being added to the water somewhere prior to discharge; and
2) Sodium and chloride are present in the discharge at approximately 1:1 proportions. (i.e., there are approximately as many sodium molecules as chloride molecules), which suggests the presence of sodium chloride and makes is reasonable to assume that any reductions in chloride will result in an equal reduction in sodium.

The MPCA expects that between 80% and 95% of municipal wastewater dischargers have a high sodium and chloride content using the criteria above. Since so many municipal wastewater dischargers are likely to have elevated sodium and chloride content, it is important for the process to consider their specific water chemistries in this question. The MPCA expects that less than 20% of industrial wastewater dischargers will meet this criteria, because relatively few industrial wastewater dischargers employ processes that discharge elevated sodium and chloride.

If the sodium and chloride content in the discharge is low, then these water quality assumptions are not applicable and further consideration of site-specific irrigation water quality assumptions are needed.

Q3: Does the NPDES discharge need a class 2B chloride limit?

This decision is based on the MPCA's chloride linkage policy. If a facility will receive or already has an effluent limit to protect the 230 mg/L Class 2B chloride aquatic life standard for chloride in their permit, then the discharger will be required to reduce sodium and chloride concentrations in their discharge in order to comply with that limit. In that case, it is reasonable to rely on the Class 2 chloride effluent limit to appropriately control the level of salts in the discharge so as to also protect the irrigation narrative standard and beneficial use.

If the discharger does not need a Class 2B chloride limit, then there is no driver for the facility to reduce their discharges of chloride, sodium and specific conductance. The chloride reductions needed to comply with the limit will also lower specific conductance and SAR proportionally to the reductions in chloride. It is possible to calculate the amount of chloride reduction required to comply with the chloride effluent limitation and use this information to calculate the commensurate reductions in the discharge of SAR and specific conductance.

Table 13 can be used to estimate how reductions in sodium and chloride correlate with reductions in specific conductance.

Table 13. Relationship between chloride, sodium, sodium chloride and specific conductance in a water solution.

For every 1 mg/L of chloride reduction, there will also be a 0.64 mg/L reduction of sodium. Every 1 mg/L of sodium chloride reduction will reduce specific conductance by approximately 1.2-1.4 µS/cm dependent on the overall salinity of the solution. The calculations were performed using pure sodium chloride solution by the MPCA in the PHREEQC water quality modeling program developed by the United States Geological Survey.

Cl (mg/L)	Na (mg/L)	NaCl (mg/L)	Specific Conductance (µS/cm)
0	0	0	0
100	65	165	252
200	130	330	473
300	195	495	680
400	259	659	876
500	324	824	1064
600	389	989	1246
700	454	1154	1423
800	519	1319	1595
900	584	1484	1764
1000	649	1649	1930

Q4: Does the class 2B chloride limit protect water quality for irrigation of sensitive crops?

Once the calculations of the reductions in SAR and specific conductance are complete, based on Table 13, it is possible to consider how complying with the chloride limit will also ensure that water quality is protected for irrigation of sensitive crops. If compliance with a chloride limit will ensure that discharge water quality for specific conductance and SAR is always below the values protective of irrigation of sensitive crops, then the discharge is assured of protecting water quality to levels sufficient for all downstream irrigators of sensitive and non-sensitive crops. If this is the case, performing the rest of the analysis is not needed and no additional effluent limit is required to protect irrigation water quality.

Table 14 defines the data needed to make the determination that the effluent is meeting the water quality requirements protective of sensitive crops. It is important to set forth clear requirements for the data needed to make this decision, because accurately characterizing the “true” (from a statistical standpoint) concentration of pollutants in the effluent relies on having a sufficient number of data points that characterize the effluent condition. Data must be available for both specific conductance and SAR, and should be from the most recent permit term (five-years). The use of a never-to-be-exceeded frequency – meaning that the discharger must not have monitored pollutant concentrations over the specified levels - is reasonable to be conservative and ensure protection of the SAR and specific conductance levels necessary to protect sensitive crops. Single excursions over the values might not result in exceedances of the standard, but as this decision leads to the conclusion that no additional effluent limit is needed, it is reasonable and appropriate to be conservative.

Table 14. Data requirements needed to make the decision “Does the Class 2B chloride limit protect water quality for irrigation of sensitive crops?”

Parameter	Magnitude	Frequency	Number of effluent data points needed
Sodium adsorption ratio	< 6	Never to be exceeded	>5
Specific conductance	< 1,500 µS/cm	Never to be exceeded	>5

Q5: Is the discharge protective of water quality for irrigation of sensitive crops?

If the water quality of the discharged effluent is always sufficient to ensure that water quality is protected for sensitive crops, then performing the rest of the analysis is not necessary, and no effluent limit to protect irrigation water quality needs to be included in the permit. If the level of pollutants in the discharge is above the water quality values needed to protect for irrigation of sensitive crops, then there is the potential that the discharger could be causing water quality problems for downstream irrigators, and it is reasonable to proceed with a more detailed analysis to determine whether an effluent limit is needed.

This question addresses discharges not addressed in boxes 2 to 4 – those that discharge lower levels of sodium and chloride, such that no chloride limit would be needed in the discharge permit. (The effluent has an ionic signature that may be high in salts but low in the specific salts of chloride and sodium). . Discharges in Minnesota can have widely-varied chemistries; some discharges have a low sodium content, but also a high total salt content (such as taconite mines, or discharge of RO brines at facilities that use RO, etc.). It is also possible for discharges to have a low sodium content and a low total salt content (this is the case at gravel pits, groundwater dewatering, conventional drinking water plants, etc.). This question ensures that the salt content of every discharge is analyzed to ensure that irrigation water quality for sodium and specific conductance is protected

Table 14 defines the data needed to make the determination that the effluent is meeting the water quality requirements protective of sensitive crops. It is important to set forth clear requirements for the data needed to make this decision, because accurately characterizing the “true” (from a statistical standpoint) concentration of pollutants in the effluent relies on having a sufficient number of data points that characterize the effluent condition. Data must be available for both specific conductance and SAR. The use of a never-to-be-exceeded frequency – meaning that the discharger must not have monitored pollutant concentrations over the specified levels - is reasonable to be conservative and ensure protection of the SAR and specific conductance levels necessary to protect sensitive crops. Single excursions over the values might not result in exceedances of the standard, but as this decision leads to the conclusion that no additional effluent limit is needed, it is reasonable and appropriate to be conservative.

Table 15 can be used to estimate how reductions in sodium and chloride correlate with reductions in specific conductance.

Table 15. Data requirements needed to make the decision "Is the discharge protective of water quality for irrigation of sensitive crops?"

Parameter	Magnitude	Frequency	Number of effluent data points needed
Sodium adsorption ratio	< 6	Never to be exceeded	>5
Specific conductance	< 1,500 µS/cm	Never to be exceeded	>5

Q6: Is there an irrigation appropriator downstream? and decision point (P)7: – Locate all downstream irrigators

This question considers whether there is an irrigation appropriator downstream of the wastewater discharger. As described in the general reasonableness section, it is reasonable to evaluate water quality at the point it is withdrawn for irrigation. Doing so requires looking for those areas of appropriation. If there are no downstream irrigators then there is no need to proceed farther in the translator and no effluent limitation need be included in the permit. However, it is likely that almost every NPDES discharger would have an irrigator downstream of them. This is because the major watersheds in Minnesota (Mississippi, Minnesota, Red River, Rainy, St. Louis) have irrigators located on the downstream reaches of the major rivers that drain them. For example, there is an appropriator on the Mississippi river at Winona, MN, and therefore all of the 599 NPDES dischargers upstream of Winona, MN have an irrigation appropriator downstream of them. A limited number of NPDES dischargers do not have irrigators downstream of them, and they primarily discharge directly to Lake Superior or are located within several miles of the Iowa or South Dakota borders in Southwestern Minnesota.

It is important to consider the needs of every irrigator using surface water downstream of the wastewater discharge in question in order to ensure that the translator process protects water quality for all downstream irrigators. The closest downstream irrigator may not be growing sensitive crops in sensitive soils, while an irrigator farther downstream may be.

Only surface water appropriators that pull water directly from the flow path downstream of the NPDES discharger will be considered. Surface water irrigators pulling water directly from waters downstream of a NPDES discharger are most likely to be impacted by water quality from the upstream NPDES discharger.

Q8: Is ambient water quality suitable for irrigation at all downstream irrigators?

This question evaluates the ambient water quality – this is the quality of the water that irrigators are likely to appropriate – to support a decision of whether that water quality is suitable for irrigation of sensitive crops and soils. If surface water quality is suitable for irrigation of sensitive soils and crops, then the water quality will be suitable for all potential crops and soils. If ambient water quality at the locations where water is being appropriated is sufficient to protect sensitive crops, then NPDES discharger cannot be causing or contributing to an exceedance of the narrative standard and the NPDES discharger does not need a WQBEL in their permit.

The MPCA has a substantial database of surface water quality data to assess whether a water is suitable for irrigation by looking at the levels of specific conductance and SAR. The MPCA has collected over 250,000 surface water quality samples for specific conductance statewide, on the majority of flowing streams and rivers. The MPCA has collected less data for the SAR; however, there are still over 1,700 locations that have been sampled for the cations (Na, Ca, Mg) used in calculating the SAR. MPCA's water quality database can be used to find data to determine whether a water is suitable for irrigation for sensitive crops by comparing to the values in the values in Table 16.

The magnitude values in Table 17 are suitable for irrigation for sensitive crops in Minnesota climates; the justification for the magnitude of these values can be found below. In order for a water to be considered as being suitable for irrigation of sensitive crops, the levels of the relevant pollutants (SAR and specific conductance) must be below the magnitude laid out in the table, and the data must meet the requirements identified for the location where the pollutant levels were measured and how many times they have been measured. The sample locations and number of data points requirements were established to strike a reasonable balance between complexity and certainty in the ambient water quality evaluation. Specific conductance and SAR are among the most consistent water quality parameters the MPCA measures. A review of the information in MPCA's database, primarily collected during the summer season, shows that specific conductance and SAR tend to vary around the median or central tendency by less than 20% at the majority of sampled locations near irrigators. They tend to vary even less as the size of the waterbody gets larger. Even in the 'flashiest' low volume streams that are subject to major flow fluctuations due to precipitation events, such as the urban Minnehaha creek, specific conductance and SAR levels are quite consistent. The dominant source of anthropogenic salt to Minnesota waterways is road salt (i.e. >300,000 tons of salt are applied during the winter in the Twin Cities Metro Area) and that salt is primarily flushed away during the spring snow melt. In the majority of flowing waterbodies, the road salt signature is unlikely to be present during the irrigation season and salt concentrations tend to vary little during the growing season.

Specific conductance and SAR tend to be so consistent that relying only on one measured data point within the last ten years is sufficient to appropriately characterize water quality for the purpose of this narrative translator method. This should not be interpreted that only one sample should be used to characterize existing water quality if more samples are available. It is also not a decision applicable to any other areas where the MPCA assesses water quality condition. The translator methods should always use as much available data as possible to determine existing water quality near an irrigator. In every situation the MPCA was able to analyze, the primary difficulty was not a lack of data, but processing the abundance of available water quality data (for example, some water quality stations measure specific conductance every fifteen minutes and produce 96 data points every day). Most waterbodies with irrigators on them have been sampled many times at several different locations, though usually not directly at the point of appropriation. The MPCA developed an automated process to evaluate the available nearby water quality data for specific conductance and SAR, but could not fully automate the evaluation because of the complexity of the data both in term of geospatial location and number of samples at any given point. It is likely that a human being will always have to make the final determination on water quality near an irrigator. This human should use as much data, automation and big data techniques as possible to make decisions.

Table 16. Data Requirements

Parameter	Magnitude	Sample Locations Required	Number of Data points needed
Sodium adsorption ratio	< 6	One location upstream of irrigator and downstream of discharger	At least once within last ten years
Specific conductance	< 1,500 µS/cm	One location upstream of irrigator and downstream of discharger	At least once within last ten years

Q9: Near all irrigators, does the soil have a salinization risk?

This step evaluates available soil data where the irrigation water is likely to be applied, to determine whether the soil has a risk to become salinized because of irrigation practices. The primary datasets in this analysis will come from the SSURGO soil survey geographic database, maintained by the Soil Survey staff of the Natural Resources Conservation Service, part of the U.S. Department of Agriculture (USDA). Salinization risk is assessed for each individual soil map unit within a two mile circular buffer surrounding the downstream irrigator. If the two-mile buffer contains one or more soil map units with a medium or high salinization risk, surrounding soil will be considered as being less suitable for irrigation, or more sensitive to salts in the irrigation water. In that case, more protective irrigation salinity values may be necessary. If the entire two-mile buffer surrounding the downstream irrigator is composed of solely low surface salinization risk soil map units, the soil would be considered suitable for irrigation with little risk from excess salinity in irrigation. Soils with a low salinization risk are well drained, have minimal interaction with the salinity in the water table of the soil horizon, and are expected to have the potential for consistent flushing of salinity from the root zone due to natural rainfall and infiltration. As a result soils in this low salinization risk category have little potential for soil salinization to occur, especially if there is evidence that the irrigation water quality is suitable for sensitive crops and soils, as was determined in the step above.

The two-mile buffer distance was selected because it is unlikely that irrigators in Minnesota would construct irrigation equipment capable of appropriating surface water from a distance greater than two miles. Constructing more than two miles of irrigation piping is a significant endeavor in terms of effort and cost, and is one that farmers are unlikely to take on or afford. The two-mile distance was chosen using a combination of best professional judgement, calculations of theoretical energy and pumping requirements to move sufficient water two miles out of a river bed, analysis of aerial images of piping systems where surface water irrigation occurs in Minnesota, and conversations with DNR water permitting staff about typical irrigation practices in Minnesota. Farmers are unlikely to install irrigation equipment longer than two miles to pump surface water out of a riverbed floodplain to upland farmlands. This is because constructing, operating and maintaining pumping systems to move water across large elevation differences is difficult, expensive, energy intensive, and likely to require engineering design that further increases complexity.

Some commenters noted that the MPCA should include provisions so that the determination of soil salinization risk near an irrigator could be even more localized, if justified. It is possible, in very limited situations, that the two-mile buffer could overestimate the salinization risk of the soils near the irrigator because the two mile buffer is conservatively large and most appropriators will be moving water a lesser distance than two miles. Consider the example of an irrigator that appropriates surface water and applies that water within a quarter-mile of the appropriation location. Within the quarter-mile distance, the soils have a low salinization risk, but at the very edge of the two-mile buffer specified in the translator method, the soils have a high salinization risk; in this scenario the irrigator would be presumptively classified as needing additional protections because the presence of some sensitive soils, when in fact the irrigator does not apply water on sensitive soils.

If presented with evidence that an occurrence such as the example above is real, the MPCA could potentially reconsider the very localized salinization risk near an irrigator. However, unless that evidence is presented to the MPCA, the most reasonable protective approach is to use the two-mile buffer distance, in order to contain the most soils that could possibly be impacted. The MPCA evaluated using more location-specific methods to classify soils near appropriators, but settled on the two mile buffer because it strikes a reasonable balance between accuracy and effort. Doing a more site-specific analysis requires evaluating who owns what parcels of lands and associating them with a specific irrigation permit; this is an extremely difficult process due to the availability of data, and therefore beyond the scope of what can reasonably be accomplished on a statewide basis.

P10: Do not include limit in permit protective of irrigation

P10 (Box 10) is an outcome of multiple analysis or questions raised previously, and the reasonableness of the outcome is discussed in the reasonableness of each piece of analysis. If this box is reached, then no water quality based effluent limit for specific conductance or SAR should be included in the permit. This is because there is minimal likelihood that the irrigation water quality in question would affect crops or soil structure. Effluent monitoring for these parameters should be continued to ensure effluent conditions do not change in such a way that would change the outcome.

Q11: Near all irrigators, is the irrigation used on usually grown sensitive crops?

As the narrative translator is built to assess site-specific factors, a critical factor to look at is the crops or vegetation that are being grown and irrigated. This question focuses on whether the water quality needs to be sufficient to protect sensitive groups. Therefore, it is necessary and reasonable to define usually-grown crops and the sensitivity of those crops where the irrigation water will be applied.

For the purposes of this translator method, sensitive crops are those found in Table 17. These crops were classified as sensitive using the categories (Table 18) from Wallender & Tanji (2011). Any crop with a root zone salinity tolerance rating of less than 1,500 µS/cm is classified as a sensitive crop. Tropical crops such as mangoes, limes and oranges are not included in the list because these crops cannot be grown in Minnesota's climate. This list only includes those crops for which there is published literature to define their sensitivities. The MPCA plans to review the list of sensitive crops on annual basis to include new crops, as needed.

Table 17. Sensitive crops to excess salinity as defined.

Sensitive crops **Herbaceous crops**	**Woody crops**
Bean, Common	Apple
Bean, Mung	Apricot
Carrot	Blackberry
Fennel	Boysenberry
Onion	Cherry
Parsnip	Peach
Pea	Pear
Pidgeon Pea	Raspberry
Strawberry	Walnut

Table 18. Sensitive crops categories. Source: Wallender & Tanji (2011) defines the salinity tolerance ratings for no crop yield loss as below:

Salinity Tolerance Rating	**Root Zone Salinity Range** **(specific conductance; uS/cm)**
Sensitive	< 1,500
Moderately Sensitive	1,500 – 3,000
Moderately Tolerant	3,000 -6,000
Tolerant	6 -10

The narrative standard currently refers to crops or vegetation "usually" grown in the area, and the

MPCA is not changing this language. Identifying the usually-grown crops at the relevant location will be done using three methods: 1) digital aerial images; 2) classifications in the DNR water appropriation database; and 3) information solicited during the public comment process of NPDES permit issuances. The reasons the three different methods are needed is explained in more detail more below.

Since 2006, the USDA has produced high-resolution annual digital land cover maps that accurately classify the state's landscape into types of vegetation and crop types. Table 19 summarizes this digital data for 2019. It shows the top thirteen usually grown crops in Minnesota for that year and the acreage over which they are grown. The top ten most common crops account for over 99% of the total harvested acreage, meaning that the dataset accurately characterizes the locations and types of crops that are usually grown in Minnesota.

Table 19. The thirteen most commonly grown crops in Minnesota and their harvest acreage (National Agricultural Statistics Service, 2019).

Crop	Harvest Acres in 2019	Percentage of total harvested acreage
Corn	7,800,000	39.4%
Soybeans	6,850,000	34.6%
Wheat	2,800,000	14.2%
Hay & Haylage	1,330,000	6.7%
Sugarbeets	424,000	2.1%
Oats	240,000	1.2%
Barley	70,000	0.4%
Sunflower	58,000	0.3%
Peas	54,000	0.3%
Canola	51,000	0.3%
Rye	50,000	0.3%
Potatoes	43,000	0.2%
Beans	3,500	0.02%

For the purposes of the translator method, a crop is classified as usually-grown if it has been grown in a location at least once over the period of record (2006-present), as demonstrated using the USDA digital annual land cover data. There are no digitized crop datasets prior to 2006, so this represents the best characterization of crops usually grown in the area. Finding and analyzing older data would require complex and resource-intensive analysis involving either analysis of analog aerial images or surveys and interviews of farmers. This is an unreasonable amount of effort, especially when the dataset available spans more than 10 years and will continue to grow, increasing the period of record. In addition, the existing "usually grown" language recognizes that crop rotations can change over time. The USDA crop data is accurate to within 0.2 acre increments and is especially accurate for the dominant crops such as soy, corn, alfalfa, and wheat; however, it is not perfect. A by-product of the way the digital satellite images are processed is a small amount of uncertainty for unusual crops and turf in the urban/rural interface. For example, the USDA crop data identifies several locations (noted as stray pixels) where pomegranates – a crop that prefers a mild-temperate to subtropical climate – are supposedly grown. To ensure that false positives for the presence of unusual crops do not occur, it is necessary to digitally tidy the aerial images. After a digital clean-up of the aerial images, the MPCA is confident that the locations of usually-grown crops can be accurately identified on greater than 99% of the cultivated landscape, except as discussed below.

The digital imagery does not clearly distinguish sensitive herbaceous tree crops such as walnuts, pears and apples. The digital imagery also does a poor job identifying locations where turf grass or landscape vegetation exists because it lumps locations dominated by turf (sports fields, cemeteries, parks, etc.) into the 'lowly developed urban area' category rather than as unique locations where specific classes of vegetation exists. Since these specific crops and turf cannot be easily located using the digital imagery, the most reasonable way to identify the location where these crops and vegetation would be irrigated is to use the classification in the DNR water appropriation database. If the irrigator is classified by the DNR as using the surface water for irrigation of nurseries or orchards, then that irrigator will be treated as requiring 'sensitive' water quality protections. Turf grass irrigation will not be classified as 'sensitive'.

If the two-mile buffer area surrounding the irrigator contains a sensitive crop in Table 17 at greater than 0.5% of the total buffer area (40 acres), then the irrigator will be considered as having the potential to irrigate sensitive crops. If a sensitive crop is present at less than 0.5% of the buffer, then the locations of that sensitive crop will be analyzed to determine whether that sensitive crop is in a contiguous plot of land and actually present on the landscape. In almost every situation the MPCA analyzed, any crop present at less than 0.5% of the buffer area was not a contiguous plot but rather a group of isolated random pixels, indicating a problem with the digital imagery similar to the one with pomegranates. If there is substantial uncertainty, the MPCA will look at available aerial imagery to determine whether the irrigator is actually using irrigation water on a sensitive crop.

Some commenters noted that the MPCA should include provisions so that the determination of sensitive crops near an irrigator could be even more localized, if justified. It is possible, in very limited situations, that the two-mile buffer could overestimate the extent of sensitive crops near the irrigator because the two-mile buffer is conservatively large. This is similar to the example described in the soil section. An irrigator may appropriate surface water and only apply that water within a quarter-mile of the appropriation location. Within the quarter-mile area, the crops being irrigated are not sensitive, but at the very edge of the two-mile buffer the crops are sensitive; in this scenario the irrigator would be presumptively classified as needing additional protections because the presence of some sensitive crops within the two-mile buffer, when in fact the irrigator does not apply water on sensitive crops.

If presented with evidence that an occurrence such as the example above is real, the MPCA would consider the hyper-localized sensitive crops near an irrigator. However, unless that evidence is presented to the MPCA, the most protective, conservative and reasonable approach is to presumptively use the two-mile buffer distance. The MPCA evaluated using more location-specific methods to classify sensitive crops near appropriators, but settled on the two mile buffer because it strikes a reasonable balance between accuracy and effort. Doing a more site-specific analysis requires evaluating who owns what parcels of lands and associating them with a specific irrigation permit; this is an extremely difficult process due to the availability of data and therefore beyond the scope of what can reasonably be accomplished on a statewide basis.

P12: Use numeric values protective of irrigation of non-sensitive crops

Protecting for common crops and soil conditions near the irrigator using numeric water quality values is the primary goal of this section. The values in Table 20 will be used in the narrative translator method to protect for irrigation for common Minnesota crops and soil conditions. The justification for these values is explained in more detail in the TSD (S-2).

Table 20. Protective values for irrigation for common Minnesota crops when calculating the need for NPDES effluent limitations.

Parameter	Magnitude	Duration	Frequency
Sodium adsorption ratio	10	Growing season average (June to September)	Never-to-be-exceeded
Specific conductance	3,000 µS/cm	Growing season average (June to September)	Never-to-be-exceeded

Specific conductance and SAR are the two parameters of concern to protect irrigation water quality from excess total salinity (specific conductance) and sodium ions that contribute to total salinity (SAR). The two parameters should be evaluated independently because doing so ensures that irrigation water quality is protected to the greatest extent. The detailed rationale for focusing on specific conductance and SAR is provided in the general reasonableness section.

Magnitude

Selecting the protective magnitude is based on a considerations of critical local factors that influence irrigation water quality as required in the proposed rule language in Minn. R. 7050.0224, subp. 2.

Specific Conductance

Considering crop types: The specific conductance magnitude of 3,000 µS/cm is protective of all crops that are classified as non-sensitive according to the criteria in Table 22 above. Choosing specific conductance magnitudes to protect moderately sensitive, moderately tolerant and tolerant crops is protective of all non-sensitive crops.

Considering climate: The protective root zone specific conductance values in ASAM assume an arid or semi-arid climate. Minnesota receives greater than 2.0 times the average annual precipitation (20-37 inches) of an arid climate (< 9.6 inches) (Figure 25 from TSD). Minnesota's natural precipitation functions to flush specific conductance from the root zone of crops, and this means that in Minnesota a higher specific conductance irrigation water can be used than in an arid climate. Therefore, it is reasonable to select the upper bound (3,000 µS/cm) of the moderately sensitive crops category (1,500 µS/cm to 3,000 µS/cm) protective of crops in arid climates.

Considering soil types: Soils that have sufficient drainage can tolerate irrigation water higher in specific conductance because natural precipitation flushes salinity from the root zone more quickly. Since irrigated soils in Minnesota generally have sufficient drainage and do not have a high salinization risk, it is unreasonable to select a specific conductance value to protect for very poorly drained soils. Therefore, it is reasonable to select the upper bound (3,000 µS/cm) of the moderately sensitive crops category (1,500 µS/cm to 3,000 µS/cm).

Irrigated soils generally are not already salinized or approaching being salinized. Soils are generally low in harmful sodium and chloride salts, and are high in calcium and magnesium salts that are less harmful to crops and soils. Since most soils do not have a high salinization risk, it is reasonable to select specific conductance values at the upper bound (3,000 µS/cm) of the moderately sensitive crops category (1,500 µS/cm to 3,000 µS/cm).

Considering irrigation practices: 3,000 µS/cm is protective of the irrigation practice most likely to cause harm crops (spray irrigation). Spray irrigation is more likely to harm crops because it puts irrigation water in direct contact with crops and increases the potential for leaf burn. The other forms of irrigation (drip, flood) have no possibility for leaf burn as the irrigation water is not applied near leaves.

Farmers using irrigation prefer to have no decrease in yield due to excess specific conductance.

Protective specific conductance values for irrigation should not allow for any decrease in yield. The 3,000 µS/cm value assumes no losses in yield.

SAR

Considering soil and crop types: A SAR magnitude of 10 is protective of all crops grown in non-sensitive soils from excess sodium in irrigation water (Franzen et. al., 1996; Fipps et al., 2003; S.D. Admin R. 74:51:01:53). Sodium toxicity is reduced if sufficient calcium is also present (Ayers & Wescot, 1994) . Since the SAR is a ratio of sodium to hardness, a SAR of 10 will ensure sodium is not elevated at levels that could impair crops or soils and that sufficient hardness is also present.

A SAR of 10 is the value that the North Dakota state extension service recommends for irrigation water statewide when natural rainfall is expected (Franzen et al., 1996). South Dakota has gone a step farther and adopted irrigation water quality criteria (S.D. Admin R. 74:51:01:53) for SAR with a magnitude of 10. North and South Dakota have determined that a SAR of 10 is protective of the semi-arid regions of their states that also have more saline soils and drier climates than Minnesota.

The soils in Minnesota have low sodium, and are not already salinized except for some isolated locations in western Minnesota. Application of irrigation water with an SAR of 10 is unlikely to cause soil infiltration issues for Minnesota soils (Franzen et al., 1996; Fipps et al., 2003; S.D. Admin R. 74:51:01:53).

Considering climate: A SAR of 10 accounts for natural precipitation and Minnesota's climate. Minnesota receives at least two times the average annual precipitation that a semi-arid climate receives (S-2, Figure 25). Minnesota's natural precipitation functions to flush sodium from the root zone of crops and this means that in Minnesota a higher SAR can be used than in an arid climate.

Considering irrigation practices: A SAR of 10 is protective of the irrigation water quality when spray irrigation is used. This is because spray irrigation puts irrigation water in direct contact with crops and increases the potential for leaf burn. The other forms of irrigation (drip, flood) have no possibility for leaf burn.

Farmers using irrigation prefer to have no decrease in yield due to excess SAR. Protective SAR values for irrigation should not allow for any decrease in yield. The 10 SAR value assumes no losses in yield.

Duration and Frequency

The protective duration for both parameters is the growing season average (June to September). The duration is the interval of time that a crop can tolerate a specific conductance or SAR in the root zone without adverse effects. The proposed language in Minn. R. 7050.0224, subp. 2 requires that irrigation water quality is protected over the growing season as an average.

The literature on the duration of exposure to higher levels of specific conductance and SAR that causes concern for usually grown crops is minimal, and what is available is scattered and outdated. The information is not readily transformed into durations relevant to water quality standards. Therefore, this analysis relies on generalized conclusions in the literature on crop exposure to specific conductance. Wallender & Tanji (2011) state that "mean soil seasonal salinity is probably a reasonable estimate" for the duration of specific conductance exposure unless better information is available for a given plant. Since there is no "better information" available for all the crops in question, the MPCA will use a seasonal average duration. Seasonal, in this case, would be June to September.

The June to September duration was selected because that duration is consistent with the protective $122Q_{10}$ flow rate in Minn. R. 7053.0205, subp. 7D and when the usually-grown crops are typically irrigated in Minnesota. Depending on location within Minnesota and the type of crop or vegetation being grown, the growing season can vary. The majority of usually-grown crops are seeded during the spring time and harvested in the fall. In the early spring time (April and May) soils in Minnesota are typically wet and because of the high moisture content, irrigation is unlikely to occur. Likewise, farmers are unlikely to irrigate in the late fall (October and November) because most farmers prefer dry soils during harvest.

Minnesota's natural precipitation functions to flush salts out of the root zone of crops, meaning that root zone specific conductance is likely to vary on any given day as a function of natural rainfall and as a results a growing season average is justifiable duration to protect water quality for usually grown crops and soils.

The protective frequency in the water is "never-to-be-exceeded". The frequency of a crop yield threshold value is how often the magnitude and duration can be exceeded. For example, a crop might experience no decrease in yield as long as the root zone conductivity or SAR (magnitude) is never exceeded (frequency) when calculated over a seasonal average (duration).

The usually-grown crops in Minnesota are typically annual crops and pass through their entire lifecycle over a single growing season. Any reductions in crop yield due to high specific conductance irrigation water would impact the grower's crops during that single season. Therefore, the specific conductance that causes effects should not be exceeded over the growing season, because the yield of the crops would not be recovered, even if salinity were to decrease over the next growing season. A never-to-be-exceeded frequency is conservatively protective of perennial crops or vegetation such as apples or pears.

P13: Use numeric values protective of irrigation of sensitive crops

Protecting all crops, including sensitive crops and crops grown in sensitive soil conditions near the irrigator, is the primary goal of this part of the narrative translator method. The values in Table 26 are used in the narrative translator method to protect for irrigation for sensitive crops and soil conditions. The justification for these values is explained in more detail later in this section.

Table 21. Protective values for irrigation for sensitive crops in sensitive soil conditions to be used when calculating the need for NPDES effluent limitations.

Parameter	Magnitude	Duration	Frequency
Sodium adsorption ratio	< 6	Growing season average (June to September)	Never to be exceeded
Specific conductance	< 1,500 µS/cm	Growing season average (June to September)	Never to be exceeded

Magnitude
Selecting the protective specific conductance and SAR magnitude is based on a set of assumptions regarding the critical local factors that influence irrigation water quality. These assumptions are discussed in greater detail below.

Specific Conductance
Considering crop types: The magnitude of < 1,500 µS/cm is protective of all crops that are classified as sensitive according to the criteria in Table 22 above. Choosing specific conductance values to protect sensitive crops is also protective of all other non-sensitive crops.

Considering climate: The protective root zone specific conductance values in Wallender & Tanji (2011) assume an arid or semi-arid climate. Minnesota receives greater than 2.0 times the average annual precipitation (20-37 inches) of an arid climate (< 9.6 inches) (S-2, Figure 25). Minnesota's natural precipitation functions to flush specific conductance from the root zone of crops, and this means that in Minnesota a higher specific conductance irrigation water can be used than in an arid climate. Therefore, it is reasonable to select the upper bound (1,500 µS/cm) of the sensitive crops category protective of crops in arid climates.

Considering soil types: Soils that have sufficient drainage can tolerate a higher specific conductance irrigation water because natural precipitation flushes salinity from the root zone more quickly. Since irrigated soils in Minnesota generally have sufficient drainage, it is unreasonable to select a specific conductance value to protect for very poorly drained soils. Therefore, it is reasonable to select the upper bound (1,500 µS/cm) of the sensitive crops category.

Irrigated soils generally are not already salinized or approaching being salinized. Soils are generally low in harmful sodium and chloride salts and are high in calcium and magnesium salts that are less harmful to crops and soils. Since most soils do not have a high salinization risk, it is reasonable to select specific conductance values at the upper bound (1,500 µS/cm) of the sensitive crops category.

Considering irrigation practices: 1,500 µS/cm is protective of the irrigation practice most likely to cause harm crops (spray irrigation). This is because spray irrigation puts irrigation water in direct contact with crops and increases the potential for leaf burn. The other forms of irrigation (drip, flood) have no possibility for leaf burn.

Farmers using irrigation prefer to have no decrease in yield due to excess specific conductance. Protective specific conductance values for irrigation should not allow for any decrease in yield. The 1,500 µS/cm value assumes no losses in yield.

SAR

The protective SAR magnitude for sensitive crops and soils is 6. Selecting the protective SAR magnitude is a based on a set of assumptions regarding the critical local factors that influence irrigation water quality. These assumptions are outlined and explained in greater detail below.

Considering soil and crop types: A SAR of 6 is protective of all crops grown in sensitive soils from excess sodium in irrigation water for continuous irrigation (Franzen et al., 1996). Sodium toxicity is reduced if sufficient calcium is also present (Ayers & Wescot, 1994). Since the SAR is a ratio of sodium to hardness, a SAR of 6 will ensure sodium is not elevated at levels that could impair crops or soils and that sufficient hardness is also present.

A SAR of 6 is the value that the North Dakota State University Extension Service recommends for continuous irrigation (Ayers & Wescot, 1994). ‘Continuous irrigation’ is short hand for irrigation in areas with limited natural rainfall where irrigation is the primary source of water for crops and natural soil flushing does not occur. A SAR of 6 is protective of soil quality for soils with an elevated salinization risk. Application of irrigation water with a SAR of 6 is unlikely to cause infiltration issues for even salinized soils.

Considering climate: A SAR of 6 accounts for natural precipitation and Minnesota’s climate. Minnesota receives at least two times the average annual precipitation that a semi-arid climate receives (S-2, Figure 25). Minnesota’s natural precipitation functions to flush sodium from the root zone of crops and this means that in Minnesota a higher SAR can be used than in an arid climate.

Considering irrigation practices: A SAR of 6 is protective of the irrigation water quality when spray irrigation is used. This is because spray irrigation puts irrigation water in direct contact with crops and increases the potential for leaf burn. The other forms of irrigation (drip, flood) have no possibility for leaf burn.

Farmers using irrigation prefer to have no decrease in yield due to excess SAR. Protective SAR values for irrigation should not allow for any decrease in yield. The 6 SAR value assumes no losses in yield.

Duration and Frequency
The duration and frequency are the same as described in the section on non-sensitive crops.

Q14: Is a limit needed to protect any downstream irrigator?

Reasonable potential is a term used to describe the analysis for determining whether a WQBEL is necessary for a permitted wastewater discharger. The term is taken from federal regulations, which require that effluent limits must control all pollutants or pollutant parameters which are or may be discharged at a level that will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard. Federal regulations require that all discharges with RP to cause or contribute to the exceedance of a state water quality standard receive a WQBEL (40 CFR 122.44).

To calculate reasonable potential, the MPCA will use the formulas and procedures from the *Technical Support Document for Water Quality-Based Toxics Control* (EPA, Office of Water, 1991). These formulas are used by the MPCA in nearly every NPDES permit issuance to calculate reasonable potential and are familiar to the wastewater community and EPA, and therefore are reasonable to use in this case as well.

Since the equations are commonly used in effluent limit setting, the MPCA will not justify the need and reasonableness of the equations themselves, but instead justify the need and reasonableness of the input variables that define the equations outputs.

Wasteload allocation formula

$$WLA = \frac{Translator * \ Q_s + Translator * Q_e - Q_{s*}C_s}{Q_e}$$

- WLA = Wasteload allocation
- Translator = Values in either box 12 or 13 depending on whether sensitive crops are being protected

  Defining the sensitivity of the crops being irrigated is needed and reasonable because it ensures that effluent limits protect the types of crops usually being irrigated and their sensitivities.
- Qs = Protective receiving water flow rate at irrigator ($122Q_{10}$ from June to September)

  The proposed rule defines the protective flow rate for effluent limits to protect irrigation water quality to be the $122Q_{10}$. Including the $122Q_{10}$ in the wasteload allocation equation, ensures that water quality is protected to the specified flow rate.
- Qe = Individual point source effluent flow rate (70% of Average Wet Weather Design Flow for municipal dischargers, Maximum Design Flow for industrial dischargers)
  - Using 70% of the average wet weather design flow for municipal dischargers is needed and reasonable for the reasons below:
    - Every municipal wastewater treatment plant has been assigned an average wet weather design flow in their permit. Since every facilities is assigned this flow, it is easy to calculate and use.
    - If facilities are operating, as a summer average, more than 70% of average wet weather design flow, they are likely to exceed safe flow capacity if a large storms happens. It is

simply too much water for the facility to safely operate if peak flows exceed average wet weather flows over the summer season.

    - The 70% of average wet weather design flow has been used extensively by the MPCA to set phosphorus effluent limits that are protective of water quality over the summer season.

  - Using maximum design flow for industrial dischargers is needed and reasonable for the reasons below:
    - Every industrial wastewater treatment plant is assigned a maximum design flow rate in their permit. Since every facilities is assigned this flow rate, it is easy to calculate and use.
    - Industrial discharge maximum flow rates can be independent of antecedent rainfall and can happen at any time of year. Therefore, using the maximum design flow rate is an appropriate metric that captures the maximal discharge volume an industry could discharge over the summer season.
    - In limited circumstances, the maximal design flow listed in permits might not represent the true maximal design flow of an industrial discharger because industrial processes that define that flow rate have changed. If presented with evidence that the maximum design flow should be revised, the MPCA would recalculate the maximum design flow of an industrial discharger.

- Cs = Existing concentration of SAR or specific conductance in receiving water.

Defining the water quality at the locations where water is appropriated for irrigation is needed and reasonable because it allows for the correct calculation of assimilative capacity in the receiving water. Accounting for assimilative capacity is an essential component of every water quality based effluent limit calculation the MPCA has ever included in a permit. To define existing water quality, the procedures in Minn. R. 7050.0260 must be used.

Coefficient of variation formula

$$CV = \frac{Standard\ deviation}{Arithmetic\ Mean}$$

The Coefficient of Variation formula (CV) is a needed part of calculating effluent limits because it characterizes the variability of the parameter of interest in the effluent. The most recent five years of effluent data must be used when calculating the CV and at least five data points must be used in the calculation. If there are less than five data points, a default coefficient of variation of 0.6 should be used. The 0.6 CV value is the EPA recommended default CV value and has been used hundreds of times by the MPCA in the effluent limit setting process as a default.

Step 5. Calculate the long Term Average (LTA) at each irrigator from the waste load allocation using the formula below.

$$LTA = WLA * e^{0.5*\sigma^2 - Z*\sigma}$$

$$where\ \sigma = \ln\left(\frac{CV}{122}^2 + 1\right) \text{ (based on 122 day averaging period)}$$

This formula ensures that the duration of the water quality value is appropriately accounted for during the effluent limit setting process. Since the protective flow rate for the irrigation designated use has a 122 day duration that protects over the summer growing season, it is reasonable to use a 122 day duration in effluent limit setting to protect over the summer growing season.

- WLA = Wasteload allocation
- LTA = Long term average
- Z= 1.645 (95% uncertainty factor)

This equation includes a z-factor which is also called a uncertainty factor. Using a 95% uncertainty factor is needed and reasonable because using a 95% uncertainty factor is standard practice during the effluent limit setting process for calculating average monthly limits and long term averages. A 95% uncertainty factor strikes a appropriate balance between characterizing uncertainty and protectiveness of the effluent limit.

Step 6. Calculate the Average Monthly Limit (AML) necessary to protect irrigation water quality using the formula below:

$$AML = LTA * e^{Z*\sigma - 0.5*\sigma^2}$$

$where\ \sigma = \ln\left(\frac{cv^2}{2} + 1\right)$ (based on sampling twice per month)

This formula statistically adjusts the average monthly limit to account for the minimum number of samples needed to calculate an average, which is at least two samples. This is a standard adjustment in the effluent limit calculation process and using this formula been standard when calculating average monthly effluent limits in the MPCA limit setting process for over twenty years.

- AML = Average monthly limit
- LTA = Long term average
- Z= 1.645 (95% uncertainty factor)

This equation includes a z-factor which is also called a uncertainty factor. Using a 95% uncertainty factor is needed and reasonable because using a 95% uncertainty factor is standard practice during the effluent limit setting process for calculating average monthly limits and long term averages. A 95% uncertainty factor strikes a appropriate balance between characterizing uncertainty and protectiveness of the effluent limit.

8) 7053.0265 Discharge restrictions applicable to Mississippi River from Rum River to St. Anthony Falls

Subp. 1. This portion of the rules is being revised to update the cross-references to Minn. R. 7050.0410 and 7050.0430, to reflect the revision of the language about use classifications and its move to Minn. R. 7050.0415. This is reasonable because it will ensure the appropriation portion of the rules are referenced.

7. Regulatory and additional analysis

A. Minn. Stat. § 14.131 SONAR requirements

Minn. Stat. § 14.131 requires this SONAR to include the following information, to the extent the Agency can, through reasonable effort, ascertain this information. The MPCA's regulatory analysis is arranged to address the nine statutory mandates of Minn. Stat. § 14.131 listed below.

1) Classes of persons who probably will be affected by the proposed rules

The MPCA is required to provide “A description of the classes of persons who probably will be affected by the proposed rule, including classes that will bear the costs of the proposed rule and classes that will benefit from the proposed rule” (Minn. Stat. § 14.131 (1)).

This regulatory analysis focuses on three major classes. The first is regulated (permitted) facilities that discharge wastewater to a water body subject to the water quality standard. Under both the current and proposed standard, the MPCA must determine if the discharges from these facilities are likely to cause or contribute to the standard being exceeded. If so, the facilities will receive effluent limits in their permit to control discharge of the pollutant. Because of the potential to receive an effluent limit, wastewater plant dischargers are always a class affected by the MPCA’s adoption or revision of water quality standards. The proposed revisions are likely to change the costs imposed on many regulated facilities. The costs are discussed later in this regulatory analysis.

The second affected class is the residents of Minnesota in their capacity as users and funders (ratepayers) of municipal wastewater and drinking water treatment infrastructure.

The final affected class is people that want to enjoy the beneficial use(s) that Minnesota’s water quality standards protect – in this specific case the use of water for industrial purposes, irrigation of crops, watering of livestock, and supporting wildlife as a source of drinking water.

Wastewater treatment plant dischargers

Water quality standards set the conditions that are necessary to ensure that beneficial uses (fishing, swimming, agriculture, etc.) are maintained. A key mechanism in meeting water quality standards is the imposition of effluent limits – limits to the amount of pollution that a permitted facility can discharge to a specific surface water.

In Minnesota, these limits are applied through NPDES/SDS permits, which are reviewed and re-issued every five years. Any facility that discharges to a water of the state where standards apply is potentially affected by a change in water quality standards. For each adopted water quality standard, the MPCA goes through an implementation process. A key component of implementation is the application of the water quality standard in permits, which is where the standard may affect individual regulated facilities through the imposition of an effluent limit. Regulated facilities include both municipal wastewater treatment facilities, which treat and discharge domestic waste, and industrial wastewater treatment facilities, which treat and discharge waste from industrial processes such as mining, ethanol production, food processing, etc.

The effluent limit review process involves analysis of a number of site-specific variables to determine whether a permit limit is required. In general, these variables include the specifics of the facility and the receiving water (including the concentration of the pollutant). The effluent limit review identifies whether a discharger has the reasonable potential to cause or contribute to an exceedance of the water quality standard (known as “RP). If a discharger has RP, the MPCA must develop a WQBEL applicable to the WWTP to ensure the water quality standard is not exceeded. In addition to the standard, the factors in developing a WQBEL include:

- The volume and concentration of the relevant pollutant in the effluent;
- The percent pollutant contribution to an affected water from an upstream discharge;
- The flow of the receiving water; and
- The effect of additional WWTPs upstream of the affected water.

Ultimately, the WQBEL and any pollution control treatment needed to meet the WQBEL are the key drivers of the costs of complying with a water quality standard. Therefore, permitted facilities that discharge pollution are the classes of persons potentially affected (in terms of costs) by the proposed revisions. More information about potential impacts on these facilities is provided in the section on the costs of compliance.

Minnesota residents as users of drinking water and wastewater infrastructure

When discussing the impacts of a regulation, it is easy to think that the costs fall solely on the regulated party. However, there are unique situations related to the way municipal wastewater treatment infrastructure is funded, as these facilities provide an important public service. Thus, much of the costs are ultimately borne by Minnesota residents.

Funding for municipal wastewater treatment infrastructure broadly comes from two categories: 1) local ratepayers; and 2) tax funded grants and subsidized loans used for capital investments. When facilities need to be upgraded, whether due to age or in order to meet new water quality standards, the costs are often spread out to ratepayers. Minnesota also has a Clean Water State Revolving Fund, which provides low-interest loans, and the Point Source Implementation Grant program that provides grants for WWTP infrastructure. Therefore, Minnesota residents and taxpayers are an affected class for the purpose of this rule.

People of Minnesota and users of water

In the broadest sense, the people impacted by any proposed water quality standard rule are those who have an interest in or who rely on the quality of Minnesota's waters for multiple uses and the biological communities those waters support. This extensive and significant class includes any person who uses Minnesota waters for any of the following purposes: drinking water; recreation such as swimming, fishing, and boating; commerce; agriculture; scientific, educational, or cultural purposes; and general aesthetic enjoyment. It may also include those who simply value knowing that there is clean water, or that certain kinds of aquatic life exist.

Minnesota's Class 3 and 4 water quality standards exist to protect water quality so that it can be safely used in industrial processes, to irrigate crops and feed livestock, and to support wildlife as a source of their drinking water. Therefore, the standards being revised here provide specific benefits to those who use water for those industrial and agricultural purposes – including those who have MDNR water appropriation permits for those purposes – or who hunt or enjoy watching wildlife that uses the waters for drinking.

The preservation of the state's water quality is a benefit to not only those who actively use Minnesota's surface waters, but also those who place a value on the existence of clean water and wildlife even where they do not actively use it. In addition, the preservation of water quality is important to future generations.

The MPCA received multiple comments during the rulemaking process – from both the general public and from some Tribal Nations – that expressed concern that the proposed revisions will adversely impact water quality, and thereby also negatively impact users of waters and impose costs on them.

When the MPCA revises a water quality standard, it must show that the new standard will be protective of the specified beneficial use. This SONAR and the supporting TSD demonstrate that the revisions to the standard will continue to provide appropriate protection to the beneficial use – just as the current standards do – there should be no change in benefit to the users of Minnesota's waters. Waters will still be able to be used for industrial purposes, to irrigate crops and water livestock, and will support wildlife. Specific responses to the concerns raised by Tribal Nations are provided in Section 9 of this SONAR.

2) Probable costs to the MPCA and to any other agency and any anticipated effect on state revenues

Minn. Stat. § 14.131 requires the MPCA to provide an analysis of "The probable costs to the agency and to any other agency of the implementation and enforcement of the proposed rule and any anticipated effect on state revenues."

Costs to the MPCA

The MPCA implements water quality standards primarily through permitting and assessment. The MPCA will continue its activities relating to permit applications, variance requests, assessments, impaired water identification, and compliance and enforcement – just using the revised standards instead of the previous standards.

When the proposed rules are adopted, some of this ongoing work will change in ways that would affect the MPCA's costs. Regardless of whether the MPCA adopts the proposed revisions, the MPCA must continue to conduct reviews of permit applications that propose discharges to waters of the state and will incur staff costs for those reviews. The MPCA expects that the complexity of implementing the proposed narrative standard will slightly increase the amount of MPCA staff time needed to review some permit applications. Interpreting the narrative standards based on site-specific factors such as soil type, crop type, location of water appropriators, etc. is more time intensive than evaluating a permittee for compliance with a single numeric value. To reduce this time, the MPCA has developed an automated program that aggregates data to complete approximately 90% of the evaluation needed to determine whether an effluent limit is needed for the proposed narrative standards. Because of this, the MPCA anticipates the proposed revisions will only slightly increase the MPCA's current administrative costs to issue permits by adding approximately one to six hours of work per permit to calculate and document the need for effluent limits in an individual wastewater permit.

However, implementation of the existing Class 3 and 4 WQS is not straightforward, and there are significant administrative costs to the agency of the current Class 3 and 4 water quality standards. The lack of specifics in the existing standards (such as duration and frequency) results in uncertainty regarding how to implement the Class 3 and 4 water quality standards in NPDES permits, increasing the time to develop permit limits. In addition, permittee skepticism over the appropriateness of the standards and how they are applied increases the questions and comments from permittees that must be responded to, as well as the likelihood of contested case hearings and litigation over permit limits.

Contested case hearings and litigation are very consuming of staff resources; a single contested case hearing on a wastewater permit can require up to several hundred hours of cumulative staff time to address. This reduces the staff time and resources that can be spent on other parts of the permitting workload, causing additional difficulties in issuing wastewater permits on time.

Issuing wastewater permits on time is important, so much so that Minn. Stat. 116.03, subd. 2b establishes permitting efficiency goals for the MPCA. Timely permit actions are critical because timely revisions: 1) ensure the MPCA can include up to date monitoring, safety requirements and effluent limits in permits that protect human health and the environment and 2) are needed to support major wastewater construction projects and any delay in permitting imposes additional costs due to increased communications and planning. Additionally, a large permitting backlog reduces public confidence in the MPCA's ability to control pollution.

The proposed rule will likely reduce workload related to effluent limit development, contested case hearings, and litigation of permits surrounding these water quality standards.

The proposed rule is also likely to reduce MPCA's administrative costs related to additional water quality standards actions – such as developing and processing site-specific standards, requests for use and value demonstrations, and issuing variances. Because of concern over the appropriateness of the standard, the MPCA has received multiple requests to consider developing site-specific standards for certain waterbodies for the Class 4A standard based on the crops grown in the area, or to consider removing the Class 3 or Class 4 uses from waterbodies based on information about where the uses are currently occurring. Responding to these requests and, if appropriate, developing the materials to support a site-specific standard or a removal of the use through a use and value demonstration, is time intensive.

Similarly resource intensive is the work to develop variances when meeting a water quality based effluent limit would cause widespread social and economic impact. As detailed further below, treatment to meet the current Class 3 and 4 water quality standards is expensive. Although permittees are never required to apply for a variance, even when treatment is expensive, the imposition of a limit to meet the Class 3 and 4 WQS often functions as the final "nudge" that moves municipal wastewater permittees towards applying for a variance. In the past two years, the MPCA has devoted one annual FTE (approximately $121,000 per year) to administering the process for municipal variances to the Class 2 chloride water quality standard, and it is reasonable to expect at least one additional annual FTE to administer future Class 3 and 4 municipal variances under the current rule. The costs to the agency to administer Class 3 and 4 variances could be greater than one annual FTE, if municipal variances are significantly more complex or controversial than currently expected. If these rule revisions proceed, the MPCA would expect requests for site-specific standards and use removals to be largely eliminated, and also a significant reduction in a projected need for variances.

Costs to other state agencies

Other state agencies incur costs to comply with water quality standards if they have permitted projects or operations that need to comply with a standard. This may include operation of a facility with a discharge that must meet the revised standard or discharge to an affected municipal WWTP that incurs increased costs and recovers those costs from their customers. It may also include projects, such as road construction, that need construction stormwater permits or CWA section 401 certifications that require compliance with water quality standards.

The Minnesota Department of Transportation (MnDOT) operates highway rest areas and the DNR operates campgrounds and fish hatcheries, all of which generate wastewater. Although the wastewater treatment systems associated with these activities are often subsurface sewage treatment systems that do not discharge, MnDOT and DNR do have NPDES permits to discharge to surface waters. The MPCA does not expect any NPDES permit owned by MnDOT or DNR to receive a new effluent limitation because of this rule and, as a result, neither of these agencies will experience any new costs.

Effects on state revenue

The proposed rules do not have any direct impacts on state revenues (taxes and fees). They do not impose any taxes or fees. The MPCA does impose and collect fees for certain water quality actions – particularly permit application fees and variance application fees. If the proposed revisions decrease the need for permit changes or variances, they may reduce the fees that are paid to the MPCA. The MPCA is considering fee changes as part of a separate rulemaking.

Water quality standards and changes to them may have more indirect effects on state revenues (taxes and fees) in several ways. The effects may counterbalance each other —being both positive and negative — and they are difficult to predict or quantify.

Effective water quality standards support clean water, sustainable wildlife, and many other social and economic benefits – including, in this case, supporting industry and agriculture. It is likely that the proposed rule will provide one incentive, among many, to encourage a greater number of municipal wastewater dischargers to reduce the amount of chloride they discharge. Reducing the amount of chloride in the environment under low flow conditions is likely to reduce one environmental stressor, among many, and allow for healthier aquatic communities.

In addition to the direct support of beneficial uses, clean water is also known to provide multiple ecosystem services. The USDA Forest Service defines ecosystem services as the:

> *benefits people obtain from ecosystems. The Millennium Ecosystem Assessment – a four-year United Nations assessment of the condition and trends of the world's ecosystems - categorizes ecosystem services as:*
>
> *Provisioning Services or the provision of food, fresh water, fuel, fiber, and other goods;*
>
> *Regulating Services such as climate, water, and disease regulation as well as pollination;*
>
> *Supporting Services such as soil formation and nutrient cycling; and*
>
> *Cultural Services such as educational, aesthetic, and cultural heritage values as well as recreation and tourism (2016)*

Accurately quantifying the total costs and benefits, including ecosystem services, of water quality and changes in water quality is one of the most difficult tasks in environmental economics. The current academic consensus is that assessing the net costs and benefits of regional or national water quality standards results in levels of uncertainty that are likely to produce uncertain findings (Keiser et al., 2019) and that, broadly speaking, the nascent field of environmental economics is not yet developed enough to make these assessments with the necessary accuracy at relevant geospatial scales (Polasky et al., 2019). Despite a lack of quantification, the benefits of good water quality are real, and they can have a positive effect on state revenue. For instance, improved water quality and wildlife habitat may increase tourism tax revenue as people travel to enjoy clean water and see wildlife.

It is considerably easier to identify the potential impact on state revenues from the ways the adoption of the proposed rules may impact industrial or agricultural growth or expansion. First, the Class 3 water quality standards and related implementation are designed to maintain Minnesota's water quality so that it can be used for industrial purposes. The Class 4 water quality standards and related implementation are designed to maintain water quality so that it can be used for irrigation of crops and watering of livestock, thereby supporting agricultural businesses. These protections remain unchanged due to the proposed revisions.

The greater changes relate to permitted dischargers that the MPCA must ensure do not cause or contribute to a violation of water quality standards. The increased certainty provided by implementation of the proposed rules is likely to encourage business investment in Minnesota. The proposed rules provide needed clarity, which will help businesses make decisions and increase the likelihood they choose to invest in Minnesota. Businesses evaluate a multitude of factors when choosing to locate in Minnesota, and one of them is evaluating wastewater treatment needs and costs. There is evidence that some individual businesses feel the existing standards are inappropriate, and may therefore locate in other states. For example, TrūShrimp, a shrimp aquaculture company, recently stated that they chose to locate in South Dakota, in part because of "a really obscure technicality in the water effluent realm" (Anderson, 2019)– which was primarily the Class 4A specific conductance standard. Businesses choosing to locate and invest in Minnesota would have positive effects on local economies and State tax revenue.

The revised standards will also impact the amount of pollution control treatment needed, compared to the existing standards. This is discussed extensively in the costs of compliance section. In the cases where there is not additional required treatment, the effect of the proposed revisions may be reflected in additional investment in the facility and a resulting beneficial effect on State and local revenue. Conversely, where any revisions to the standards result in the need to design new treatment systems and to install and operate those systems, this could result in new equipment purchases and new incomes and jobs to pollution control manufacturers. This would increase income and sales taxes. Many stakeholder discussions and comments have expressed concerns that the existing standards may have a negative economic effect on some municipalities and industries. There are concerns that such high wastewater treatment costs, whether for municipal or industrial purposes, would have a negative effect on local economies in general, and could affect the state's economy. Overall, the revised standard will have some effect on State revenues, and may potentially affect the distribution of State revenues, but it is difficult to say with certainty whether that effect will be positive or negative.

3) A determination of whether there are less costly methods or less intrusive methods for achieving the purpose of the proposed rule

Protecting Minnesota's waters so they can be used for multiple purposes – including industrial use, irrigation, and livestock and wildlife watering – is the key focus of Minnesota's water quality standards. Protecting the industrial and agricultural uses is already established in rule. The proposed rule changes incorporate modern science and allow for more specific tailoring of the level of protection to the uses, making the proposed changes a less costly method for achieving the purposes of the industrial and agricultural water quality standards. As described previously, the proposed implementation methods are designed to minimize costs associated with achieving the purpose of the rule.

4) A description of any alternative methods for achieving the purpose of the proposed rule that were seriously considered by the Agency and the reasons why they were rejected in favor of the proposed rule

Not changing the current rules, or delaying the changes

The MPCA could retain the existing Class 3 and 4 WQS. However, this was rejected as unreasonable because the current standards are based on outdated science and are ambiguous on critical needs for implementation of the standards in NPDES permits. Water quality standards are promulgated into rule based on the best available science at the moment they are adopted. Because science continues to progress, every water quality standard in rule could to some degree be considered to be based on outdated science; depending on when a standard was adopted and scientific advancements, some water quality standards hold up over time better than others. The MPCA conducted a review of the science supporting the adoption of the current standards in 1967 and determined that the current standards are based on unreasonably outdated science and do not currently serve Minnesota's needs. The current water quality standards do not provide a scientifically justifiable level of protection when modern science is considered.

Another reason the MPCA chose not to keep the current rules is that they are ambiguous on key factors that are necessary in order to implement the standards. The current standards do not specify important details such as the duration and frequency of the Class 3, 4A and 4B numeric standards.

In addition, the existing rules have confusing and vague phrases such as "the following standards shall be used as a guide" (for Class 4A) and "additional selective limits may be imposed for any specific waters of the state as needed" (for Class 4B) that require extensive interpretation. They also allow MPCA greater discretion that would likely be allowed in rules written today. The MPCA has used these parts of the rule in the past within two NPDES permits to include effluent limits protecting the Class 4B livestock beneficial use. The MPCA considered whether maintaining the rules as currently written and using these flexible phrases might be a way to accomplish the purpose of these proposed rules.

The MPCA has the authority to make reasonable discretionary interpretations on ambiguous rules, but the greater the gaps that need to be filled the more likely the interpretations are to raise concerns and challenges and increase future conflict. The past use of the ambiguous phrases to develop effluent limits came at a time when these water quality standards were less controversial. A prominent theme across recent public comments to the MPCA – on rules, permits, and other actions - is that the MPCA should make its decision making transparent, consistent, and subject to public comment. Ultimately, the MPCA chose to reject keeping the current rules, because doing so would require making unreasonable discretionary decisions and those decisions are best made clear and available for public comment.

Some commenters stated or implied that MPCA should make changes to these rules, but only after promulgating rules to protect aquatic life from salty parameters. The MPCA felt it was appropriate to continue to move forward with this rulemaking due to the length of time it has been under discussion (with preliminary technical documents from University of Minnesota, 2010), and the need to provide clarity as discussed above.

Linking aquatic life and drinking water beneficial uses to Class 3 and 4 beneficial uses

The MPCA seriously considered linking aquatic life and drinking water uses to Class 3 and 4 beneficial uses but rejected the idea because doing so is contrary to the Clean Water Act, does not appropriately protect all beneficial uses, and would significantly complicate future rulemakings. The MPCA has received comments suggesting that it might be appropriate to link one class of beneficial uses to protect other beneficial uses. For example, commenters have suggested that if water quality is suitable for drinking water or aquatic life it should also be suitable for industry, irrigation, livestock or wildlife. Or, more specifically, that MPCA should focus on protecting only human health or aquatic life, and in doing so the water will also support other beneficial uses.

The idea of linking beneficial uses is contrary to the structure of how the Clean Water Act protects water quality using beneficial uses. Water quality standards include three components – the designated use, the criteria, and antidegradation. A key tenet is that the criteria must be sufficient to protect the designated use; thus evaluating a criteria (the numeric value or narrative description of the water quality conditions) is impossible without knowing the designated use that the criteria is intended to protect. A water quality standard, particularly a numeric standard, is specific to the beneficial use being protected and the specific pollutant that can negatively impact that beneficial use. Also, it is a fundamental pillar of the Clean Water Act that multiple water quality criteria are independently applicable to any given waterbody to meet that waterbody’s multiple listed beneficial uses.

There is unambiguous evidence that the water quality needs of aquatic life or drinking water and industrial consumption, irrigation, livestock and wildlife differ in meaningful ways. For example, specific industries might need a higher water quality than is needed to protect aquatic life and vice versa. It is possible to identify limited and specific parameters where the needs of several beneficial uses are similar (i.e., irrigators, industrial consumers and aquatic life generally benefit from similar pH values). However, for the current Class 3 and 4 parameters in rule, there are many more differences than similarities with regards to water quality needs between the beneficial uses (i.e., industrial consumers, irrigators, livestock and wildlife all have different salinity related water quality needs). The MPCA seriously considered ways to link all of the beneficial uses for all potential parameters of concern into a single “mega standard” but quickly abandoned the effort because the result of linking beneficial uses was a tangled web of confusion, in addition to being contrary to the Clean Water Act.

Another reason the MCPA chose not to link beneficial uses in this rulemaking is because of the precedent it sets for future water quality standard rulemakings. If different beneficial uses and their criteria became officially linked in rule, then changing a criteria in one beneficial use would also require detailed scientific justification to ensure that it is protective of every other beneficial use. Promulgating and adopting new water quality criteria to protect aquatic life or drinking water is already a significant effort, and science moves at different paces. If every rulemaking package to change a human health based water quality standard also had to also justify how the standard was protective of aquatic life – even if such science did not exist or was very tenuous - then it would be much harder to adopt new criteria, even when clearly needed for one beneficial use. The MPCA does not want to set a precedent that limits its ability to adopt and revise water quality standards in the future to protect a specific beneficial use such as drinking water or aquatic life.

Developing site-specific water quality standards

The MPCA seriously considered the development of site-specific standards to achieve the purpose of the proposed rule, to update the protection of the beneficial use and base it on specific conditions.

Water quality standards are most frequently adopted to protect a beneficial use statewide or with variation by ecoregion. Sometimes available information about a single waterbody suggests that the waterbody needs a different water quality standard that the one applicable to the state or region. Site-specific standards can be derived under Minn. R. 7050.0220, subp. 7; they must maintain and protect the beneficial use.

The MPCA estimates that between several hundred and several thousand site-specific standards would be needed to achieve the purpose of this proposed rule just to protect irrigation water quality. Dozens to hundreds more site-specific standards would be required to protect industrial water appropriators and potentially as many for livestock and wildlife. Developing a site-specific water quality standard for a single waterbody requires individualized waterbody specific analyses and requires several hundred hours of MPCA staff review time. In addition, while they do not require rulemaking, each requires notice and comment and EPA approval. It is conceivable that the MPCA could develop a streamlined site-specific standard process to reduce future workload but that process would be functionally equivalent to this proposed rule but would have a higher total workload.

The amount of staff effort required to achieve the purpose of this rule using many site-specific standards is prohibitive and therefore pursuing a statewide rulemaking is the only reasonable option.

5) The probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals

The CWA requires that water quality standards be based on environmental science and the water quality level necessary tto prodect the beneficial uses. The CWA and case law prevents consideration of cost from being a factor in establishing a standard. In order to be approved at the federal level, economic effects cannot be a factor in establishing or revising the standard. Although the cost of compliance was a driver for the MPCA's decision to prioritize the review and revision of these rules, cost was not considered in determining the level of the proposed water quality standards. No information provided due to the state Administrative Procedures Act requirement that the economic effect of a rule must be identified and discussed in the SONAR should be construed to mean that the standards were based on cost considerations. The costs are laid out here for their value in providing information on the impacts of implementation of the standard via permits.

Note that this analysis covers only the costs of compliance for the revisions to the water quality standards. Any costs due to implementation of the existing narrative biological standard, as described in S-5, are not considered as that rule is already in effect. Note also that any statement about likely effluent limits or permit conditions for a facility are based on the MPCA's best efforts to determine potential future permit conditions, but final decisions are only made during a permit issuance process.

Cost borne by municipal and industrial wastewater dischargers to comply with the proposed rule

The primary identifiable category of affected parties by the proposed rule are wastewater dischargers.

Owners and operators of permitted wastewater facilities are frequently concerned about the potential impact of new or revised water quality standards, as standards result in considering the need for protective effluent limits. Permitted facilities bear costs related to applying for permits – for instance, many permittees retain consultants that charge fees for preparing applications, and the MPCA charges permit application fees – but the largest cost of new standards comes if they result in the need for new effluent limits and thus new pollution control equipment.

In reviewing and providing information on permitted dischargers, we have used the best information available. However, because the SONAR analysis is a broad assessment, and because what sources are permitted to discharge is often not what they actually discharge, there may be some information that is inconsistent. All permitted dischargers are examined individually during permit issuances.

Effluent limits are usually not imposed immediately. Facility permits are reissued every five years. When a new water quality standard is promulgated, the MPCA does not immediately reopen all 1000+ wastewater discharge permits and add requirements. Instead, permits are evaluated when they next come up for reissuance. If the facility does not monitor its effluent for the pollutant that is the subject of the standard, the first step in the process is generally to add monitoring for the next five year permit term. Once monitoring data is available, the MPCA can determine if the facility has the reasonable potential to cause or contribute to an exceedance of the water quality standard and therefore needs an effluent limit.

Needed new effluent limits become permit conditions and potentially require spending to install and operate new treatment technologies that reduce pollution to levels below the effluent limit. Facilities operate their treatment systems so that the levels of pollution discharged are, in fact, *well* below the effluent limit, to ensure a margin of safety to prevent any concerns about compliance. The cost of pollutant treatment technologies to meet any water quality based effluent limits imposed due to a new water quality standard is the main driver of the cost of compliance with a water quality standards rulemaking.

Estimating the costs of compliance with a proposed new water quality standard for wastewater treatment facilities is more straightforward when the standard is for a parameter not previously found in rule and would require the addition of a new treatment technology. In such cases, the cost of compliance is equivalent to the cost of the treatment technology, summed over all the facilities that would need to install the technology. As MPCA has done limited application of the Class 3 and 4 WQS in the past, this may well feel like a standard that applies new requirements. However, the requirements exist and could be applied at this moment – without the adoption of these rules.

This rulemaking revises the standards based on the development of specific analyses of the water quality conditions needed to protect the beneficial uses. We expect that to result in more targeted application of effluent limits. The new standards, particularly in Class 4B but also through the translation process, likely will still result in some facilities receiving an effluent limit.

One of the reasons the MPCA chose to revise the Class 3 and Class 4 WQS as a group is due to the similarity in treatment technology for removing the pollutants that impact these uses. The ionic pollutants are not easily reduced with pollution reduction techniques, and are difficult and expensive to remove from effluent, and generally require add-ons to the conventional technologies used to treat most wastewater. Whether about it is the cost of complying with the new Class 4B sulfate standard, or the avoided cost of not having a limit imposed due to the Class 4A specific conductance standard, or even the cost of potentially having to add treatment to comply with the interim approach for aquatic life (which is not discussed because it is not specific to these rules), the types of treatment available and the resulting costs are generally similar. It is just a question of whether the treatment technology or is not necessary to meet an effluent limit. For the purposes of this regulatory analysis, therefore, there is a particular connection between the costs borne by impacted classes and the costs of not adopting the proposed rules.

The standards being proposed in this rulemaking are a mix of numeric standards and narrative standards coupled with translators that define implementation of appropriate protective permit conditions. The combined effects of all the proposed changes and how they relate to existing rules ultimately defines the number and level of effluent limits that go into an individual permit. Some of the proposed changes (such as moving the location of the wetland standards, removing numeric pH standards from Class 3 and 4, and removing chloride standards from Class 3) are likely to have minimal to no effect on wastewater dischargers because no increase or decrease in permit limits will result. Other changes (removing all Class 3 numeric standards, removing Class 4A numeric total dissolved solids and specific conductance standards, increasing the Class 4B total dissolved solids standard) are likely to affect many wastewater dischargers. However, these changes will likely result in fewer and less restrictive limits in permits, thereby decreasing the cost of complying with the Class 3 and 4 WQS compared to the current rules.

The effects of the proposed rule, categorized by the likelihood of impact, beneficial use and water quality parameter follows.

Unlikely to significantly change costs

Wetland standards moved to Class 2
The proposed rule moves the wetland standards from Class 3D and Class 4C to become Class 2 water quality standards, as the Class 2 designated use more accurately describes the purpose of these standards. This change does not add or subtract any language from Minn. R. ch. 7050. The MPCA expects that this minor revision will cause no changes in terms of the cost of compliance because no new limits will be imposed as a result of the change.

Class 3 chloride
The MPCA determined that the removal of the Class 3 numeric chloride standards will have no effect on the majority of NPDES dischargers because the controlling chloride standard with regards to chloride effluent limits is the 230 mg/L aquatic life chloride standard. The Class 3A and Class 3B chloride standards are 50 and 100 mg/L respectively, and which are both lower than the 230 mg/L standard, but those standards are only applicable to Class 3A and 3B waters. Only a handful of NPDES dischargers discharge to Class 3A and 3B waters; none of them have reasonable potential to cause or contribute to an exceedance of the Class 3A and 3B chloride standards and therefore none have effluent limits. For every NPDES discharger the MPCA analyzed, the controlling water quality standard for effluent limit setting is the 230 mg/L aquatic life chloride standard. Since that standard is not changing in this rule, removing the Class 3 standards will have no effect on the cost of compliance for NPDES dischargers.

Class 3 pH
The MPCA determined that the removal of the Class 3 numeric pH standards may only affect one NPDES permit; this permit discharges to a Class 3A water and has an effluent limit set to meet the Class 3A maximum pH standard of 8.5. Every other NPDES permit is required to discharge pH within the range of 6.0 to 9.0 and that range is a universal state discharge requirement in Minn. R. ch. 7053. In addition, the

CWA's anti-backsliding rules general make it difficult to change an effluent limit only due to a change in the underlying water quality standard. Because there are already pH discharge requirements applicable to every NPDES discharger, removing the Class 3 pH standards will likely have no effect on any NPDES permits.

Class 4A boron

Under the proposed rule, the 0.5 mg/L boron Class 4A water quality standard remains in rule and the duration and frequency of the boron standard is formally defined. These changes effectively maintain the current status quo with regards to boron and wastewater effluent limits. At this time, only 14 NPDES permits measure boron in their discharge and all of those are industrial NPDES permits (either ethanol processing facilities or taconite dischargers) and four NPDES dischargers have boron effluent limits. None of the 14 permittees discharges in exceedance of the 0.5 mg/L boron water quality standard, so none of the dischargers would be required to employ a wastewater treatment technology for boron.

Class 4A pH

The removal of the class 4A numeric pH standard may affect only one NPDES permit, the same permittee discussed above in the Class 3 pH section. The Class 3A and Class 4A pH standards are the same, so the likely impacts are also the same.

Class 4B pH

The proposed rule makes no change to the class 4B pH standard magnitude, but it does specify a 30 day duration and a not to be exceeded frequency.

Specifying the duration and frequency of class 4B pH standards is unlikely to affect any NPDES permit. Every NPDES permit is required to discharge pH within the range of 6.0 to 9.0 as never to be exceeded values and that range is a universal state discharge requirement in Minn. R. ch. 7053. Because there are already pH discharge requirements applicable to every NPDES discharger, specifying the class 4B pH standards duration and frequency will have no effect on any NPDES permits.

Class 4B nitrate

The proposed rule adds a 100 mg/L nitrate standard. Although the value is not particularly stringent, it does represent the first imposition of a statewide nitrate standard. (The only other standard is a 10 mg/L standard that applies only in waters designated for domestic consumption.)

The MPCA conducted an RP analysis for each active NPDES facility with reported nitrate (NO_3^-) data. We did this in the manner described regarding the Class 4B total dissolved solids standard. The MPCA expects that no NPDES permits will receive limits based on the proposed 100 mg/L nitrate standard since no NPDES permittees discharge nitrate in excess of 100 mg/L. Industrial meat processing NPDES facilities discharge the highest concentrations of nitrate, typically between 40 and 80 mg/L, and none of them discharge nitrate in excess of 100 mg/L. Since the proposed rule is unlikely to require any new nitrate limits in permits, NPDES dischargers are unlikely to experience any new cost.

Likely to decrease costs of compliance

Class 3 hardness

The removal of the Class 3 hardness numeric standards will have broad effect on NPDES dischargers. The proposed narrative translator to protect the industrial consumption beneficial use applies to new and expanded dischargers. Based on the MPCA's current analysis, the translator process is unlikely to result in hardness effluent limitations more stringent than 350 to 500 mg/L as $CaCO_3$, when limits are needed at all. The large majority of municipal and industrial discharges do not have effluent hardness concentrations greater than 350 to 500 mg/L as $CaCO_3$, and therefore are unlikely to receive effluent limits under the proposed rule.

New dischargers or current dischargers that are expanding need new or revised NPDES permits and therefore would need to be evaluated for an effluent limit using the Class 3 translator. The MPCA expects that fewer than two NPDES permits actions in any given year would be for new or expanded facilities and would therefore have to consider the Class 3 narrative translator method (S-3). The majority of these expanded permits are likely to be municipal wastewater plants increasing the capacity of their plants to account for residential growth. They may also be municipal WWTPs expanding discharge capacity to account for a growth in a connected industrial user, or an industrial wastewater treatment plant needs to increase wastewater design flows to account for growth. There may also just be new facilities constructing that need to be permitted. When the economy is good and funding (including bonding) is accessible, there might be more permits for new and expanding sources, and when the economy is not as good, the number would likely decrease.

Looking at the current universe of permitted dischargers, no additional hardness effluent limits would be applied to either municipal wastewater treatment plans or industrial dischargers (such as taconite dischargers, ethanol producers, food processors and other industrial users). Since there will be no new hardness effluent limitations as an immediate result of the proposed rule, there is likely to be no new costs associated with hardness treatment under the proposed rule. Some facilities that would previously have needed a hardness limit will not need one, thereby decreasing the costs of compliance.

The proposed Class 3 translator method (S-3) has a small likelihood of increasing permitting costs by increasing the complexity of issuing a new and expanded NPDES permits. The proposed Class 3 translator method (S-3) does contain some very complex calculations but the translator is structured so that the complex calculations are only needed if simpler calculations do not demonstrate that the discharger will not cause or contribute to a violation of the standard. It is very unlikely that a new or expanded discharger would need to perform the most complicated calculations. Since most users would not need to perform very complex analyses, and the MPCA has offered to help performing those complex calculations, the proposed narrative translator is unlikely to increase permitting costs for most new or expanded NPDES issuances.

Class 4A bicarbonate

The removal of the numeric Class 4A bicarbonate standard will have broad effect on NPDES dischargers. The proposed narrative translator to protect irrigation water quality does not consider bicarbonate as an individual parameter of concern for water used to irrigate crops. Therefore the proposed narrative translator will result in no new bicarbonate effluent limits in any NPDES permit. Since there will be no new bicarbonate effluent limitations as a result of the proposed rule, there is likely to be no new costs associated with bicarbonate treatment under the proposed rule. Some facilities that would previously have needed a bicarbonate limit will not need one, thereby decreasing the costs of compliance.

Class 4A specific conductance and total dissolved solids

The removal of the Class 4A numeric total dissolved solids and specific conductance standards will have broad effects on NPDES permits statewide. The total dissolved solids and specific conductance standards are functionally identical because they measure the same underlying parameter and their effects are best analyzed together.

Under the proposed rule, the MPCA estimates that no NPDES discharger would receive a specific conductance effluent limit. The MPCA performed this analysis by using the methods outlined in the proposed irrigation water quality translator, as applied through an automated data viewer that can assess with approximately 90% accuracy whether a given NPDES discharger is likely to get a specific conductance effluent limit in their permit to protect irrigation water quality. The 10% uncertainty is a byproduct of the complexity of the analysis; some of the steps in the translator, especially around determining existing water quality near an irrigator and estimating flow rates, are too complex to automate and are likely to always partly require human review. To achieve 100% accuracy would require the MPCA to rigorously evaluate every single NPDES discharger separately; that level of individual rigorous evaluation is best left to the permit issuance process.

The primary reasons most NPDES dischargers would not receive effluent limits under the proposed rules and irrigation narrative translator are bulleted below:

- Ambient water quality at the locations where irrigators appropriate water is almost always less than 1,500 µS/cm, which is the value protective of the most sensitive crops usually grown in Minnesota. This is a strong signal that ambient water quality in Minnesota is broadly suitable for irrigation with regards to specific conductance and that very few waters might need protection with regards to the needs of irrigators.
- Using the proposed narrative translator, effluent limits protecting irrigation water would be set to protect water quality at the $122Q_{10}$ flow rate, at locations where water is appropriated for irrigation. Under the current rule, effluent limits are set to protect water quality at the $7Q_{10}$ flow rate for the first downstream water from the NPDES discharger, regardless of whether a water appropriator exists on that water. Since the $122Q_{10}$ flow rate is several times larger than the $7Q_{10}$ and the effective "point of compliance" is typically farther downstream, there is more dilution available which reduces the likelihood of permit limits.
- At least one hundred municipal dischargers, and possibly dozens more, will eventually require chloride limits based on the chloride aquatic life standard. The chloride reductions required to comply with chloride permit limits will reduce total dissolved solids and specific conductance. In every case the MPCA could analyze, complying with chloride limits would also result in effluent specific conductance also becoming less than 1,500 µS/cm, which is the value protective of sensitive Minnesota crops. Thus an additional limit is not needed.

Class 4A sodium

The removal of the Class 4A numeric sodium standards will have minimal effects on NPDES permits statewide. Under the proposed rule, the MPCA estimates that no NPDES discharger would receive a sodium limit in a permit.

The MPCA performed this analysis by using the methods outlined in the proposed irrigation water quality translator, as applied through an automated data viewer that can assess with approximately 90% accuracy whether a given NPDES discharger is likely to get sodium effluent limit in their permit to protect irrigation water quality. The 10% uncertainty is a byproduct of the complexity of the analysis; some of the steps in the translator, especially around determining existing water quality near an irrigator and calculating flow rates, are too complex to automate and are likely to always require human review. To achieve 100% accuracy would require the MPCA to rigorously evaluate every single NPDES discharger separately; that level of individual rigorous evaluation is best left to actual permit issuances.

The primary reasons most NPDES dischargers would not receive sodium effluent limits under the proposed rules and irrigation narrative translator are bulleted below:

- Ambient water quality at the locations where irrigators appropriate water almost always has a Sodium Absorption Ratio (SAR) less than the 3.0 SAR value that is protective of the most sensitive crops usually grown in soils types seen in Minnesota. This is a strong signal that ambient water quality in Minnesota is broadly suitable for irrigation with regards to sodium and that very few locations need protection to ensure they meet the water quality needs of irrigators.

- Using the proposed narrative translator, effluent limits protecting irrigation water would be set to protect water quality, at the $122Q_{10}$ flow rate, at locations where water is appropriated for irrigation. Under the current rule, effluent limits are set to protect water quality at the 7Q10 flow rate for the first downstream water from the NPDES discharger, whether or not water has ever been appropriated from that first water. Since, the $122Q_{10}$ flow rate is several times larger than the $7Q_{10}$ and the effective "point of compliance" is typically farther downstream, there is more dilution available which reduces the likelihood of permit limits.
- At least one hundred municipal dischargers, and possibly dozens more, will eventually require chloride limits based on the chloride aquatic life standard. The chloride reductions required to comply with chloride permit limits will also reduce sodium. In every case the MPCA could analyze, complying with chloride limits would also result in effluent SAR also becoming less than 6.0, which is the value protective of sensitive crops and soils seen in Minnesota.

Likely to increase/impose new costs

Class 4B total dissolved solids
The proposed rule removes the Class 4B 1000 mg/L total salinity standard and replaces it with a 3000 mg/L total dissolved solids standard. (Salinity and total dissolved solids are functionally identical but the term total salinity is out of date and rarely used, and is therefore being replaced with total dissolved solids).

Currently, no NPDES permits have total salinity effluent limits based on the existing 1000 mg/L total salinity standard. No NPDES permits have total salinity limits because the Class 4A 700 mg/L total dissolved solids standard is more restrictive than the Class 4B total salinity standard; since every water of the state is both a Class 4A and 4B water, the more restrictive Class 4A standard is the limiting one for NPDES discharges.

The MPCA has calculated the potential total dissolved solids effluent limits resulting from the proposed Class 4B standard of 3000 mg/L. For this analysis, the MPCA first identified the permittees that have previously discharged effluent with a total dissolved solids concentration in exceedance of 3000 mg/L. The MPCA looked at data reported by the permittees from 2013 to the present, and examined daily sample values. The MPCA used monthly values if facilities had not reported daily sample values or the latter dataset was limited.

The MPCA calculated total dissolved solids effluent limits for facilities that have reasonable potential (RP) based on the proposed Class 4B total dissolved solids standard. The RP analysis requires a number of inputs, including background concentrations for the given parameter (total dissolved solids in this case), a facility's effluent concentrations of the given parameter, and the $7Q_{10}$ flow value of the receiving water. The $7Q_{10}$ flow is the lowest average discharge for seven consecutive days with a recurrence interval of ten years (7053.0135, subp. 3A) and protecting water quality down to the $7Q_{10}$ is a requirement in Minn. R. 7053.0205, subp. 7 unless another flow is applicable.

The MPCA has identified 12 NDPES permits that will likely include total dissolved solids permit limits based on the proposed standard, see Table 22. The likely daily maximum and monthly average effluent limits for total dissolved solids are shown in Table 22, and some key parameters used in the RP analysis and limit calculation are presented in

Table 23.

Of the twelve NPDES permits likely to receive a total dissolved solids limit under the proposed rule, only three would not also require a Class 2B chloride limit. The MPCA expects that every discharge that requires a chloride limit would ultimately not require a limit based on the proposed 3,000 mg/L total dissolved solids standard because, using the chloride linkage, compliance with the chloride limit would ensure that the proposed 3,000 mg/L total dissolved solids standard is also protected. These twelve discharges would experience no new cost because of the proposed rule.

The three NPDES permits for which the chloride linkage is not applicable, have unique stories. They are food processing companies that use salt in their food processing and the MPCA does not have detailed information to be able to identify their salt load with the needed specificity. Without this information, the MPCA cannot accurately estimate how new effluent limitations might impact these dischargers. Future issuances of these permits are likely to require a more detailed salt source investigation as part of the permit requirements.

Table 22: Projected total dissolved solids effluent limits for NPDES dischargers given proposed class 4B standards.

Facility Name	Requires Class 2B chloride limits	Permit ID	SD Station	Likely Daily Max Limit (mg/L)	Likely Monthly Average Limit (mg/L)
Brewster WWTP	Yes	MN0021750	SD001	4561.97	3524.64
Del Monte Foods Inc-Sleepy Eye Plant 114	No	MN0001171	SD006	3558.94	3204.80
Fairmont Foods Inc	No	MN0001996	SD003	3860.36	3490.90
Hubbard Feeds Inc-Worthington	No	MN0033375	SD001	6725.52	4083.62
ISD 363-Indus School	Yes	MN0049263	SD001	6528.80	4038.39
Lester Prairie WWTP	Yes	MN0023957	SD002	3784.83	3281.50
Marshall WWTP	Yes	MN0022179	SD001	3716.35	3258.57
MG Waldbaum Co	Yes	MN0060798	SD001	4152.05	3820.00
Montrose WWTP	Yes	MN0024228	SD001	4771.97	3585.69
Morris WWTP	Yes	MN0021318	SD003	4426.21	3484.21
Polar Semiconductor LLC	Yes	MN0064661	SD001	5169.74	3696.74
Waseca WWTP	Yes	MN0020796	SD003	4569.96	3570.61

Table 23: Parameters used in the total dissolved solids RP determination for NPDES dischargers.

Facility Name	Permit ID	SD Station	Background Concentration (mg/L)	Max Value (mg/L)	7Q10 (cfs)
Brewster WWTP	MN0021750	SD001	529	3650	0.00
Del Monte Foods Inc-Sleepy Eye Plant 114	MN0001171	SD006	675	3880	0.00
Fairmont Foods Inc	MN0001996	SD003	434	4130	0.03
Hubbard Feeds Inc-Worthington	MN0033375	SD001	529	3280	0.00
ISD 363-Indus School	MN0049263	SD001	196	3820	0.00
Lester Prairie WWTP	MN0023957	SD002	379	3400	0.00
Marshall WWTP	MN0022179	SD001	845	3860	0.00
MG Waldbaum Co	MN0060798	SD001	362	3820	0.08
Montrose WWTP	MN0024228	SD001	326	3770	0.00

Facility Name	Permit ID	SD Station	Background Concentration (mg/L)	Max Value (mg/L)	7Q10 (cfs)
Morris WWTP	MN0021318	SD003	561	3520	0.00
Polar Semiconductor LLC	MN0064661	SD001	362	3810	0.00
Waseca WWTP	MN0020796	SD003	364	3690	0.07

Class 4B sulfate

The proposed rule adds a 600 mg/L sulfate standard. Again, although not particularly stringent, this is the first applicable statewide sulfate standard. While some facilities have limits based on a 1000 mg/L sulfate standard applied under the Class 4B standards using the language for "additional selective limits," there has not been a sulfate standard clearly defined in the Class 4B standards. Some particular facilities have raised concerned about the cost of this proposed standard. U.S. Steel, the owner of several taconite mines, submitted a comment letter arguing that treatment costs associated with complying with the Class 4B sulfate standards in the proposed rulemaking could cause significant economic and social hardship for their business and that the benefits of treatment do not exceed the costs.

It is clear that some facilities will need effluent limits for these standards. The MPCA determined the RP of all active NPDES facilities with reported sulfate data in the same manner as described above for the total dissolved solids and nitrate standards. The MPCA found 17 dischargers that are likely to receive new sulfate limits due to the proposed Class 4B sulfate standard.

Table 24: Projected sulfate (SO_4^{2-}) effluent limits for NPDES dischargers given proposed Class 4B standards.

Facility Name	Permit ID	SD Station	Likely Daily Max Limit (mg/L)	Monthly Average Limit (mg/L)
Amboy WWTP	MN0022624	SD002	1531.69	856.98
Arkema Inc	MN0041521	SD001	945.11	714.47
Arkema Inc	MN0041521	SD002	1770.02	901.87
Bluegrass Proteins Inc	MN0048968	SD001	1758.22	899.84
Brewster WWTP	MN0021750	SD001	875.11	693.78
Chippewa Valley Ethanol Co LLLP	MN0062898	SD001	795.28	668.85
Cliffs Erie – Dunka	MN0042579	SD005	~950	~700
Cliffs Erie – Dunka	MN0042579	SD007	~950	~700
Cliffs Erie – Dunka	MN0042579	SD009	~950	~700
Cliffs Erie - Hoyt Lakes Mining Area	MN0042536	SD033	~950	~700
Cliffs - United Taconite Mining Area	MN0044946	SD007	~950	~700
DENCO II LLC	MN0060232	SD002	1260.05	796.92
Fairmont Foods Inc	MN0001996	SD003	2174.92	1028.88
Hubbard Feeds Inc-Worthington	MN0033375	SD001	1663.98	882.86
Madison WWTP	MN0051764	SD002	1210.56	784.95
Marshall WWTP	MN0022179	SD001	798.39	669.85
Mountain Lake WWTP	MN0021466	SD001	1681.51	1161.51
Saint John's University	MN0046035	SD001	761.20	657.71

Facility Name	Permit ID	SD Station	Likely Daily Max Limit (mg/L)	Monthly Average Limit (mg/L)
Saint John's University	MN0046035	SD003	854.42	687.47
Trimont WWTP	MN0022071	SD002	1278.52	801.30
US Steel – Minntac TB	MN0057207	SD001	~950	~700
Walnut Grove WWTP	MN0021776	SD002	825.49	678.47
Winthrop WWTP	MN0051098	SD001	1043.44	741.92

Table 25: Parameters used in the sulfate (SO_4^{2-}) RP determination for NPDES dischargers.

Facility Name	Permit ID	SD Station	Max Value recorded in effluent (mg/L)	Receiving water flowrate 7Q10 (cfs)
Amboy WWTP	MN0022624	SD002	831	0.00
Arkema Inc	MN0041521	SD001	817	0.00
Arkema Inc	MN0041521	SD002	1000	0.00
Bluegrass Proteins Inc	MN0048968	SD001	1330	0.00
Brewster WWTP	MN0021750	SD001	1870	0.00
Chippewa Valley Ethanol Co LLLP	MN0062898	SD001	997	0.00
Cliffs Erie – Dunka*	MN0042579	SD005	842	0.00
Cliffs Erie – Dunka*	MN0042579	SD007	1114	0.00
Cliffs Erie – Dunka*	MN0042579	SD009	1605	0.00
Cliffs Erie - Hoyt Lakes Mining Area	MN0042536	SD033	1060	0.00
Cliffs - United Taconite Mining Area	MN0044946	SD007	925	0.00
DENCO II LLC	MN0060232	SD002	3130	0.00
Fairmont Foods Inc	MN0001996	SD003	1990	0.03
Hubbard Feeds Inc-Worthington	MN0033375	SD001	1170	0.00
Madison WWTP	MN0051764	SD002	860	0.00
Marshall WWTP	MN0022179	SD001	1800	0.00
Mountain Lake WWTP	MN0021466	SD001	887	0.36
Saint John's University	MN0046035	SD001	1320	0.00
Saint John's University	MN0046035	SD003	1434	0.00
Trimont WWTP	MN0022071	SD002	1490	0.00
US Steel – Minntac TB	MN0057207	SD001	989	0.00
Walnut Grove WWTP	MN0021776	SD002	835	0.00
Winthrop WWTP	MN0051098	SD001	736	0.00

As discussed in other sections of this document, removing sulfate from a wastewater discharge is difficult and expensive. Due to the high cost of treating sulfate, the most cost-effective ways to reduce sulfate in a wastewater discharge is to look for ways to not add extra sulfate in the first place. If a discharger can find ways to eliminate or reduce added sulfate, they could potentially save millions of dollars in effluent limit compliance costs compared to installing a very expensive treatment system capable of treating salts.

With this in mind, the first step in this cost analysis was analyzing whether the discharger could easily find a way to reduce sulfate. If the sulfate reduction is not feasible, then active sulfate treatment would be required. The MPCA grouped the discharges into categories to perform this analysis as seen below.

Municipal dischargers with high sulfate in their drinking water source.
The cities of Amboy, Trimont, Madison, Mountain Iron, Walnut Grove, and Winthrop all source their drinking water from groundwater that has naturally high concentrations of sulfate. For these municipalities, the high sulfate in their groundwater is the driver of the high sulfate in their wastewater discharge. It is unlikely that these cities could easily or cheaply find a source of drinking water that has lower sulfate and would allow them to comply with their proposed sulfate effluent limits.

The MPCA expects that none of these municipalities could afford the sulfate treatment technologies capable of complying with the proposed sulfate effluent limits in the Table 24. All of these municipalities would likely need to apply for an economic variance from the proposed sulfate effluent limitation because of unaffordable sulfate treatment costs. In order to minimize costs, the MPCA intends to develop a streamlined approach to sulfate variances similar to that we have developed for chloride.

Municipal dischargers with significant industrial users that contribute to elevated sulfate.
The cities of Brewster and Marshall both have high sulfate because local industries discharge high sulfate waste stream into the municipal system, and because they are in areas of the state with relatively high sulfate (> 300 mg/L sulfate) in the groundwater that is the source of drinking and industrial process water.

Marshall is a unique discharge because its permit has chloride limits to protect the chloride aquatic life standard. Marshall has committed to upgrading the water softening system at their drinking water plant to comply with their chloride limits. It is possible that providing higher quality softened water to local industries will result in those industries using fewer sulfate containing chemicals - thereby reducing sulfate levels in the Marshall wastewater discharge. Without knowing the ultimate impact of upgrading the water softening system, and whether it will be sufficient to meet sufate limits, it is not possible to accurately estimate compliance costs for the city of Marshall related to the proposed sulfate standard. Like the owner of any municipal wastewater treatment plant, the city could also place some burden on the contributing industries to reduce sulfate.

The Brewster wastewater treatment plant has high sulfate because it receives reverse osmosis concentrate salt brine from a local industry that uses reverse osmosis to soften water used in the brewing process. This RO concentrate has high sulfate because groundwater in the area naturally has elevated sulfate. The MPCA expects that Brewster could not afford the treatment technologies capable of complying with the proposed sulfate effluent limits in Table 24. The only way Brewster could comply with the proposed sulfate effluent limits would be to stop receiving RO (RO) concentrate from the local industry. The MPCA expects that Brewster would be eligible for a variance based on socioeconomic factors from the proposed sulfate effluent limitations.

Ethanol dischargers
The Chippewa Valley Ethanol Co discharge would require new sulfate effluent limits under the proposed rule, but the discharger already has effluent limits for sulfate of 1,000 mg/L in their permit in addition to other Class 3 and 4 limits. Because of the Class 3 and 4 effluent limits, the facility is in the process of moving towards a zero discharge waste system and will not need an NPDES discharge permit in the future. Therefore, Chippewa Valley Ethanol would experience no new cost because of this rule change.

Denco II, LLC, is also a unique case because it has effective Class 3 and 4 effluent limits based on the current rule in their permit, along with an associated compliance schedule. Denco is located in Morris. The city of Morris recently upgraded their drinking water treatment plant to lime softening and now provides water that is about three times softer than before. Denco is purchasing softened water from the city and the new softened water is likely to further reduce their discharged salt concentrations and allow them to use less salt containing chemicals in their ethanol processing. It is likely that Denco would be able to comply with a sulfate effluent limit based on the proposed rule as they update their industrial processes to use less salt.

Food processors
The MCPA cannot say with certainty how the food processors (Bluegrass Proteins, Fairmont Foods, Inc., and Hubbard Feeds, Inc. – Worthington) will be affected by the proposed rule. These food processors use various types of salts in their food processing and the MPCA does not have detailed information to be able to identify their salt load with the needed specificity. Without this information, the MPCA cannot accurately estimate how new effluent limits based on the proposed rule might impact these dischargers. Future issuances of these permits are will require a more detailed salt source investigation as part of the permit requirements.

Taconite mines
Several taconite mines will be affected by the proposed 600 mg/L sulfate standard because they are likely to receive new effluent limits in their permits as a result of the proposed rule.

For taconite mines, the likely costs of complying with effluent limits protective of the 600 mg/L sulfate standard are similar to cost of complying with the current Class 3 and 4 WQS. The section below on the costs of the current Class 3 and 4 WQS for the taconite mines covers the topic.

Strategies to Reduce Costs at Permitted Facilities

Although the level of a water quality standard cannot consider cost, the CWA provides permitting and implementation tools for situations when the cost of compliance with a water quality standard or effluent limit is so high as to be infeasible due to widespread social and economic impacts. One of the main tools to address these situations is a variance (40 C.F.R. §§ 131.13 and 131.35; Minn. R. 7050.0190).

A water quality variance is an exemption from meeting otherwise applicable water quality standards and their associated WQBELs. A permittee (e.g., municipal wastewater treatment facility, industrial facility) may apply for a variance when they cannot currently meet a WQBEL due to economics, technology, or limited other factors. The most common reason for a variance in Minnesota has been the economic impact.

The EPA provided guidance for determining a facility or community's eligibility for a variance in *Interim Economic Guidance for Water Quality Standards* (S-13). The process generally involves conducting a financial impact analysis to examine if compliance with water quality standards would lead to substantial economic impacts for the facility and, if so, whether these impacts will also cause widespread social or economic impacts in the local community where the facility is located.

If the cost of compliance would cause widespread social or economic impacts, the facility is eligible for a variance. Variances are intended to be temporary and apply to a specific pollutant. The term of a variance had previously been limited to five years, but variances of up to fifteen or twenty years have recently been approved by EPA. During the time period of the variance, the facility will have alternate effluent limits (usually equivalent to the best performance of the existing equipment) and the facility must also take actions to look for other ways (like source reduction) to reduce their discharge of the specific pollutant. The facility must make progress towards eventual compliance with the limit.

Variances are issued by the MPCA and approved by EPA, and the requirements are then included into the facility's permit. Ultimately, the variance has the impact of mitigating the compliance costs. A variance is a tool available to any facility impacted by the costs of these revised standards. Variances are discussed in more detail in section on the costs of not adopting the proposed rules.

Costs borne by Minnesota residents as users of drinking water and wastewater infrastructure

When discussing the costs of compliance with a regulation, it is easy to think that the costs fall solely on the regulated party. However, there are unique situations related to the way municipal wastewater treatment infrastructure is funded, as these facilities provide an important public service. Thus, much of the costs are ultimately borne by Minnesota residents. Discussing the funding also provides important context to the economic affordability pressures faced by cities that own and operate WWTP. Water and wastewater infrastructure is the single biggest asset any given city has, and water and wastewater upgrades are typically the single largest capital investment a city ever makes.

Funding for municipal wastewater treatment infrastructure broadly comes from two categories: 1) local ratepayers; and 2) tax funded grants and subsidized loans used for capital investments.

Minnesota currently has over $5 billion in municipal wastewater maintenance needs, not including any costs related to complying with chloride or the Class 3 and 4 related effluent limitations (MPCA, 2018a). The state legislature typically bonds between $150 and $200 million per year for municipal wastewater but that amount is two to three times less than the actual need to maintain the current level of wastewater infrastructure, not including salty parameter compliance (Minnesota Report Card Committee, 2018).

Most of Minnesota's municipal wastewater infrastructure was first built in the late 1970s and 1980s during the 'construction grants' era, when cities could expect to receive about 90% matched grant funding from the state and federal government when building a WWTP. This helped keep rates low for local businesses and residents. Many of those original WWTPs work well but are reaching the end of their design life. In 2020, there is proportionally less grant funding available and cities can expect to receive only about 30% to 40% grant funding from state and federal sources, with the balance being paid by the city through rate increases.

Proposed wastewater infrastructure projects looking to secure state funding are ranked based on need and the water quality improvements that will result from the project. The highest ranking projects are first in line for funding and every year high scoring projects are left unfunded. So, while cities can receive some funds for complying with water quality standards, there is not enough funding to go around and ratepayers end up paying the difference.

Costs borne by people of Minnesota and users of water

Users of water for industrial purposes, irrigation of crops and watering for livestock – including those who hold MDNR water appropriation permits for these uses - and wildlife are unlikely to experience any costs under the proposed rules. The proposed rule protects water quality for the intended beneficial use. Since the beneficial use will be protected, no industrial user, irrigator of crops or watering of livestock or wildlife would experience a cost or negative effect.

Commenters have raised concerns that other beneficial uses will suffer, causing an intrinsic negative effect and also imposing a cost on those who value those uses (aquatic life, fishing, etc.) and the water quality needed to support those uses. In general, this is due to a belief that the changes to the standards will result in dramatic increases in concentrations of salts in Minnesota's waters. In other portions of this SONAR, MPCA has demonstrated why such an increase in salts is unlikely. Therefore, these costs will not be incurred.

6) The probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals

If the proposed rules are not adopted, then current water quality standards remain in place. As discussed above, the current water quality standards have the potential to impose significant costs on some impacted parties – namely wastewater dischargers. Owners and operators of permitted wastewater facilities have raised concerns about the financial impact of implementation of the current Class 3 and 4 WQS. The current standards affect several hundred NPDES dischargers and are highly likely to impose costs. While the MPCA cannot provide an exact numeric dollar value, this section provides detailed analysis of the costs of compliance with the existing rules, costs that would be avoided if the proposed rules are adopted.

The current water quality standards have complex effects on NPDES dischargers that vary by the type of discharger, where that discharger is located, the financial health of the discharger or the community that the discharger serves, the types of technologies that allow for compliance, and the timeline being considered, among other factors. For most NPDES dischargers affected by the current rules, complying with the current rule could cost anywhere between zero and many millions of dollars. As such a wide range of cost estimates is not very useful, the rest of this section attempts to explain the factors that impact the costs of compliance for NPDES dischargers. In order to best communicate the cost of the current rule for NPDES dischargers, the MPCA determined it was best to group NPDES dischargers by type – such as municipal wastewater plants, industrial dischargers generally, and taconite facilities as a specific industrial category. This was done for two reasons: 1) the comments received indicate that the public evaluates these standards in terms of how they affect specific classes of NPDES dischargers and 2) it resulted in less redundancy because the compliance strategies and costs are can be grouped by type of dischargers.

The cost assessment below focuses on the costs of installing pollution control equipment to control salty parameters or ionic pollutants. As discussed above, the ionic pollutants are difficult and expensive to remove from effluent, and generally are not treated with the conventional technologies used to treat most wastewater.

Municipal wastewater treatment plants

Summary

Cities that own and operate wastewater treatment plants (WWTPs) are affected by the current numeric Class 3 and 4 water quality standards. Collectively they potentially face millions of dollars in costs related to these salty parameter standards, particularly the Class 3 and Class 4A standards. The primary way that WWTPs are affected is through the inclusion (or not) of effluent limits for hardness, bicarbonate, specific conductance, and total dissolved solids in their NPDES permit. Inclusion of effluent limits is likely to require spending on pollutant control technologies to ensure compliance with the effluent limits. The effects of the current water quality standards are not equally distributed; some WWTPs and the communities they serve are greatly affected while others are not affected at all.

Cities experience significant costs when effluent limits protecting the Class 3 and 4 water quality standards are included in their NPDES wastewater permits and complying with those limits requires spending on new infrastructure, such as pollutant control technology, that reduces pollution to levels that ensure compliance with the limits. Well over 161 Minnesota municipal wastewater treatment plants are likely to require a limit to protect a Class 3 or 4 water quality standard. In almost every case, compliance with those limits would require the WWTP operator to build new infrastructure. Over 90% of affected cities are small rural cities of less than 5,000 people and no city of greater than 25,000 people is likely to be affected by the current rules.

The options for end of pipe treatment of salty or ionic pollutants are limited and expensive. Therefore, the only feasible means of compliance with effluent limits related to the current Class 3 and 4 water quality standard is through reducing the load of salt coming into the WWTP (source reduction). For almost every city this means reducing chloride loading from individual water softeners, and the only feasible way to do this is to provide centrally softened drinking water and then eliminate or upgrade individual softeners. Building new centrally softened drinking water plants is also expensive.

Given the general infeasibility and expense of removing salts from effluent at small WWTPs, the MPCA has been working to develop creative permitting solutions that protect the environment while reducing the costs of compliance. The first strategy is known as the “chloride linkage” (S-20). The chloride linkage both recognizes that WWTP must operate their facilities to comply with effluent limits for multiple pollutants, and relies on the fact that reducing chloride pollution also reduces levels of other salts and, in many cases, supports compliance with multiple limits. Cities that are likely to receive effluent limits to comply with the existing Class 3 and 4 WQS are over thirty-three times more likely to also have (or need) limits to comply with Minnesota’s Class 2 aquatic life standard for chloride. The strategies for ensuring compliance with a chloride limit are substantially similar to those for ensuring compliance with limits imposed to meet the existing Class 3 and 4 WQS, with some notable differences around affordability. For example, centralized lime softening supports compliance with both chloride and the Class 3 and 4 effluent limitations but is unaffordable for cities with less than approximately 5,000 people. RO softening can be affordable for small towns and allow for compliance with chloride limits but RO does not support compliance with Class 3 and 4 limits for cities using naturally hard water (where salt levels exceed the values set in the current Class 3 and 4 standards).

Ultimately, over 100 municipal facilities will receive chloride limits to meet the Class 2 aquatic life standard. It is reasonable to expect an additional $30 million to $150 million per year in spending associated with new centralized softening infrastructure to comply with these limits. This will represent a significant environmental benefit. However, in smaller cities where RO softening would be the best choice to reduce chloride, it may not be beneficial to pursue RO because that supports compliance with only the chloride limit and not any limits related to Class 3 and 4. Facilities in this situation may choose to pursue another permitting solution - the issuance of a variance - based on the economic hardship of compliance with multiple salty parameter limits. Without facing effluent limits based on the current Class 3 and 4 WQS, these facilities could go install technologies that reduce chloride. Close to 80 cities are in this position of likely being able to take steps to comply with the chloride limits, but not limits derived from the current Class 3 and 4 water quality standards. For these cities in particular, the proposed revisions to the Class 3 and 4 WQS represent significant cost savings. They also may result in increased benefit to the environment by spurring compliance with the chloride standard.

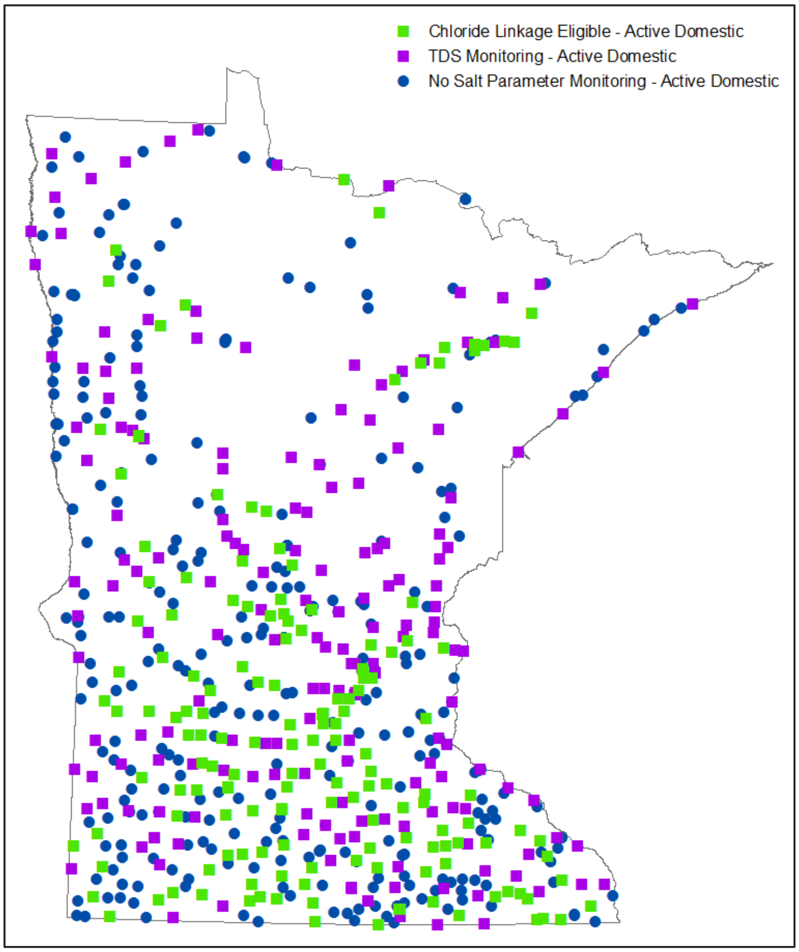
Identifying municipal wastewater plants affected by the current rule.

Nine municipal WWTPs currently have a Class 3 and 4 effluent limit in their permit. However, this is a substantial undercount of the number of facilities that are affected by the Class 3 and 4 water quality standards.

Not every municipal WWTP monitors for the full suite of salty parameters in their discharge; without this monitoring the MPCA cannot calculate whether a discharger would need a limit for chloride and/or a Class 3 and 4 parameter. Additional facilities may need permit limits in the future, once monitoring data is available.

Figure 5 shows all of the municipal wastewater treatment plants in Minnesota and the types of salty parameters they measure for in their discharge. Among these municipal wastewater treatment plants, 282 have no total dissolved solids monitoring for a surface discharge station (37%), 329 have surface discharge stations with total dissolved solids monitoring (43%), and 153 WWTPs conduct sufficient salty parameter monitoring on a surface discharge station that enable the MPCA to consider their eligibility for the chloride linkage (20%).

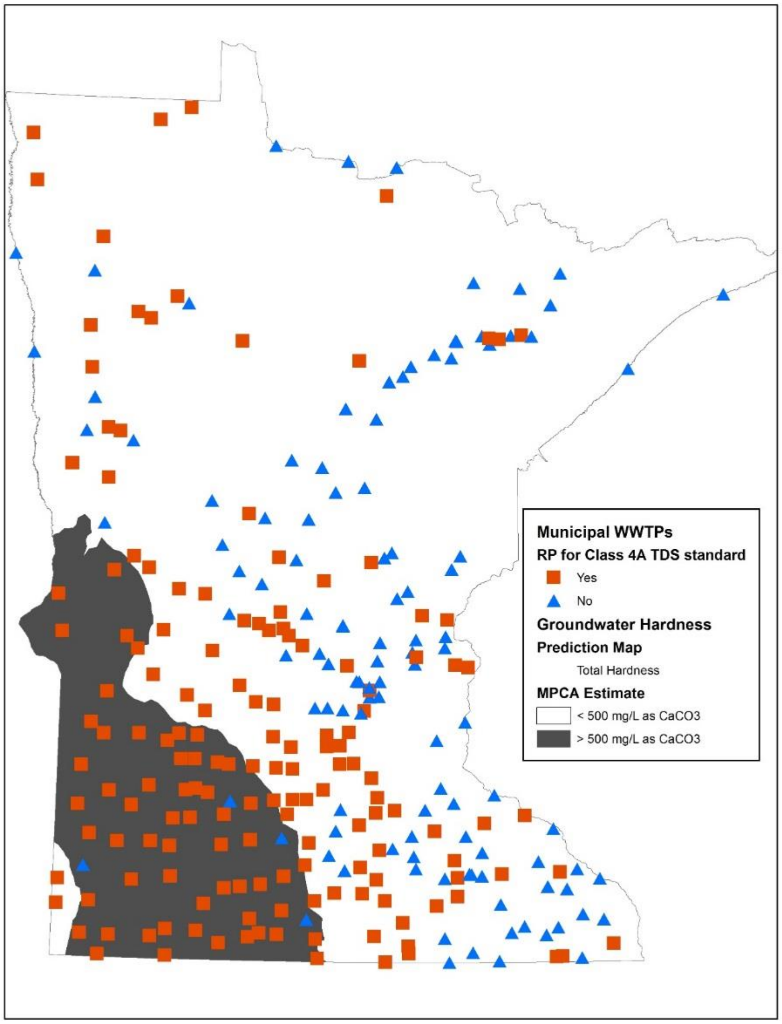
Figure 5. Municipal wastewater treatment plants in Minnesota and the salty parameter they sample for as of October 2020.



The MPCA has identified over 161 individual municipal wastewater treatment plants that have the reasonable potential (RP) to exceed the Class 4A total dissolved solids standard of 700 mg/L and thus would ultimately require an effluent limit in their permit (Figure 6). This standard is the most restrictive of the current Class 3 and 4 water quality standards and if a facility has RP for total dissolved solids they are over twenty five times more likely to have RP for another Class 3 and 4 water quality standard. These 161 facilities represent facilities that have been conducting salty parameter monitoring and have sufficient data to make a formal reasonable potential determination. Because the need for a total dissolved solids effluent limit is highly correlated with with areas where groundwater has high total dissolved solids, MPCA anticipates that if every one of Minnesota’s 571 municipal NDPES permittees had data and information available to evaluate them for RP, many (perhaps more than 100) additional facilities would also need effluent limits. The MPCA currently prioritizes requiring salty parameter monitoring from WWTPs with the greatest potential to have negative salt related impacts, i.e. those that discharge to low dilution streams, continuous rather than controlled dischargers, larger dischargers, etc. and has no plans to require additional monitoring at this time.

Figure 6. Municipal wastewater treatment plants with the reasonable potential to exceed the class 4A 700 mg/L total dissolved solids water quality standard.

A square 'Yes' indicates an individual municipal wastewater treatment plant that requires an effluent limitation to protect Class 4A total dissolved solids water quality standard. Cities within the dark area are likely to have drinking water from groundwater naturally in exceedance of the Class 3C 500 mg/L water quality standard.



Effluent limits protecting the current Class 3 and 4 water quality standards and the aquatic life chloride standard are inextricably linked. For example, if a municipal WWTP has RP for the aquatic life chloride standard they are statistically thirty three times more likely to also have RP for the Class 4A total dissolved solids standard. Similarly, any reduction in chloride will also proportionally reduce total salt, specific conductance and the amount of sodium in the water. Municipal WWTPs necessarily consider compliance with the aquatic life chloride limit and the Class 3 and 4 limits together and colloquially address them as "salty parameters."' The rest of this document will address chloride and salty parameter compliance strategies together because they are closely linked from a compliance perspective.

The type of municipal WWTP most likely to be affected by the current rules are those that serve communities of less than 5,000 people and discharge to low volume waterbodies in areas of the state with high hardness in their source of drinking water. (Areas of high hardness are shown in gray in the map above.)

Where WWTPs discharge to low volume waterbodies (e.g. small streams, ditches, wetlands), their effluent is a greater portion of the flow in the waterbody. Therefore, no dilution capacity is accounted for when setting effluent limits and these facilities have the highest potential for receiving effluent limits. Minnesota's largest municipalities are primarily found on large rivers that have a high dilution capacity and are therefore less likely to have effluent limits for salty parameters. Minnesota's small towns are typically situated further away from large waterbodies and are therefore more affected by this rule because they tend to discharge to smaller waterbodies. For example, the Dawson WWTP discharges to a very small waterbody in the former prairie and Dawson has Class 3 and 4 effluent limitations that are statistically identical to the water quality standard. In contrast, the Twin Cities metro plant discharges over five times more salt mass than any other WWTP but has no RP for any salty parameter because the effluent salt concentrations are not high enough to cause an exceedance of any in-stream water quality standard in the high flow Mississippi River.

The primary source of anthropogenic salt loading to municipal WWTPs are point-of-entry ion exchange water softeners. The majority of Minnesota cities do not centrally soften their water and water users in these communities tend to run water softeners, especially if the water is hard (Figure 8). This softened water, which contains high levels of ions, then moves into the wastewater and the wastewater treatment plant. In cities with hard water and widespread use of water softeners, salt loading from water softeners accounts for 50 to 90 percent of anthropogenic salt loading. The additional salt loading from water softeners is the key reason most cities have or need limits for the Class 2 chloride water quality standard and the Class 3 and 4 water quality standards. Cities that actively soften water at the drinking water plant or those cities in Northeastern Minnesota with naturally soft water are unlikely to have high salt loading from water softeners, because when water is soft there is no need to operate point-of-entry water softeners.

Ion exchange water softeners inherently require using lots of salt; engineers consider ion exchange softening to be 'salt inefficient' because the physical chemistry of ion exchange requires using and disposing of high volumes of maximally salty brine (i.e. > 357,000 mg/L salt). After the softener is regenerated with salt brine, the spent brine is sent down the drain and ultimately travels to the WWTP. The cumulative salt loading from all the ion exchange water softeners is the reason chloride loading is high at over 90 percent of municipal WWTPs in Minnesota.

Limit setting and compliance strategies for municipal wastewater treatment plants

Minnesota has had the Class 3 and 4 water quality standards in rule since 1967 and the Class 2 chloride water quality standard in rule since 1991. However, it was only in 2009 that the MPCA began to require effluent monitoring for salts, allowing the MPCA to assess whether effluent limits in municipal WWTPs were needed. In response to federal effluent salty parameter sampling requirements in 40 CFR 122.21(j) and public concerns that the taconite and ethanol industry were discharging too much salt, the MPCA initiated a statewide effluent monitoring plan to assess the salt loading from all types of WWTPs. As of 2020, over 350 municipal wastewater treatment plants now measure at least one salty parameter in their discharge and report that data to the MPCA.

Municipal WWTP permits are re-issued every five years, and upon that re-issuance the MPCA evaluates all available sampling data. Sufficient data, typically ten or more effluent samples, is needed in order to make an RP determination. If a facility has RP for a pollutant then an effluent limitation must be included in the permit. Sometimes the effluent limit can be met and is simply included in the permit. When the limit cannot be met, the WWTP usually will develop a compliance schedule. A compliance schedule details all of the actions the permittee will take to move towards compliance with their limits beginning with evaluations of technical solutions available to comply with the effluent limit, and proceeding to a schedule for construction of the needed solution. A compliance schedule may last for many years, but has a fixed end date. Once an effluent limit is included in a permit and met, it is difficult to remove without a complicated analysis known as "anti-backsliding." In other words, once a limit is established in a permit it is functionally permanent.

Given the general infeasibility and expense of removing salts from effluent at small WWTPs, the MPCA has been working to develop creative permitting solutions that protect the environment while reducing the costs of compliance. The first strategy is known as the "chloride linkage," relying on the previously explained link between chloride and other salts. Since 2017, the MPCA has used the chloride linkage policy to set limits for wastewater treatment plants that have RP for chloride and any of the Class 3 and 4 water quality standards. The chloride linkage policy relies on the fact that actions to comply with a final effluent limit for chloride also reduce total salt loading – including specific conductance, hardness, sodium and bicarbonate – to levels protective of the current Class 3 and 4 water quality standards. The relationship between complying with chloride and the Class 3 and 4 water quality parameters was established by empirical observations and computer modeling of wastewater discharges that are dominated by ion exchange softeners. The chloride linkage is applicable to all but a handful of municipal WWTPs with unique salt signatures in their discharge. The municipal WWTPs for which the chloride linkage is not applicable are those that receive wastewater from unique industrial users such as meat processors and breweries. The concept of using one limit to protect many water quality parameters and beneficial uses is common in wastewater permitting. For example, E. coli is used as a simple and convenient way to control for total wastewater pathogens because it is reasonable to assume that if E. coli is treated then other pathogens that are much more difficult to measure have also been treated.

Assigning chloride limits using the chloride linkage commits the permittee to evaluating the technical and economic viability of pollution prevention or pollution control technology to comply with the chloride limit. This usually means evaluating the potential to move toward centralized lime softening for community water and removing softeners and their associated salt loading. By reducing the salt load from water softeners, total salt and specific conductance loading is reduced proportional to the amount of chloride reduced; lime softening reduces hardness. The MPCA uses the chloride linkage because cities cannot know, immediately upon receiving new effluent limits, what overall salty parameter compliance strategy will work best for them. Relying on a chloride limit allows cities more flexibility and time to develop appropriate compliance strategies and determine affordability. If a city eventually determines that the best approach will not adequately reduce all salty parameters, then the assumptions of the chloride linkage would be invalid and additional effluent limits would need to be applied.

This cost analysis uses the generalized salty parameter limit compliance strategies, including the chloride linkage, outlined below. The strategies were developed through a workgroup process where representatives of eight municipalities with salty parameter effluent limits and two consulting engineering firms met with the MPCA and came to a consensus on compliance and permitting solutions, as described in MPCA/Chloride Work Group proposal (2017). The three alternatives listed below are a distillation of a much more detailed engineering analysis (MPCA, 2018d).

The notable commonality among the three options below is that none of them involves treating salty parameters at the WWTP. Municipal wastewater treatment plants are not designed to treat salty parameters and no municipal WWTP in Minnesota is currently capable of doing so. All of the salty parameters that enter a municipal WWTP leave the WWTP unchanged in concentration and mass. Treating salty parameters at the WWTP is technologically possible but not economically feasible. The best way to treat or manage salty parameters is to avoid putting additional salts in the water in the first place.

Treating salty parameters at the WWTP involves the extreme treatment technologies of RO coupled with evaporation and crystallization of the resulting RO waste brine stream. This option is very expensive with many secondary consequences such as increased energy use and related carbon emissions, high waste disposal costs, and the development of a totally new operator skillset.

The MPCA received $180,000 in financial support from the Minnesota Environment and Natural Resources Trust Fund to commission a study that investigated treating salty parameters (specifically sulfate) at municipal WWTPs. The study (Bolton & Menk, Inc. & Barr Engineering Company, 2018) came to the conclusion that the most feasible, but still problematic, way to treat salty parameters at the WWTP was to use RO with evaporation and crystallization. The costs of this technology can be seen in Figure 6, though the cost estimates in that figure are likely conservatively low. Using EPA municipal wastewater affordability criteria (i.e., total wastewater costs should be less than 2% of median household income) the MPCA calculates that no municipality in Minnesota can afford to install this technology to treat salts at the WWTP. Since the costs of treating salts at the WWTP are clearly unaffordable, the rest of this cost analysis focuses options that reduce chloride and salty parameters in the water coming in to the WWTPs. The three most feasible such source reduction strategies are:

1) Upgrade residences and businesses to high efficiency point-of-entry softeners.

This option maintains the municipalities' drinking water infrastructure status quo and is the least expensive option. Municipalities in the chloride working group preferred this option because it requires no new drinking water infrastructure, thereby avoiding the difficult work involved in constructing new drinking water infrastructure – from planning, to funding (including the potential of rate increases), communicating about the need for the project and the funding, all the way through actual construction. In addition, it does not raise potential concerns for job loss and economic impacts among water softening professionals.

However, the MPCA predicts that most affected municipal WWTPs (more than 95%) will not be able to reliably meet their salty parameter effluent limits by widespread upgrading to higher efficiency softeners. While modern 'high efficiency' water softeners use approximately 50% less salt when compared to very old water softeners, even this lower amount of salt represents a large amount relative to the levels of the water quality standards. The MPCA based this prediction on its own internal calculations, which is borne out by three different engineering firms representing the cities of Alexandria, Morris, Lakefield, Sherburne and Otsego have come to similar conclusions and these cities have chosen not to pursue solely upgrading water softeners as a compliance strategy.

Perhaps 5 percent of cities might find this option works for them, but that decision should be made on a site-specific basis using loading calculations and with an evaluation of the reasonableness of input assumptions. The cost estimates in Figure 6 for this option should be thought of as maximum upper estimates because it assumes every water softener needs upgrading and a conservatively high cost of $2000 to replace each softener. To be clear, the MPCA does not recommend a blanket ban or forced upgrade of point-of-entry ion exchange softeners without a numeric analysis of whether it is necessary.

2) Centralized lime softening and evaluating the need to remove all point-of-entry softeners.

A second chloride source reduction option is switching a city's drinking water to centralized lime softening and removing all point-of-entry softeners. Installing centralized lime softening and removing all point-of-entry softeners has the highest degree of certainty of ensuring compliance with chloride effluent limits and other Class 3 and 4 limits. In specific circumstances, it may be possible to reliably meet chloride effluent limits through centralized lime softening while still allowing the use of high efficiency point-of-entry softeners in the distribution network.

Lime softening has the advantage of reducing total salt and hardness concentrations relative to the source water and therefore ensuring compliance with any Class 3 and 4 effluent limitations at the WWTP. Lime softening works by chemically precipitating calcium, magnesium and bicarbonate ions and physically retaining them at the drinking water plant. By removing the calcium, magnesium and bicarbonate ions, total salt content decreases, as do levels of specific conductance, hardness and bicarbonate. Lime softening also has public health benefits such as being able to treat radium, gross alpha emitters and arsenic.

Lime softening is not equally suitable or affordable for all municipalities. Lime softening is substantially more expensive than other forms of centralized softening for small towns of less than 5,000 people and is likely to be unaffordable for most small towns (Figure 7). Lime softening is operationally complex, cannot be fully automated the way RO can, requires the highest level of operator certification, does not scale down well in terms of cost and produces a lime sludge that requires disposal. Not only is lime softening more expensive to build at small scales, but it has approximately double the operational costs of RO for small towns ($7 vs $4 per 1000 gallons). Lime softening is a better centralized softening solution for large towns that can take advantage of the economies of scale large lime softening plants have. Minnesota’s largest cities tend to use lime softening and smaller towns preferentially to use RO if they centrally soften (Figure 7).

3) Centralized reverse-osmosis softening and evaluating the need to remove all point-of-entry softeners.

Switching a city’s drinking water to centralized RO softening and removing all point-of-entry softeners is another source reduction strategy for compliance with chloride limits. This option also has the highest degree of certainty of ensuring compliance with chloride effluent limits. In specific circumstances, it is possible to reliably meet chloride effluent limits through centralized RO softening while still allowing the use of high efficiency point-of-entry softeners in the distribution network; Sherburne and Lakefield are two cities that still allow high efficiency softeners while centrally RO softening.

RO softening cannot reduce the hardness and salt loading a WWTP would receive relative to the source water. For example, if the source water hardness concentration is 500 mg/L and RO is used to soften drinking water, the hardness concentration in the wastewater effluent will always be at least 500 mg/L. RO softening works by reducing the hardness and salt loading the end-users receive and routing the concentrated salt mass to the WWTP where the concentrations become similar to what they were originally in the source water (See chloride alternative analysis for a flow diagram of the conservation of mass). If a city’s drinking water source is naturally above any Class 3 or 4 water quality standard, then installing centralized RO softening would ensure that the WWTP would always have discharge concentrations above the Class 3 and 4 water quality standards. RO can have public health benefits such as treating nitrate, radium and arsenic to protect human health.

RO softening is not equally suitable or affordable for all municipalities. All things being equal, RO softening is less expensive and much easier to operate for small towns of less than approximately 5000 people compared to lime softening (Figure 7). For small towns, installing RO softening can be affordable (especially with state funding) but lime softening would be unaffordable to build and maintain. The choice between Class 3 and 4 parameter limit compliance (lime) and affordability (RO) can be very difficult for small towns and a case example of the city of Lakefield’s limit compliance decisions can be found below. If they centrally soften, Minnesota’s small towns tend to use RO softening (Figure 8).

There are at least 79 small towns for whom RO is likely not a feasible compliance strategy because it does not support compliance with the Class 3 and 4 water quality standards. These 79 cities are those within the dark area in Figure 6. Every city in that area sources drinking water from groundwater and in that area groundwater is naturally in exceedance of the existing class 3C 500 mg/L as CaCO3 hardness water quality standard. It is likely that the total number of cities in this situation is greater than 79, but the MPCA does not have the means to identify all of them within a reasonable accuracy.

Figure 7. Estimated capital costs of salty parameter limit compliance strategies by city population size.

These are high level cost estimates with accuracy of ± 50% that are suitable for initial project costing. The RO and Lime costs were provided to the MPCA thanks to the engineering firm Bolton and Menk.

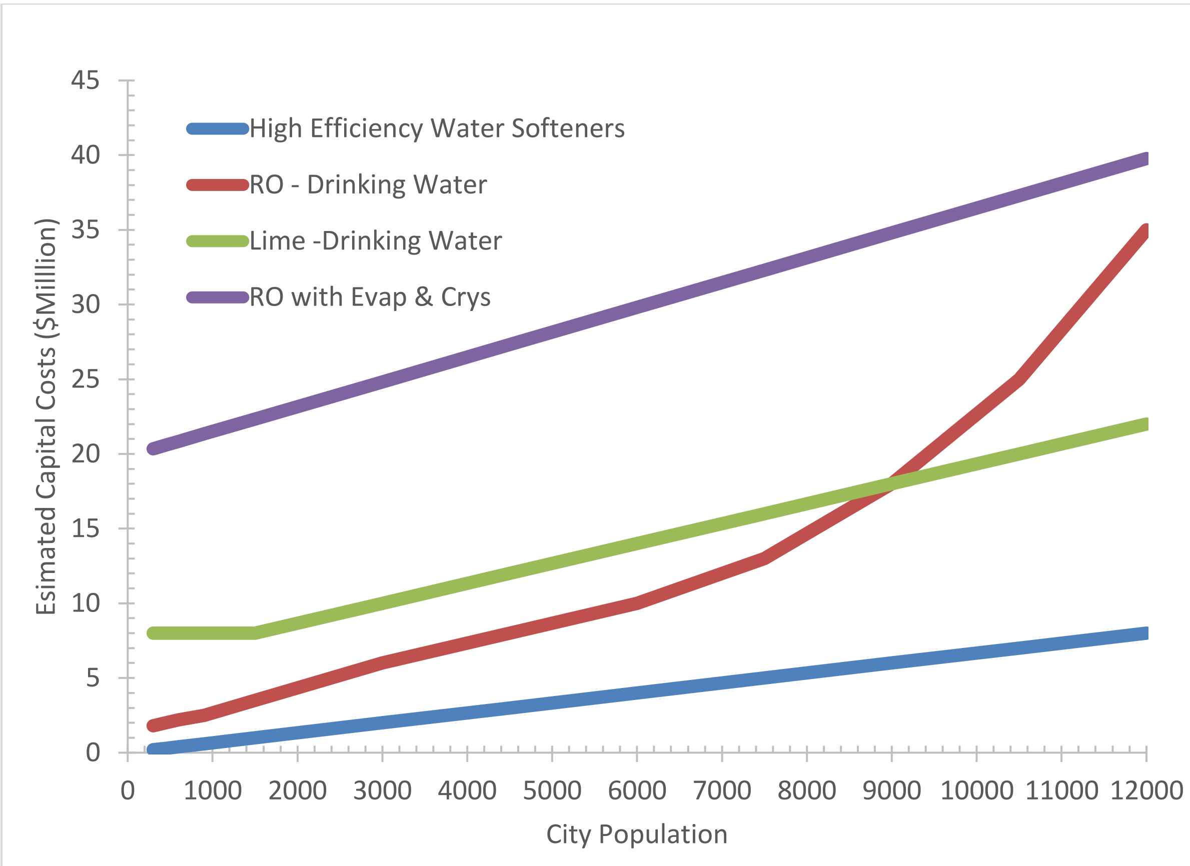
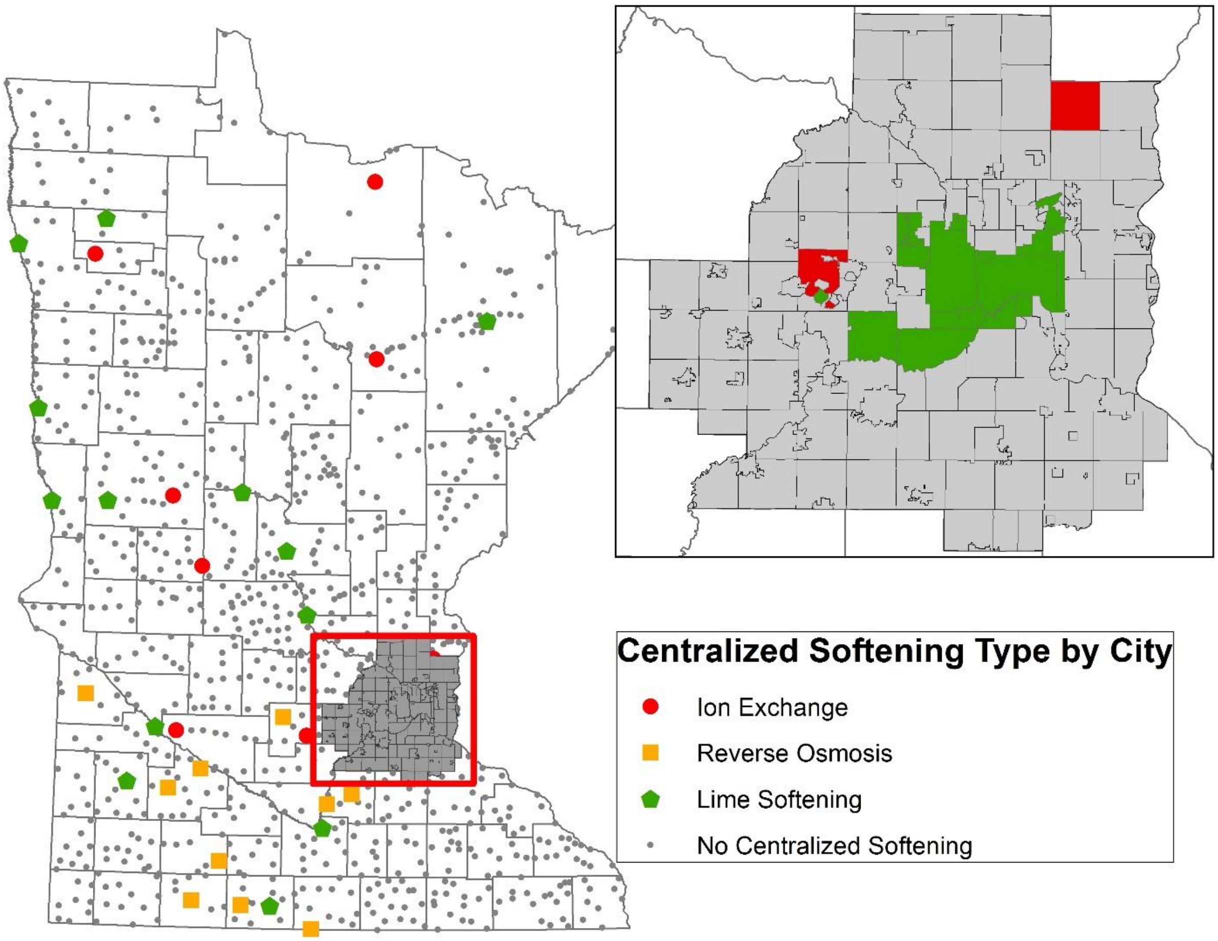


Figure 8. Map of Minnesota and the type of softening they employ at the drinking water plant.

The source of this information is the Minnesota Department of Health. Centralized ion exchange softening is not discussed in this analysis because it is not a feasible salty parameter limit compliance solution, and relatively few communities use it.



Choosing a final limit compliance strategy is dependent on numerous factors, some of which the MPCA cannot know and some of which would be irresponsible for the MPCA to try to predict (Figure 9). For example, the Minnesota Department of Health (MDH) regulates drinking water in Minnesota. MDH provides communities guidance regarding drinking water treatment to achieve specific human health goals and MPCA should not interfere with MDH's public health recommendations.

Since the MPCA cannot know, at this time, a given municipality's final limit compliance strategy with regards to the chloride and the Class 3 and 4 effluent limitations, it is not possible to list out the exact costs of the current rule for each individual municipal wastewater plant. The best the MPCA can do at this time is to provide costing information to bookend the costs in the form of numeric tables. If a municipality is interested in evaluating the potential costs of either upgrading to lime softening or RO to comply with limits they can use Table 26 to estimate capital costs. The tables below have a costing accuracy of approximately ± 40%.

Figure 9. A wordmap of some of the decision points that cities are likely to consider as they decide whether to pursue centralized softening as a limit compliance strategy.

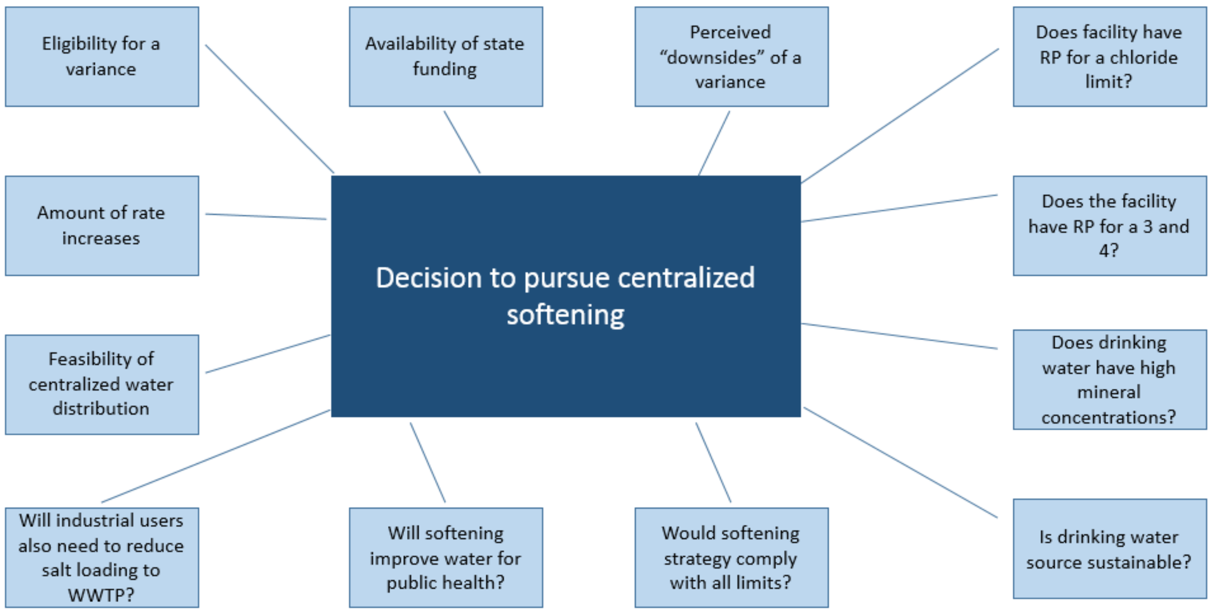


Table 26. Approximate costs of drinking water softening by city zize

City population	New RO drinking water plant (capital cost range in $mil)	New lime softening drinking water plant (capital cost range in $mil)
< 300	1.1 - 2.5	4.8 - 11.2
300 - 450	1.2 - 2.8	4.8 - 11.2
450 - 600	1.3 - 3.1	4.8 - 11.2
600 - 900	1.5 - 3.5	4.8 - 11.2
900 - 1500	2.1 - 4.9	4.8 - 11.2
1500 - 3000	3.6 - 8.4	6 - 14
3000 -4500	4.8 - 11	7.2 - 16.8
4500 -6000	6 - 14	8.4 - 19.6
6000 - 7500	7.8 - 18	9.6 - 22.4
7500 - 9000	10.8 - 25	10.8 - 25.2
9000 - 10,500	15 - 35	12 - 28
10,500 - 12000	21 - 49	13.2 - 30.8

Variances

As discussed above, variances are an available tool when the cost of compliance with a water quality standard would result in widespread social or economic hardship. While variances are a cost reducing tool, the variance process also involves costs for determining eligibility, application, and then completing required actions under the variance.

When determining if municipalities are eligible for a variance, the MPCA uses the numeric affordability criteria developed by the EPA. Under this criteria, total wastewater cost should be less than 2% of median household income; widespread economic hardship would result if costs were above this threshold. These numeric affordability criteria are critically important but they are not the only metric cities consider in terms of wastewater and salty parameter compliance.

The MPCA estimates that every city in Minnesota that has or may have RP for a salty parameter water quality standard would be preliminarily eligible for a variance based on the previously mentioned EPA economic hardship criteria. The MPCA (2019a) made this estimate using the streamlined automated variance eligibility calculator that is available to the public as a spreadsheet. The calculator aggregates publically available economic data required by the EPA to determine variance eligibility criteria (e.g. bond rating, median household income, unemployment rate, etc.) and uses pollutant control technology cost estimates to calculate variance eligibility. The calculator was developed primarily for the use of the 98 facilities with chloride RP. Since all 98 cities would be eligible for a chloride variance based on economic criteria, and the compliance strategies and costs are similar between chloride and other salty parameters (including the existing Class 3 and 4 WQS) it is reasonable to assume that every facility with a Class 3 and 4 limit would also be eligible.

The calculator assumes no state funding is available and that lime softening is the preferred compliance strategy; these are reasonable assumptions for cities that have not yet had the time to develop detailed compliance strategies but know that treating salty parameters at the WWTP is not feasible.

Applying for a variance costs $10,080 dollars under Minnesota's current water quality fee rules, though the current MPCA commissioner has chosen to waive that cost for cities applying for a variance from a salty parameter. Applying for a variance can have other costs such as hiring engineering consultants to develop location specific compliance strategies to justify the variance. After talking with several cities and consulting firms, retaining a firm to apply for a variance is likely to cost between $50,000 and $150,000, depending on the complexity of the variance. The MPCA developed the streamlined variance process to minimize the need for hiring consultants, but a limited number of cities with unique drinking water systems or significant salt loading from a commercial or industrial business might need to hire a consultant to develop more detailed compliance solutions. The city of Avon successfully applied for and received the first chloride variance in Minnesota without retaining a consultant and the MPCA expects the majority of small towns less than 5000 people would not need to retain a consultant to apply for a variance.

A difficult to quantify cost of a variance is time and effort required to apply. Even with the streamlined variance process, applying for a variance is paperwork intensive and requires many consultations with the MPCA. This process has real costs for cities. Minnesota currently only has one chloride variance and from start to finish it took over two years to receive final approval from EPA. This was the first chloride variance MPCA and EPA had ever approved for Minnesota and future variances are expected to take substantially less time. Some cities have chosen not to pursue a variance, in part, because of perceived time delays and a desire to spend effort on developing physical infrastructure to ensure limit compliance.

These costs of variances will continue to exist for the Class 3 and 4 water quality standards unless the proposed rules are adopted.

Wastewater and drinking water users

As discussed in the costs of compliance, many municipalities rely on state grants to help fund wastewater infrastructure – including the costs of compliance with water quality standards. As noted previously, Minnesota has a large need for wastewater infrastructure that is not fully funded. In addition, wastewater operators may identify key needs that are not even eligible for state grant funding.

This second issue can be addressed by changes in the types of projects allowed to receive funding. In

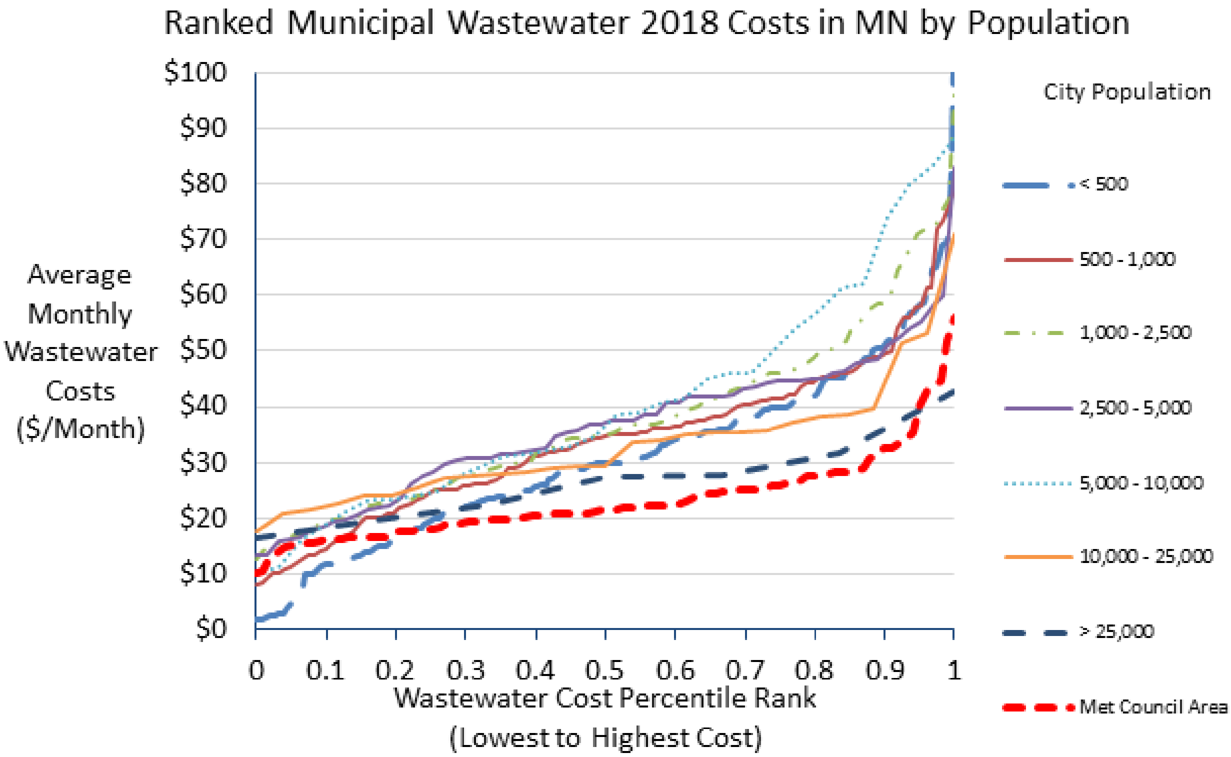
2016, the funding protocols were changed so that cities could use wastewater funding strings to pay for drinking water infrastructure that would ensure compliance with wastewater salty limits. In the 2020 wastewater project priority list, 6 of the 239 projects (representing $34 million out of the total $1.4 billion on the list) are for centralized softening projects to comply with salty parameter limits on wastewater facilities. The MPCA expects the funding needs for centralized softening from the wastewater fund to increase in the future but it is difficult to say precisely by how much. The six WWTPs on the 2020 list received their chloride limits prior to 2016, and it took them two to four years to develop a plan to submit for funding. As of September 2020, only 18 municipal WWTPs have a salty parameter (including chloride) limits in their permit. As dozens more cities receive new limits, it would be reasonable to see ten to twenty drinking water projects on the annual wastewater project priority list representing something in the range of $30 to $150 million in annual project costs. Allowing drinking water infrastructure to be eligible provides important sources of funding for cities but also functions to place further stress on the funding system, reducing the net available funding for 'conventional' wastewater parameters associated with treating raw sewage. Adopting these proposed rules would minimize the likely increase in facilities applying for state grant funds for projects related to salty parameters.

When city representatives are considering water and wastewater upgrades, they consider all of this information. They know the majority of project costs will be paid by local ratepayers in the form of rate increases, and that securing project funding via state grants is increasingly competitive. City councils also know that rate increases are not distributed equitably, as Minnesota cities use flat rate structures where everyone pays the same rate irrespective of ability to pay. This results in low income residents paying a significantly greater percentage of their income than high income resident for water and wastewater. Minnesota small towns of less than 5000 people typically have about 20% to 30% of households with incomes of less than $25K per year. For these low income people, any rate increase can be especially burdensome. For example, a $40 per month wastewater bill is 3.2% of a $15K per year income but less than 0.5% of a $100K per year income.

Small towns in Minnesota also typically pay significantly higher wastewater rates than larger towns (Figure 10). For example, residents of small towns of less than 5000 people typically pay about $10 to $20 per month more than cities greater than 25,000 people. Smaller cities tend to have higher rates because they cannot take advantage of economies of scale and the ability to hire wastewater management professionals in the way larger cities can.

Figure 10. 2018 Wastewater rates in Minnesota grouped by city population size.

The Met Council area is broken out separately.



Industrial wastewater dischargers

The MPCA has identified 29 individual industrial wastewater treatment discharges that have the reasonable potential (RP) to exceed the current Class 4A total dissolved solids standard of 700 mg/L and thus would ultimately require an effluent limit in their permit under the current Class 3 and 4 standards (Figure 11; Table 27; Table 28). The 700 mg/L total dissolved solids standard is the most restrictive of the current Class 3 and 4 water quality standards and if a facility has RP for total dissolved solids they are likely to have RP for another Class 3 and 4 water quality standard. These 29 facilities represent a subset of the 69 facilities that have been conducting salty parameter monitoring and have sufficient data to make a formal reasonable potential determination for total dissolved solids.

For this analysis, we first identified the permittees that have previously discharged effluent with a total dissolved solids concentration in exceedance of 700 mg/L. We looked at data reported by the permittees from 2013 to the present, and examined daily sample values. We used monthly values if facilities had not reported daily sample values or the latter dataset was limited. The RP analysis requires a number of inputs, including background concentrations for the given parameter (total dissolved solids in this case), a facility's effluent concentrations of the given parameter, and the $7Q_{10}$ flow value of the receiving water. The $7Q_{10}$ flow is the lowest average discharge for seven consecutive days with a recurrence interval of ten years (Minn. R. 7053.0135, subp. 3A) and protecting water quality down to the $7Q_{10}$ is a requirement in Minn. R. 7053.0205, subp. 7 unless another flow is applicable.

The 29 industrial discharges represent a diverse array of industries and these industries employ varied industrial processes and wastewater treatment process. The MPCA categorized these dischargers by industry type and whether they would also require a chloride limit.

The MPCA expects that the ten industrial discharges in Table 27 that require a chloride limit would likely not require a limit based on the current 700 mg/L total dissolved solids standard. This is because, using the chloride linkage, compliance with the chloride limit would likely also ensure that the current class 3 and 4 standards are protected. These ten discharges are unlikely to experience a new cost because of the proposed rule. Some discharges have not monitored for chloride in their discharge and without that monitoring the MPCA cannot know for certain whether they would be eligible for the chloride linkage.

Effects of the current rule on industrial dischargers by category type

Cooling tower and RO reject discharges

These discharges use RO to purify water prior to use in heating and cooling systems such as boilers or cooling towers. The by-product of RO is a concentrated salt brine that elevates concentrations of salt in a discharge. In order to comply with the current Class 3 and 4 standards, these discharges would need to find a way to either dilute or re-use the concentrated salt brine or find another way to purify their water. The MPCA does not have sufficient information to determine a reasonable compliance strategy and the costs of that compliance strategies for these discharges.

Ethanol discharges

Ethanol dischargers are broadly affected by the current Class 3 and 4 water quality standards. Some of these discharges already have effluent limits protective of the current class 3 and 4 water quality standards in their permits. Ethanol facilities are capable of operating as zero discharge facilities that discharge no effluent at all. Chippewa Valley Ethanol Company is the first discharger in the state of Minnesota to move to zero discharge, and they did this, in part, to comply with their Class 3 and 4 effluent limitations and whole effluent toxicity testing requirements (WET tests ensure that the discharge is not toxic to aquatic life). Chippewa Valley Ethanol Co. found it was more affordable to move towards zero discharge than install technologies capable of treating salts.

It is likely, but not certain, that the majority of ethanol discharges will move towards a zero discharge in the future in order to comply with current Class 3 and 4 water quality standards and whole effluent toxicity testing requirements. The MPCA does have sufficient information to accurately characterize the costs of moving towards a zero discharge system for ethanol dischargers.

Food and sugar beet processing

The food processing dischargers are a complex class to evaluate for the effects of the current Class 3 and 4 standards. This is because they are highly varied, ranging from companies making pea powder protein, to egg and milk producers, to rendering plants. These different products require different processing techniques that have effects on the types and quantities of salt in a discharge. Some of these discharges might be able to easily reduce their salt use, while others might find that they cannot reduce their salt use without unwanted negative effects. The MPCA does not have sufficient information to determine a reasonable compliance strategy and the costs of that compliance strategies for every one of these discharges.

At least one discharger in this category has told the MPCA that if their NPDES permit were re-issued with limits based on the current Class 3 and 4 discharge they would be forced to shut down. The company did not provide any engineering cost estimates or financial statements to support that decision and without that information, the MPCA cannot accurately determine whether a variance based on economic hardship would be a realistic possibility for that discharge, in part because of complex financial structures.

Southern Minnesota Beet Sugar currently has Class 3 and 4 effluent limitations in their permit and has applied for a variance based on economic hardship from those effluent limits. As of October 2020, their draft permit, including approval of the economic variance, has been put up for public notice but has not been issued.

Manufacturing

The manufacturing dischargers are also a complex class to evaluate, due to variation. They range from companies making semi-conductors to biomedical products. These different products require different processing techniques that have effects on the types and quantities of salt in a discharge. Some of these discharges might be able to easily reduce their salt use, while others might find that they cannot reduce their salt use without unwanted negative effects. The MPCA does not have sufficient information to determine a reasonable compliance strategy and the costs of that compliance strategies for every one of these discharges.

Figure 11. Active industrial facilities that monitor for total dissolved solids.

Of the facilities, those that have discharged total dissolved solids in exceedance of 700 mg/L are shown with orange triangles, while those that have not discharged total dissolved solids in exceedance of 700 mg/L are indicated with blue triangles.

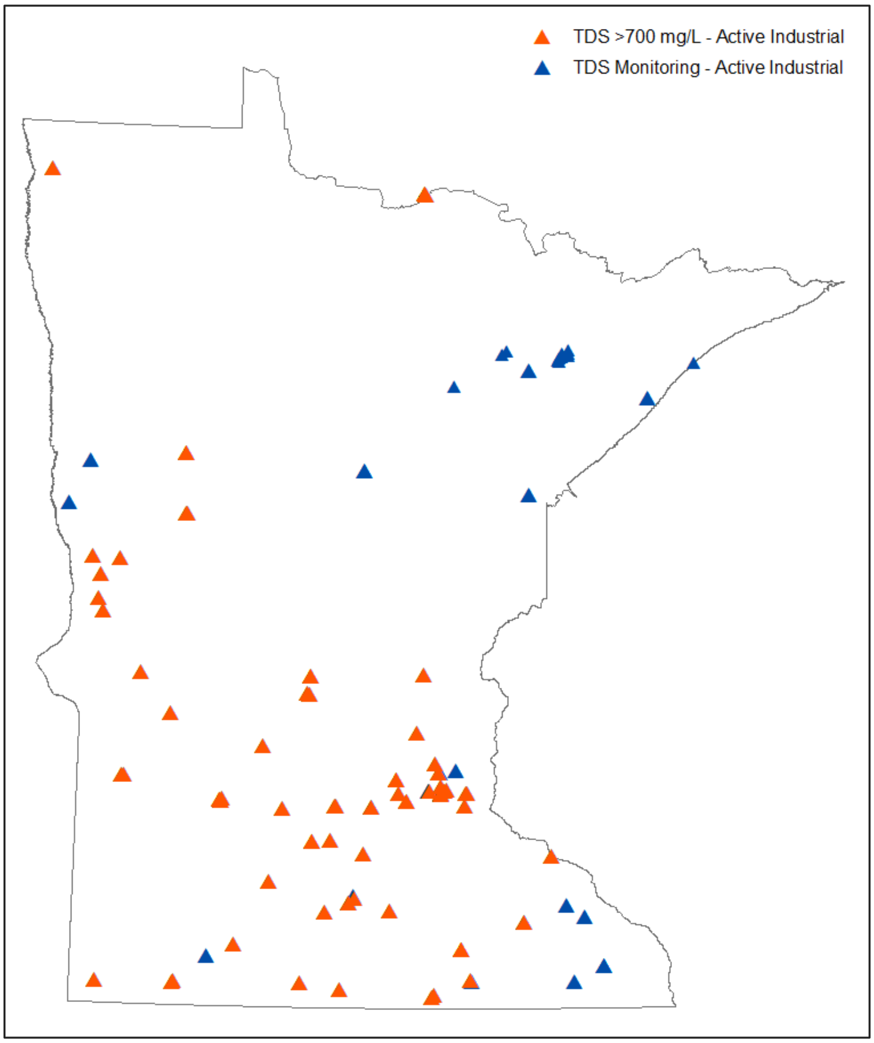


Table 27. Projected total dissolved solids effluent limits for industrial wastewater dischargers given the existing Class 4A total dissolved solids standard.

Facility Name	Type	Chloride limit required?	Permit ID	SD Station	Likely Daily Max Limit (mg/L)	Likely Monthly Average Limit (mg/L)
Ag Processing Inc - Dawson	Ethanol	No	MN0040134	SD 001	853	755
Agri-Energy	Ethanol	Yes	MN0064033	SD 001	795*	735*
Arkema Inc	Cooling Tower & RO Reject	No monitoring	MN0041521	SD 001	1067	823
Arkema Inc	Cooling Tower & RO Reject	No monitoring	MN0041521	SD 002	920	778
Bluegrass Proteins Inc	Food Processing	No monitoring	MN0048968	SD 001	764	724
Bongard's Creameries Inc	Food Processing	No	MN0002135	SD 002	1146	846
Boomerang Laboratories	Manufacturing	No	MN0066508	SD 001	1149	847
Buffalo Lake Advanced Biofuels LLC	Ethanol	No	MN0063151	SD 001		700*
Chippewa Valley Ethanol Co LLLP	Ethanol	No	MN0062898	SD 001	2575*	1700*
CHS Hallock	Ethanol	No	MN0068969	SD 001	1013	807
Dairy Farmers of America - Winthrop	Food processing	Yes	MN0003671	SD 001	1251	875
Darling Ingredients Inc - Blue Earth	Food processing	Yes	MN0002313	SD 002	1858	1608
Del Monte Foods Inc - Sleepy Eye Plant 114	Food processing	No	MN0001171	SD 006	830	748
DENCO II LLC	Ethanol	No	MN0060232	SD 002		820*
Fairmont Foods Inc	Food	No	MN0001996	SD 003	853	774
Federal-Mogul Powertrain LLC	Manufacturing	Yes	MN0001147	SD 001	1011	806
Hoya Optical Labs of America, Inc.	Manufacturing	No monitoring	MN0065501	SD 001	1146	846
Hubbard Feeds Inc - Worthington	Food Processing	No	MN0033375	SD 001	1535	945
Lifecore Biomedical, LLC	Manufacturing	No	MN0060747	SD 001	1023	810
MG Waldbaum Co	Food Processing	Yes	MN0060798	SD 001	925	799
Minn-Dak Farmers Cooperative	Sugar Beet	No monitoring	MN0070386	SD 001	847	754

Facility Name	Type	Chloride limit required?	Permit ID	SD Station	Likely Daily Max Limit (mg/L)	Likely Monthly Average Limit (mg/L)
Minn-Dak Farmers Cooperative	Sugar Beet	No monitoring	MN0070386	SD 002	1099	832
Minn-Dak Farmers Cooperative	Sugar Beet	No monitoring	MN0070386	SD 003	996	802
Minn-Dak Farmers Cooperative	Sugar Beet	No monitoring	MN0070386	SD 004	1003	804
Minn-Dak Farmers Cooperative	Sugar Beet	No monitoring	MN0070386	SD 005	893	769
Perham Resource Recovery Facility	RO Reject	No monitoring	MN0067415	SD 001	1137	843
POET Biorefining - Bingham Lake	Ethanol	No monitoring	MN0063118	SD 001	958	790
POET Biorefining - Glenville	Ethanol	No monitoring	MN0065692	SD 001	1115	837
POET Biorefining - Glenville	Ethanol	No monitoring	MN0065692	SD 002	934	782
Polar Semiconductor LLC	Manufacturing	Yes	MN0064661	SD 001	1221	867
Polar Semiconductor LLC	Manufacturing	Yes	MN0064661	SD 002	1048	817
Rochester Athletic Club	Pool	Yes	MN0062537	SD 002	929	781
Saint John's University	Cooling Tower and RO reject	No	MN0046035	SD 003	812	741
Seneca Foods Corp - Glencoe	Food Processing	No	MN0001236	SD 002	855	756
Southern Minnesota Beet Sugar Coop	Sugar Beet	No	MN0040665	SD 001	1101*	
Southern Minnesota Beet Sugar Coop	Sugar Beet	Yes	MN0040665	SD 009	1101*	
Worthington Industrial WWTP	Food Processing	Yes	MN0031178	SD 002	808	740

*Effective limit in NPDES permit as of October 2020

Table 28. Parameters used in the total dissolved solids RP determination of industrial wastewater dischargers.

Facility Name	Permit ID	SD Station	Max Value (mg/L)	7Q10 (cfs)
Ag Processing Inc - Dawson	MN0040134	SD 001	1470	0
Agri-Energy	MN0064033	SD 001	2005	0
Arkema Inc	MN0041521	SD 001	1180	0
Arkema Inc	MN0041521	SD 002	1840	0
Bluegrass Proteins Inc	MN0048968	SD 001	1870	0
Bongard's Creameries Inc	MN0002135	SD 002	2217	0
Boomerang Laboratories	MN0066508	SD 001	1000	0
Buffalo Lake Advanced Biofuels LLC	MN0063151	SD 001	821.5	0
Chippewa Valley Ethanol Co LLLP	MN0062898	SD 001	1885	0
CHS Hallock	MN0068969	SD 001	1610	0
DAIRY FARMERS OF AMERICA	MN0003671	SD 001	2810	0
Darling Ingredients Inc - Blue Earth	MN0002313	SD 002	2820	0.67
Del Monte Foods Inc - Sleepy Eye Plant 114	MN0001171	SD 006	3880	0
DENCO II LLC	MN0060232	SD 002	4987.5	0
Fairmont Foods Inc	MN0001996	SD 003	4130	0.03
Federal-Mogul Powertrain LLC	MN0001147	SD 001	850	0
Hoya Optical Labs of America, Inc.	MN0065501	SD 001	878	0
Hubbard Feeds Inc - Worthington	MN0033375	SD 001	2350	0
Lifecore Biomedical, LLC	MN0060747	SD 001	1200	0
MG Waldbaum Co	MN0060798	SD 001	925.1197	0.08
Minn-Dak Farmers Cooperative	MN0070386	SD 001	847.398	0
Minn-Dak Farmers Cooperative	MN0070386	SD 002	1098.736	0
Minn-Dak Farmers Cooperative	MN0070386	SD 003	996.2004	0
Minn-Dak Farmers Cooperative	MN0070386	SD 004	1002.952	0
Minn-Dak Farmers Cooperative	MN0070386	SD 005	892.7904	0
Perham Resource Recovery Facility	MN0067415	SD 001	1230	0
POET Biorefining - Bingham Lake	MN0063118	SD 001	1705	0
POET Biorefining - Glenville	MN0065692	SD 001	592	0
POET Biorefining - Glenville	MN0065692	SD 002	1500	0
Polar Semiconductor LLC	MN0064661	SD 001	3840	0
Polar Semiconductor LLC	MN0064661	SD 002	1090	0
Rochester Athletic Club	MN0062537	SD 002	672	0
Saint John's University	MN0046035	SD 003	2200	0
Seneca Foods Corp - Glencoe	MN0001236	SD 002	1030	0
Southern Minnesota Beet Sugar Coop	MN0040665	SD 001	1082	0
Southern Minnesota Beet Sugar Coop	MN0040665	SD 009	2480	0
Worthington Industrial WWTP	MN0031178	SD 002	2260	0

Taconite industry

Background

There are currently six active iron-ore mining operations in Minnesota. Each operation generally consists of a mine site with one or more pits, a processing facility/pellet plant where the iron ore is processed into taconite pellets and a tailings basin located near the processing facility where waste tailings from the ore processing are disposed of. The processing facility/tailings basin is co-located at the mine site for some operations or located at a separate distant site for others. Separate NPDES/SDS permits are typically issued for the mine site and for the processing facility/tailings basin for each operation regardless whether they are co-located or not.

The six operations are:

- Northshore Mining – Consisting of the Peter Mitchell mine in Babbitt and the processing facility in Silver Bay;
- ArcelorMittal Minorca Mine – Consisting of the Laurentian and East Reserve mines near Gilbert and a processing facility in Virginia;
- United Taconite – Consisting of a mine in Eveleth and a processing facility in Forbes;
- Minntac – Consisting of a mine and processing facility in Mt. Iron,
- Hibbing Taconite (Hibtac) – Consisting of a mine and processing facility in Hibbing; and
- Keetac – Consisting of a mine and processing facility in Keewatin.

All of these mines have been operational through 2019 and are also currently operational except Keetac, which has been idled as a result of the Covid19 pandemic but is expected to reopen in December 2020. A seventh mine in Nashwauk is under construction by Mesabi Metallics (formerly known as Essar and Minnesota Steel), and has potential to be operational in the future. A former mine and processing facility at Hoyt Lakes – formerly operated by LTV and before that Erie Mining – is currently a closed site, but still has some active discharges.

Mining operations in Minnesota produce a final iron-ore product called taconite pellets (traditional or Direct Reduced Iron [DRI] grade), derived from ample reserves of taconite ore (DNR, 2020b). Traditional pellets are those with 65% iron content (“Taconite,” 2020), typically used as feedstock for steelmaking in basic oxygen furnaces or blast furnaces (BFs) (“Blast Furnace,” 2020), where heat energy is used to oxidize the impurities in the feedstock to convert it into pig iron, which contains 90-94% iron content (“Pig Iron,” 2020), which subsequently is used to make steel. DRI-grade pellets are made by ‘reducing’ iron-ore into metallic iron without having to melt the ore (“Direct Reduced Iron,” 2020). These concentrated pellets (90-97% iron content) can be used as feedstock on their own (Tuck, 2020b), or combined with steel scrap/recycled steel in an electric arc furnace (EAF) to make high grade steel (“Electric Arc Furnace,” 2020).

These Minnesota mining producers are economically important nationally, making up 85% of U.S. iron-ore production and supplying a major input to the domestic steel industry. They are economically important locally for maintaining employment in the taconite-assistance area (TAA, flanked by the Mesabi iron range) of the state (see Figure 12). Each mining operation typically comprises open pit mining areas and a processing plant/tailings basin (TB) area, which are treated here as separate dischargers as they may have different treatment needs.

Figure 12. Map of the Taconite Assistance Area

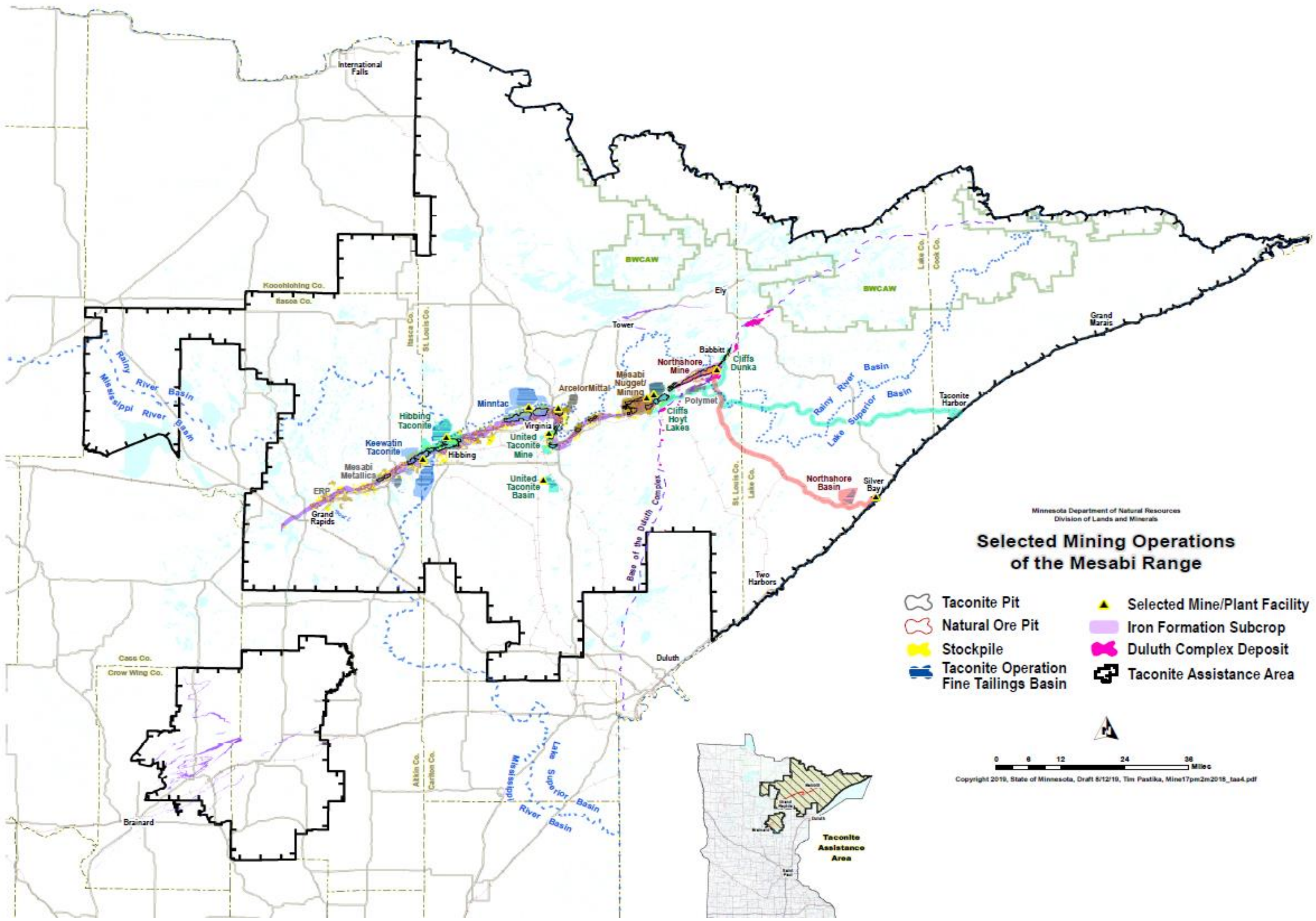


Table 29. Annualized costs of available pollution control technologies for mining facilities to meet current Class 3 and 4 WQS

A: RO with evaporation and crystallization, costs in $Mil

Parent Company	Facility	Mine/TB	Flow (mgd)	Need limit & treat?	K-Hi	K-Lo	OM-Hi	OM -Lo	Ann. RO-Hi	Ann. RO-Lo	Ann. RO-Avg	NPV RO-Hi	NPV RO-Lo	NPV RO-Avg
AM	Minorca	Mine	4.1	Yes	$101.2	$45.0	$8.6	$3.8	$16.1	$7.1	$11.6	$239.0	$106.2	$172.6
AM, CC, USS	Hibtac	TB	2.4	Yes	$74.0	$32.9	$6.4	$2.8	$11.8	$5.2	$8.5	$175.7	$78.1	$126.9
USS	Minntac	Mine	11.6	Yes	$220.9	$98.2	$18.6	$8.3	$34.8	$15.5	$25.2	$518.2	$230.3	$374.3
USS	Minntac	TB	0.2	Yes	$38.9	$17.3	$3.4	$1.5	$6.3	$2.8	$4.6	$93.8	$41.7	$67.7
CC	United Tac	Mine	3.2	Yes	$86.8	$38.6	$7.4	$3.3	$13.8	$6.1	$10.0	$205.5	$91.3	$148.4
CC	United Tac	TB	0.14	Yes	$38.0	$16.9	$3.4	$1.5	$6.2	$2.7	$4.4	$91.6	$40.7	$66.1

B: Lime softening (LS), costs in $Mil

Parent Company	Facility	Mine/TB	Flow (mgd)	Need limit & treat?	K-Hi	K-Lo	OM-Hi	OM -Lo	Ann. Lime-Hi	Ann. Lime-Lo	Ann. Lime-Avg	NPV Lime-Hi	NPV Lime-Lo	NPV Lime-Avg
AM	Minorca	Mine	4.1	Yes	$31.5	$14.0	$13.5	$10.5	$15.8	$11.5	$13.6	$234.8	$171.2	$203.0
AM, CC, USS	Hibtac	TB	2.4	Yes	$23.0	$10.2	$7.9	$6.1	$9.6	$6.9	$8.2	$142.5	$102.4	$122.4
USS	Minntac	Mine	11.6	Yes	$68.9	$30.6	$38.1	$29.6	$43.2	$31.9	$37.5	$642.3	$474.4	$558.4
USS	Minntac	TB	0.2	Yes	$12.0	$5.3	$0.7	$0.5	$1.5	$0.9	$1.2	$22.9	$13.5	$18.2
CC	United Tac	Mine	3.2	Yes	$27.0	$12.0	$10.5	$8.2	$12.5	$9.1	$10.8	$185.9	$134.8	$160.3
CC	United Tac	TB	0.14	Yes	$11.7	$5.2	$0.5	$0.4	$1.3	$0.7	$1.0	$19.7	$11.0	$15.3

Table Notes:
K: Capital costs – maximum (Hi) and minimum (Lo) estimate
OM: Annual operation and maintenance costs – maximum (Hi) and minimum (Lo) estimate
Ann Lime: Annualized costs of lime softening - maximum (Hi), minimum (Lo), and average (Avg) estimate
NPV Lime: Net Present Value of Lime softening - maximum (Hi), minimum (Lo), and average (Avg) estimate

Costs to comply with existing Class 3 and 4 WQS

Evaluating the probable costs of a water quality standard rulemaking to the taconite industry is a complex analysis that must consider the need for effluent limits on specific dischargers and the types and costs of treatment technologies capable of meeting any applicable limits. This section provides detailed information on the cost to comply with the existing Class 3 and 4 WQS, costs that generally would be avoided if the rules are adopted. (Note, however, that some facilities would receive limits under the proposed new standards. Costs to meet those limits are similar to the costs to meet limits imposed under the current standards.) This section also explores the likelihood of variances; where facilities would be eligible for variances for the existing Class 3 and 4 water quality standards, variances would mitigate the costs. This section of the SONAR provides an overview, with extensive detail about the taconite industry included in Exhibit S-19.

MPCA began in 2009 to require widespread effluent monitoring to be able to assess whether effluent limitations were needed to protect the Class 2 chloride standard and the Class 3 and 4 water quality standards. As of 2020, all taconite facilities have measured at least one salty parameter in their discharge and reported that data to the MPCA.

Table 29 shows the estimated costs of pollution control technologies that are available for mining facilities and address the pollutants covered by the existing Class 3 and 4 WQS.

Investments for such pollution control technology may be difficult to afford for some facilities, and may also lead to wider negative economic impacts in the local community. To address this issue, facilities can apply for a variance. The EPA has provided guidance for determining a facility’s eligibility for a variance, which generally involves conducting a financial impact analysis to examine if compliance with water quality standards would lead to substantial economic impacts for the facility and if so, whether these impacts will also cause widespread social or economic impacts in the local community where the facility is located (EPA, 1995). Examining variance eligibility is a reasonable way to look at the economics of pollution control.

Several of these mining operations - pits and/or tailing basins - have potential to get new discharge limits for parameters included in the current Class 3 and 4 standards, and therefore will be affected by the proposed Class 3 and 4 WQS rulemaking. These are the mines and/or tailings basins of ArcelorMittal-Minorca, Minntac, United Taconite, and Hibbing Taconite, as listed in Table 30. These taconite facilities, in turn, are wholly or partially owned by three parent companies: ArcelorMittal, USA (AM); Cleveland-Cliffs, Inc. (CC); and U.S Steel Corporation (USS).[2]

Facilities experience costs due to water quality standards through the inclusion of an effluent limit in their NPDES/SDS permit; without a limit, no treatment (or spending on treatment) is needed. Therefore, the first step in estimating compliance costs is determining what taconite discharger would require limits.

ArcelorMittal’s Laurentian pit, Minntac, Hibbing Taconite and United Taconite would all require a limit protecting one of the Class 3 and 4 WQS (Table 30). A Hoyt Lakes mine site – formerly LTV or Erie Mining – does have reasonable potential (RP) to cause or contribute to an exceedance of the standard for several Class 3 and 4 water quality parameters. The Hoyt Lakes area was not further evaluated because it is not an active site and has a complicated history of ownership and future

2 As of September 2020, however, CC announced acquiring the assets of AM at the Minorca and Hibbing taconite facilities, which would reduce the number of parent companies to two, CC and USS in the next few months (Johnson, 2020).

compliance with Class 3 and 4 WQS.

The limit assessments were completed by the MPCA using the summarized water quality data below in Table 30. This is data the MPCA compiled from sampling at regulated surface discharge points. If the mine or tailing basin had an exceedance of any of the Class 3 and 4 water quality standards, then it was assumed to require a limit. (The only exception was a data point for Northshore's Peter Mitchell Mine that appears to be an outlier.)

The MPCA did not calculate numeric effluent limits applicable to each permitted surface discharge station – of which a single mine or tailings basins may have many - but instead considered each mine or tailing basin as a whole and assumed that the total mine or tailing basin discharge needed to be less than the applicable water quality standard. This simplified the cost estimation because it eliminated the need to evaluate complex treatment needs at multiple unique locations. It is also a reasonable assumption because water at these surface discharge locations are hydrologically related.

The goal was to develop a high level understanding of potential treatment costs and their economic implications within a reasonable amount of effort. The goal is not to predict costs down to the dollar level but to predict costs within at least order of magnitude (for example, are likely treatment costs closer to $10 million or $100 million or $1 billion?). The information used in this treatment cost analysis section comes from publically available sources and no new cost studies were commissioned as part of this rulemaking.

Selecting treatment options

Reverse osmosis (RO) with evaporation and crystallization (EC), and lime softening (LS) were selected as the treatment options for further cost evaluations (Bolton & Menk, Inc. & Barr Engineering Company, 2018). This study focused on treating salts at municipal wastewater treatment plants (WWTPs) but the analysis includes technological rankings and cost curves directly relevant to the ability to treat water containing all salts. The study references and builds upon decades of academic and industry research in mine water treatment and is consistent with the findings of frequently cited mine water treatment review articles (Runtti et al., 2018; Skousen et al., 2017; Johnson & Hallberg, 2005).

The primary consideration in selecting a technology is the ability to treat the pollutant of concern to below the applicable water quality standard using commercially available treatment methods. Both RO with EC, and LS have been built at the full scale in the USA and vendors that sell the individual unit operations exist. Other factors such as relative costs, disposal of waste products, carbon emissions, operational complexity, and design complexity were also considered. The technology selection process is an elimination process where technologies are eliminated as feasible until the most feasible technologies remain standing and this elimination process is described in detail in the cited alternative analysis above. This analysis will not describe why specific technologies were eliminated as feasible except for an evaluation of the infeasibility of "passive treatment." Understanding why passive treatment was eliminated is useful to understand why active treatment technologies are needed.

Passive treatment is a broad term that refers to a water treatment technology that does not require continuous supervision and management. Passive mine water treatment is much cheaper than active treatment and if workable, is preferable due to lower costs. In mine water treatment, passive treatment can range from waste rock storage practices to managing in-mine water balances to biological treatment cells. Passive treatment practices have been successfully employed at Minnesota taconite mines at small and large scales but have yet to realize the quantity of salt concentration reductions that would be necessary to comply with the current Class 3 and 4 WQS. Passive treatment has a strong promise for treating sulfate, but is not currently capable of treating hardness, bicarbonate and total salts to levels below the Class 3 and 4 WQS.

Active treatment would be required to treat taconite related discharges to below the Class 3 and 4 WQS. In the context of treating mine water, active treatment means constructing treatment systems capable of continuously treating mine water using chemical and physical processes. Just as importantly, active treatment would require building water conveyance structures to contain and transport water to the treatment systems where it can be treated prior to discharge.

Water quality associated with taconite has a distinct chemical signature characterized by elevated concentrations of major ions with the ionic composition dominated by magnesium, calcium, bicarbonate and sulfate. This ionic composition has sulfate ion pairings that are very soluble and therefore difficult to treat below the Class 3 and 4 WQS. It is theoretically possible, particularly where sulfate is less than approximately 200 mg/L, that traditional lime softening could be used to remove calcium, magnesium, and bicarbonate ions to below the hardness and bicarbonate standards and that the resultant ionic reductions could reduce total salt content to levels below the total dissolved salt and specific conductance standards. Substantial site-specific engineering design would be required to confirm that theory and incorporate it into full-scale design. Despite the design uncertainties, lime softening was included as a potential treatment option below because of its potential.

While lime softening could work in specific situations, the technology most likely to be able to simultaneously treat all ions below the Class 3 and 4 WQS is RO with evaporation and crystallization. The technology works by first physically concentrating the salts from the water using two linked RO membranes and then applying heat to “boil” away the water from the brine and convert the salts into a solid form. This technology is not used at any Minnesota facility and if built, would be the most complex wastewater treatment system ever built in Minnesota. The pros and cons of these technology are bulleted below.

This analysis focuses solely on the economic implications to the taconite industry based on the components of EPA’s variance affordability criteria. It does not include additional environmental costs, but it is worth noting that these treatment technologies have substantial environmental drawbacks most notably with regards to carbon emissions and new streams of waste products that require disposal. Evaporation and crystallization demand very high energy levels and require natural gas to “boil” the water; using a rough calculation it is likely that treating just the seepage from the Minntac tailing basin would result in new annual carbon emissions equivalent to the annual carbon emissions from a 5,000 to 10,000 person town. The complex environmental trade-offs involved in mine water treatment are difficult to analyze quantitatively and ultimately require decisions to be made taking into account more than just finances.

Table 30. Summarized water quality data for taconite dischargers. All *italicized values in red* are above the water quality standard.

Location	Discharge	Maximum or Average	Alkalinity (mg/L)	Ca (mg/L)	Mg (mg/L)	Hardness (mg/L as $CaCO_3$)	S.C. (umoh/cm)	Sulfate (mg/L)	Total dissolved solids (mg/L)
Arcelor Mittal Laurentian	SD003	Max	*663*			*513*	*1303*	171	*856*
Arcelor Mittal Laurentian	SD003	Avg	*529*			447	*1088*	147	671
Arcelor Mittal Laurentian	SD005	Max	*614*			*907*	*1855*	592	*1290*
Arcelor Mittal Laurentian	SD005	Avg	*501*			*739*	*1567*	435	*1072*
Hoyt Lakes Tailings Basin	SD001	Max	*383*			486	948	154	600
Hoyt Lakes Tailings Basin	SD001	Avg	*322*			385	830	115	529
Hoyt Lakes Tailings Basin	SD002	Max	*638*			*778*	*1419*	197	*952*
Hoyt Lakes Tailings Basin	SD002	Avg	*610*			*685*	*1370*	187	*872*
Hoyt Lakes Mining Area	SD008	Max	*319*			411	832	117	486
Hoyt Lakes Mining Area	SD008	Avg	*291*			389	795	110	481
Hoyt Lakes Mining Area	SD012	Max	183			215	461	69	350
Hoyt Lakes Mining Area	SD012	Avg	169			203	442	63	283
Hoyt Lakes Mining Area	SD026	Max	*382*			476	860	114	553
Hoyt Lakes Mining Area	SD026	Avg	*299*			403	670	101	464
Hoyt Lakes Mining Area	SD030	Max	171			241	454	71	319
Hoyt Lakes Mining Area	SD030	Avg	147			209	409	62	284
Hoyt Lakes Mining Area	SD033	Max	*360*			*1290*	*2234*	1060	*1840*
Hoyt Lakes Mining Area	SD033	Avg	*330*			*1176*	*2031*	938	*1634*
Hoyt Lakes M.A. Embarrass R.	MLC-1	Max	201			197	394	14	345
Hoyt Lakes M.A. Embarrass R.	MLC-1	Avg	161			151	316	5	267
Hoyt Lakes M.A. Embarrass R.	PM-11	Max	*255*			282	580	72	425
Hoyt Lakes M.A. Embarrass R.	PM-11	Avg	208			242	483	40	352
Hoyt Lakes M.A. Embarrass R.	TC-1	Max	*324*			332	705	60	494
Hoyt Lakes M.A. Embarrass R.	TC-1	Avg	*279*			271	584	27	402
Utac Mining Area	SD007	Max	*886*	60	376	*1610*	*2687*	925	*2000*

Location	Discharge	Maximum or Average	Alkalinity (mg/L)	Ca (mg/L)	Mg (mg/L)	Hardness (mg/L as $CaCO_3$)	S.C. (umoh/cm)	Sulfate (mg/L)	Total dissolved solids (mg/L)
Utac Mining Area	SD007	Avg	*720*	37	283	*1257*	*2094*	693	*1553*
Utac Mining Area	SD008	Max	*378*	113	96	*678*	*1308*	308	*968*
Utac Mining Area	SD008	Avg	205	60	45	335	724	116	479
Utac Mining Area	SD004	Max	*580*	26.4	129	*589*	*1010*	59.4	625
Utac Mining Area	SD004	Avg	*473*	18	103	469	818	44	475
Utac Mining Area	Rouch Pit	Max	239	50	38.2	279	561	49.7	379
Utac Mining Area	Rouch Pit	Avg	193	42	32	237	503	42	306
Northshore Peter Mitchell	SD002	Max	98			222	597	118	375
Northshore Peter Mitchell	SD002	Avg	87			185	499	99	317
Northshore Peter Mitchell	SD004	Max	106			223	642	125	432
Northshore Peter Mitchell	SD004	Avg	95			192	579	101	363
Northshore Peter Mitchell	SD005	Max	110			203	537	118	359
Northshore Peter Mitchell	SD005	Avg	83			160	468	84	302
Northshore Peter Mitchell	SD009	Max	120			164	343	27	212
Northshore Peter Mitchell	SD009	Avg	96			124	269	19	178
Northshore Peter Mitchell	SD010	Max	99			112	202	11	176
Northshore Peter Mitchell	SD010	Avg	89			98	190	9	141
Northshore Peter Mitchell	SD016	Max	170			182	397	23	289
Northshore Peter Mitchell	SD016	Avg	145			154	345	18	232
Northshore Peter Mitchell	SD017	Max	157			305	*1045*	49	569
Northshore Peter Mitchell	SD017	Avg	110			226	753	32	454
Northshore Peter Mitchell	SD018	Max	51			150	653	33	390
Northshore Peter Mitchell	SD018	Avg	48			112	489	21	312
Northshore Peter Mitchell	SD019	Max	130			158	424	18	261
Northshore Peter Mitchell	SD019	Avg	97			126	316	13	222
Northshore Peter Mitchell	SD024	Max	103			143	390	20	310

Location	Discharge	Maximum or Average	Alkalinity (mg/L)	Ca (mg/L)	Mg (mg/L)	Hardness (mg/L as $CaCO_3$)	S.C. (umoh/cm)	Sulfate (mg/L)	Total dissolved solids (mg/L)
Northshore Peter Mitchell	SD024	Avg	82			121	369	15	277
Minntac Mining Area	SD001	Max	*466*	63	198	926	1950	488	*1290*
Minntac Mining Area	SD001	Avg	*394*	47	159	773	1679	398	*1076*
Minntac Mining Area	SD003	Max	*486*	44	140	653	1382	283	*861*
Minntac Mining Area	SD003	Avg	*416*	35	121	586	1207	237	*778*
Minntac Mining Area	SD004	Max	*410*	88	216	1036	1828	593	*1260*
Minntac Mining Area	SD004	Avg	*362*	69	172	879	1582	499	*1097*

Lime softening

- Pros
  - Widespread and commercialized technology
  - Capable of treating bicarbonate and hardness to comply with limits
  - Capable of treating total salt to below limits (if magnesium and sulfate are low)
  - Operator knowledge and skillset present in Minnesota
  - Engineering design well understood
- Cons
  - Unclear whether lime softening could comply with total salt limits and would require site-specific testing to ensure total dissolved salt limits can be met if sulfate and magnesium are high
  - Requires using large volumes of lime and soda ash that cannot be currently produced without very high carbon emissions
  - Produces a lime sludge that must be disposed of permanently
  - Due to high magnesium and sulfate concentrations (i.e. non-carbonate hardness) lime softened mine water will have elevated sodium concentrations which could negatively affect aquatic life
  - Not dramatically cheaper than RO with evaporation and crystallization from a life-cycle analysis perspective
  - Unable to remove any sulfate salts

RO with EC

- Pros
  - Capable of treating all salts (hardness, bicarbonate, sulfate, etc…)
  - Commercially available technology
  - Demonstrated to work at full scale
- Cons
  - Requires very complicated engineering and specialized design
  - Evaporation and crystallization steps are high energy and carbon intensive
  - Operator knowledge and skillset not present in Minnesota
  - Produces a salty waste product (crystallized salts) that would require disposal
  - Difficult to maintain and operate
  - Expensive to operate, maintain and staff

Table 29 describes two available treatment technologies - RO with EC and LS – and lays out a range of annual pollution treatment costs and net present values (NPVs) over a conventional 20-year operation, for each of these six facilities. "NPV is the difference between the present value of cash inflows and the present value of cash outflows over a period of time" (Kenton, 2020, para. 1), given a specified rate of return.

The annualized pollution treatment costs for compliance in Table 29 range between $10 and $37 million for mines and between $1 and $8.5 million for tailings basins. These treatment costs in Table 29 are accurate within approximately ± 80% of what the true full scale cost would be; this level of accuracy is within industry norms for an initial high level cost estimate such as this one. The costs assume that the facility is treating the combined discharge flows indicated in Table 29 and that all water requiring treatment can be transported to a single treatment plant at each location. These costs include annual operation and maintenance (O&M) costs and annualized capital costs (OM and K in Table 29) based on a 20-year loan with an interest rate of 4% (based on average 3% 30-year mortgage rates [Bankrate, 2020]) and a conventional discount rate of 3%.3 While total costs of investing in either technology can be substantial, there are differences in the way costs evolve over time for the two technologies. RO has higher capital costs but lower O&M costs compared to LS. These differences could be leveraged by facilities facing discharge limits in a way that best fits their finances and infrastructure. For example, as capital costs clearly depend on the size of the facility and its annual production flow, a large facility might find it more cost-effective to invest in RO technology, while a small facility with discharge flow of approximately 2 million gallons per day (mgd) or lower could spend less over the same time period using LS.

Estimating costs for water collection systems

An essential part of treating mine water is collecting and transporting the water to a centralized location where it can be treated. The locations listed in Table 29 have very complex and varied water flows and hydrogeology that make it very difficult to assess water collection and transportation design needs and resultant costs. For example, at the Hibbing Taconite tailing basin, water seeps outward along a several mile long perimeter and completely containing that water would require a complex underground seepage capture systems as well as miles of piping to transport the collected water.

The MPCA cannot predict, within a reasonable amount of effort, the exact costs of water collection systems required to treat taconite impacted mine water. Using solely best professional judgement, water collection systems capital costs for a given location are likely to scale with flow, be in the range of million to tens of million dollars and are unlikely to be greater than $50 million. These costs are likely to be within the upper bound of costing uncertainties of wastewater treatment systems in Table 29 and therefore the MPCA did not include a specific cost estimate for water collection.

Reducing Costs of Compliance - Variances

As described previously, variances are a way to reduce or avoid the costs of compliance. To be eligible for a variance, an entity has to show that it cannot afford the necessary pollution control equipment, and that there is evidence that substantial and widespread social and economic impacts would result from the expense of having to invest in pollution control equipment. The phrase "substantial impacts" refers to the impact on the private entity itself, while "widespread impacts" refers to the impact on the entity's community. The EPA's (1995) guidance states: "When applying for a change in a designated use or for a variance, the applicant must demonstrate that meeting water quality standards will cause substantial and widespread economic and social impacts" (p. 1-4). The guidance further states that "the applicant must demonstrate that the pollution control measures needed to meet water quality standards are not affordable. In addition, the applicant will have to show that there will be widespread adverse impacts to the community if it is required to meet standards" (EPA, 1995, p. 4-7).

The process for determining substantial impacts depends on measures evaluating the economic health of a firm, the primary measure being profitability. If the firm is able to prove substantial economic

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[3] The discount rate is an interest rate used to determine the current value of future returns or cash flows. Discounting is used to determine the present value future cash flows based on the principle that the same amount of money obtained in future is worth lower to account for the 'time value of money' or ability to earn interest on receipt (Chen, 2020, Discounting, para. 1).

impacts from pollution control costs, the EPA (1995) recommends a further examination of potential widespread economic impacts in the local community. Unlike for municipalities, there are no numeric criteria specified for this analysis of widespread impacts, but the EPA recommends basing the analysis on changes in a range of socioeconomic indicators for the relevant geographical area, including changes in employment, household income, and property tax revenues in that community.

If substantial economic impacts cannot be demonstrated, an analysis of widespread economic impacts is unnecessary and the variance request cannot be approved on socioeconomic grounds.

Substantial Impacts

Our goal is to assess the impact of pollution control costs, and therefore variance eligibility, for the six Minnesota taconite mining facilities shown in Table 30. These six facilities are the dischargers that would be responsible for paying any necessary pollution control costs. These facilities are likely to face effluent limits through implementation of the existing Class 3 and 4 WQS or, in some cases, under the proposed new WQS.

For private sector entities such as mining facilities assessing "substantial" impacts largely depends on a financial impact analysis. The primary measure for this process is profitability, examining the question of adverse impacts to the discharger's profits (i.e. a profit decline) due to the costs of compliance with pollution control requirements. This is combined with analyses of secondary measures of liquidity, solvency, and leverage. Financial data at the firm level such as financial statements are required to calculate these measures.

The EPA (1995) clearly identifies profitability as the primary measure to assess the discharger's ability to pay pollution control costs, asking the question "how much will profits decline due to pollution control expenditures?" (p. 3-4). Assessing this measure uses a metric called the Profit Test. This metric is calculated by dividing the discharger's earnings before taxes (EBT) by its annual revenues for the most recent fiscal years. The EPA recommends calculating the metric both before and after pollution control costs are considered, and calculating it for the most recent three fiscal years to capture any trends in profitability. The 'before' metric is calculated to examine if the discharger had difficulty being profitable before pollution control investments are made. "If the discharger is already not profitable, it may not claim that substantial impacts would occur due to compliance with water quality standards" (EPA, 1995, p. 3-6).

The EPA (1995) does not provide numeric values indicative of an acceptable profit level. The guidance states that as long as profits are being made both with and without pollution control costs, at levels comparable to industry standards, it is plausible that the discharger has sufficient disposable earnings to pay for pollution control costs. Given data availability, the EPA economic guidance recommends additional consideration to examine the discharger's profitability in the future and relative to similar facilities in the business.

The EPA (1995) recommends analyzing three secondary measures: liquidity, solvency, and leverage, along with the primary measure of profitability, to determine the discharger's overall financial health. Similar to profitability, the EPA economic guidance recommends calculating the metrics for the secondary measures for at least the three most recent years in order to identify possible trends, and compare them to those of similar dischargers to understand financial health relative to industry standards.

Liquidity examines the question of how easily an entity can pay its short-term bills. The EPA's (1995) economic guidance recommends measuring that liquidity using the current ratio, the ratio of the discharger's current assets (including cash and assets that could reasonable be converted into cash) to its current liabilities. In general, a current ratio greater than 2 shows reasonable liquidity and an ability to pay for pollution control investment, when considered together with other measures of financial health. A current ratio between 1.5 and 2 is acceptable and suggests the entity has between 1.5 to 2 times in current assets compared to its liabilities and is not facing serious liquidity problems, unlike a current ratio below 1 where current assets drop below current liabilities (ReadyRatios, n.d.-a).

Solvency examines how easily an entity can pay its fixed costs and long-term bills. The EPA (1995) recommends measuring solvency using the Beaver's Ratio, the ratio of the discharger's cash flow to its long term debt (or long term liabilities). Typically a Beaver's Ratio greater than 0.20 indicates solvency, a ratio below 0.15 indicates possible insolvency and a ratio between these numbers suggest uncertainty in determining solvency.

Leverage examines an entity's borrowing power. It is a measure that helps understand the extent of additional debt the discharger can assume in the future, i.e. the discharger's debt-capacity. The EPA (1995) recommends measuring leverage using the debt-to-equity ratio, the ratio of the discharger's long term liabilities to its owners' equity (the equity held by its stockholders). A debt-to-equity ratio between 1.0 and 1.5 generally shows additional debt capacity. Acceptable ratios can go up to 2.0 depending on facility size and type of industry (ReadyRatios, n.d.-b).

Private sector entities such as mines are frequently owned and/or operated by large parent companies as is the case for these facilities. Detailed financial information at the level of the discharger, i.e. individual mines, is difficult to obtain for several reasons, including complex ownership structure, lack of operational continuity, links between inputs, final products, and market signals, and data privacy issues.

We explored the financial health of the individual mines using publicly available data primarily from the most recent version of the Mining Tax Guide, which reports data for the period 2010-2019 (Minnesota Department of Revenue [DOR], 2020). Based on a combination of these data and data from previous years' Mining Tax Guides (2018 and 2019), it is evident that the individual mines have remained operational through the period 2008-2019. The combined taconite production of Minnesota mines was about 37 million metric tons in 2019, which, based on an average market price for taconite pellets at $112.15 per metric ton (Tuck, 2020b), means a combined annual revenue of about $4.2 billion (DOR, 2020). While mines are not subject to income, property taxes, or corporate franchise taxes, they pay production and occupation taxes (Kleman, 2018). For example, the mines collectively paid production taxes of $106 million at $2.811 per metric ton, and occupation taxes of $15 million, at approximately 2.45% of profit in 2019 (see Table 32). These tax obligations, given revenues of $4.2 billion, should allow for substantial disposable income after taxes.

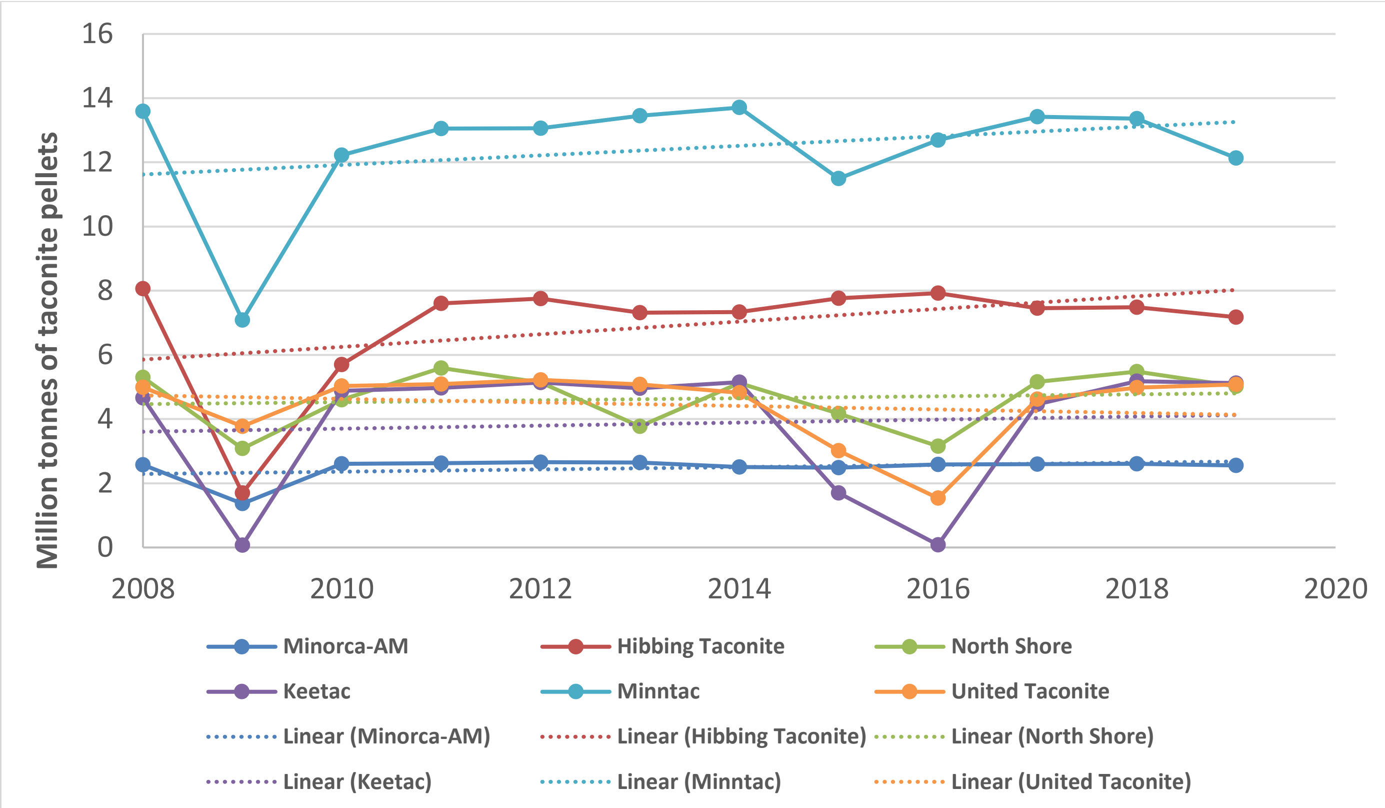
Based on the individual mines' production (DOR, 2020) and average market price data over time (Tuck, 2020a), the combined revenues for these Minnesota mines have exceeded $2 billion every year and $3 billion for 7 of the 12 years, except in 2009 when they were $1.58 billion, as shown in Table 31.

Table 31. Minnesota mines taconite production (metric tons), price, and revenues.

Year	Minorca	Hibbing Taconite	Northshore	Keetac	Minntac	United Taconite	Total	Price ($/ metric ton)	Revenue ($B)
2008	2,571,803	8,058,366	5,299,304	4,663,703	13,588,239	4,986,395	39,167,810	70.43	$2.76
2009	1,364,783	1,693,512	3,081,289	74,680	7,087,356	3,777,486	17,079,106	92.76	$1.58
2010	2,604,162	5,697,457	4,599,796	4,883,724	12,226,427	5,028,482	35,040,048	98.79	$3.46
2011	2,625,659	7,604,595	5,591,721	4,969,039	13,047,915	5,095,221	38,934,150	99.45	$3.87
2012	2,658,023	7,753,828	5,140,985	5,144,477	13,063,450	5,220,491	38,981,254	98.16	$3.83
2013	2,645,243	7,312,252	3,776,603	4,956,740	13,448,911	5,081,692	37,221,441	87.42	$3.25
2014	2,508,625	7,338,620	5,123,277	5,153,784	13,705,811	4,823,478	38,653,595	84.43	$3.26
2015	2,490,099	7,760,305	4,168,373	1,702,877	11,491,695	3,011,800	30,625,149	81.19	$2.49
2016	2,585,337	7,928,200	3,153,811	85,899	12,695,781	1,535,192	27,984,220	73.11	$2.05
2017	2,592,807	7,456,883	5,162,815	4,466,520	13,418,112	4,622,710	37,719,847	80.15	$3.02
2018	2,607,494	7,481,616	5,480,542	5,180,427	13,365,538	4,983,259	39,098,876	82.00	$3.20
2019	2,556,397	7,180,256	5,024,544	5,120,108	12,128,617	5,079,821	37,089,743	112.15	$4.16

Graphing the annual production data in Figure 13, we can see that these mines have had losses in specific years, such as in 2008-2009 owing to the great economic recession of 2008-2013 (Chappelow, 2020), and the period 2015-2016, owing to the fall in world steel prices and large increases in U.S. steel imports from 2011-2014 (Stewart et. al, 2014), but these losses have been temporary, followed by quick recoveries. We also note that all mines were not equally impacted by these periods of losses. For example, Minntac, Keetac, and Hibbing Taconite had larger losses in the 2009 recession, while Keetac, United Taconite, and Northshore had more volatility in their revenues over the 12 year period. This could be due to a combination of factors including mine size, market share, and ownership.

Figure 13. Taconite production by Minnesota mines



We also examined the profitability of individual mines based on publicly available information. Unlike production taxes, the occupation taxes paid by the individual mines were based on their reported profits as noted in the Mining Tax Guide (DOR, 2020). As Table 32 shows, all of the mines under consideration earned positive profits and paid occupation taxes in 2019.

While the positive profits earned by these mines are a good sign of their financial health, their overall financial positions and continued profitability are linked to the major mining corporations owning them. The Minntac and Keetac mines earned the largest revenue and profits, mainly based on the contribution of the Minntac mine, which earned more than $1 billion in revenues in 2017, 2018, and 2019 and is substantially profitable. The mines owned by Cleveland-Cliffs should also have substantial profitability based on their parent company's unique position as the main supplier of iron-ore products, as well as being able to produce steel owing to the recent acquisitions of AK Steel and ArcelorMittal, USA (Cleveland-Cliffs Inc., n.d.).

The price per metric ton in Table 32 is an average price based on production and revenue, but selling prices can be significantly higher than the $88-$90 derived for the Hibbing, Northshore and United Taconite mines in Table 32. For example, the selling price for Cliffs' products was $99-$104 per metric ton in 2019 (Cleveland-Cliffs Inc., 2019b). Consequently, revenue and profit estimates in Table 32 could underestimate actual profits made by these mines.

Table 32. Minnesota mines taconite production (metric tons), revenues, price, occupation taxes, profits, and costs (adapted from DOR, 2020 pp.24-25).

Mines	Production ('000 metric tons)	Revenue ('000 $s)	Price ($/metric ton)	Tax ('000 $s)	Profit ('000 $s)	Cost of Production ('000 $s)
Minorca	2,704.70	$237,913.08	$87.96	$150	$6,122.45	$237,906,953.55
Hibbing Taconite	7,202.87	$649,972.67	$90.24	$3,500	$142,857.14	$649,829,815.86
Northshore	5,051.57	$449,992.61	$89.08	$1,140	$46,530.61	$449,946,074.39
Minntac and Keetac	17,876.25	$1,596,014.66	$89.28	$9,096	$371,265.31	$1,595,643,389.69
United Tac	5,218.45	$460,195.18	$88.19	$1,550	$63,265.31	$460,131,913.69

Based on the above information, the Minnesota mines have had combined positive annual earnings of at least $2 billion over most of the last 12 years. They also have had positive earnings individually based on recent information on production and revenues (Table 31). Based on Table 32, they have also had positive profits in 2019, the most recent year for which data for individual mines are reported. According to the EPA, positive earnings shows ability to afford pollution control costs: "as long as the applicant maintains positive earnings, it can afford to pay for pollution control" (1995, p. 3-6). The iron-ore mining industry, similar to the steel industry, is cyclical, its revenues affected by several other industries dependent on its products (Dive, 2018). This implies there may be temporary declines in earnings and profits in some years but these are typically offset by recovery in other years.

As more detailed information, for example financial statements on individual mines, is not available, we cannot conduct a financial analysis to assess overall financial health based on economic measures such as profitability and ability to remain solvent into the future. However, as the Minnesota mines are owned by much larger corporations, whose financial information is available, we can analyze the health of the parent firms and use the results to supplement the existing information on the subsidiaries.

The next section analyzes the financial health of the parent companies based on the EPA's (1995) economic guidance. We also include a discussion on possible exogenous impacts on the parent companies based on international trade in iron and steel, changes in technology, consumer tastes and preferences, and the COVID-19 pandemic in 2020. The results of this analysis provide an estimate of the financial health of their subsidiary mines. The strength of the estimate depends on the strength of the links between parent firms and their subsidiaries, on which we provide further analysis in the subsequent section. Our conclusion on the financial health of the mines is based on assessment of parent company financials as well as available evidence on links between parents and subsidiary mines.

In case of financial information not being available at the level of the discharger, EPA (1995) recommends estimating them from the parent companies' financial information. As the discharger and parent companies may be connected in operation or production and other ways, the EPA Economic Guidance recommends consideration of the structure, size and financial health of the parent company, regardless of data availability at the discharger level. The EPA Economic Guidance also advises use of parent company data in cases of known links between parent company and permittee, for example in choosing the interest rate used in calculating annual pollution control costs. Moreover, in assessing the value of a permittee's operations or product to the parent company where the permittee's product is used as an input in another facility owned by the parent: "if a facility produces an important input used by other facilities owned by the firm, the firm may be likely to support the facility even if it appears to have only borderline profitability" (EPA, 1995, p. 3-4). The MPCA notes that for Minnesota's taconite mining industry, the basic product is taconite pellets, which may be sold in the open market or used as an input in the production of the final product, steel. In the latter case, both the mining facility and processing plant may be owned by the same parent company.

Consequently, the MPCA decided to assess the individual mining facilities' financial health as a function of the parent companies' financial health, combined with existing information on the subsidiary mines and evidence of their positive valuation by the parent companies as described previously. The limitations of data availability at the facility level means the findings from our assessment may not be an exact representation of the financial health of the mines, but are the best analysis possible under these limitations.

The MPCA assessed the financial health of the three major parent companies associated with the Minnesota iron-ore mines affected by the proposed Class 3 and 4 WQS rule: U.S. Steel, Cleveland-Cliffs Inc., and ArcelorMittal, USA (as of October 2020) using publicly available financial information on these companies. Based on Cliffs' decision to acquire ArcelorMittal USA in September 2020, there will be only two parent companies in the next few months, U.S. Steel and Cleveland-Cliffs. But all three companies were parent companies for the dischargers affected by the proposed rule above for the duration of data availability for our financial impact analyses, i.e., through 2019, and still are as of October 2020. Hence all three companies are considered and referred to as parent companies in our analyses.

As ArcelorMittal USA is a part of Arcelor Mittal S. A., a company that has ownership in iron and steel interests globally, the MPCA used their consolidated financial statements to assess overall financial health (ArcelorMittal, n.d.). The MPCA calculated metrics for the key financial measures described before as a part of a financial impact analysis, based on data from 2017 through 2019, but with data from earlier years to examine trends in financial health. Based on our assessment, the three parent companies are in good financial health for the analysis period. If the impact of any new pollution control expenditure on Minnesota mines are only partially captured by the impact on these parent companies, then additional information on the financial health of the individual mines would be needed to assess their specific situations. In the paragraphs below, the MCPA describes our assessment and findings based on the EPA (1995) metrics for each of these measures.

Profitability is the primary measure in the financial impact analysis and is generally assessed via the *profit test*, which is calculated by dividing earnings before taxes (EBT) by revenues. EBT is also a measure of a company's operating income, i.e. income after excluding annual expenses and losses from net interest payments, depreciation and amortizations. Table 33 shows the profit rates of the three parent companies for the most recent three years.

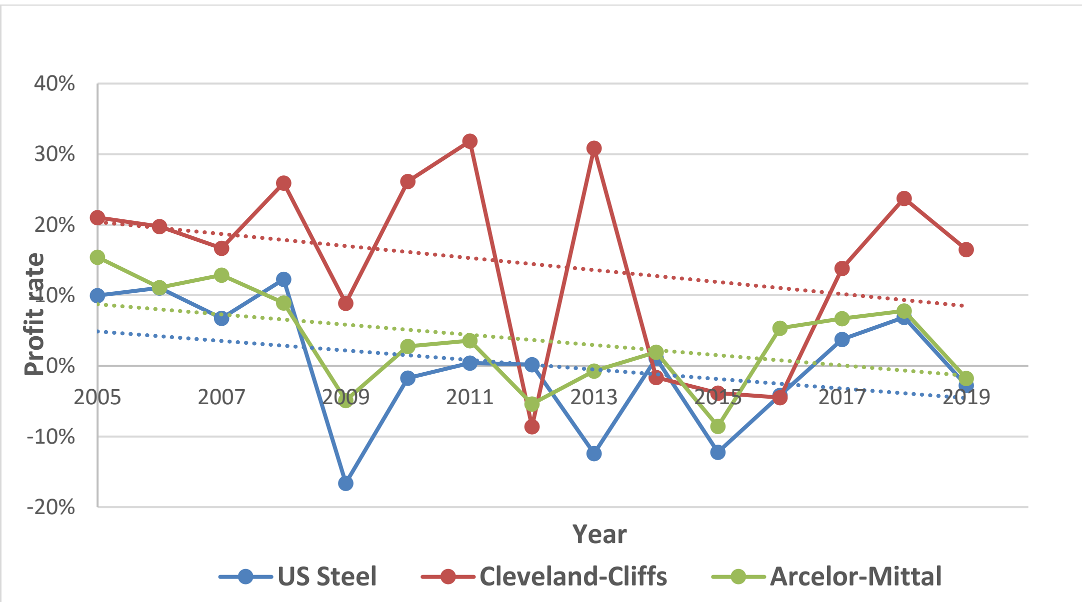
Table 33. Annual profit rates for parent companies of mining facilities for 2017-2019.

Company	2017	2018	2019
US Steel	4%	7%	-3%
Cleveland-Cliffs	14%	24%	16%
Arcelor Mittal	7%	8%	-2%

For all three companies, the profit test indicator is, on average, positive for the most recent three years. Cleveland-Cliffs has maintained its high profitability over all of the three years, while U.S. Steel and ArcelorMittal maintained their profitability for 2017 and 2018, but recorded negative 3% and 2% profit rates owing to negative EBTs in 2019. Negative profits continuing over a longer duration could be cause for concern but cycles in profit and loss are generally common for these large corporations. Also, as Figure 14 shows, these companies went through a major economic recession (2008-2013), and a global steel market downturn (2011-2014) during the last 15 years, and still remained operational, recovered, and made positive profits on average.

Overall, all three companies have good profitability based on their positive average profitability for the last three years, as well as maintenance of their profitability over the last 15 years, despite losses from serious exogenous impacts such as the great recession. Apart from average positive profits, all three companies also reported positive average annual operating incomes over the last three years of $361 million, $380 million, and $3 billion for U.S. Steel, Cleveland-Cliffs, and ArcelorMittal respectively. Given these reported average annual earnings, earnings would still be positive after paying the annual cost of pollution control for compliance with the existing Class 3 and 4 standards for Minnesota mines laid out in Table 30. Earnings would remain positive even if average compliance costs would approach a range of $50-$100 million. This indicates that demonstrating a lack of profitability due to installing pollution control technology is unlikely.

Figure 14. Profit rates of parent companies, 2005-2019.



Liquidity is assessed via the *current ratio*, which equals current assets divided by current liabilities, and is shown by Table 34 for the last three years.

Table 34. Current Ratio for parent companies of mining facilities for 2017-2019.

Company	2017	2018	2019
U.S. Steel	1.71	1.51	1.45
Cleveland-Cliffs	3.42	3.16	2.19
Arcelor Mittal	1.25	1.38	1.34

None of the three parent companies have a current ratio below 1, which means they are not facing serious liquidity problems. Also, all of them have had positive and substantial current assets for all three years (the values of current assets for U.S. Steel, Cleveland-Cliffs and Arcelor Mittal in 2019 are $3.8 billion, $0.9 billion, and $28.6 billion, respectively), so that covering short term debt would not be an issue for them. Considering their current ratios for 2017-2019, they all had above-average current ratios compared to the mining industry as a whole (Credit Guru, n.d.).

Solvency is assessed via the *Beaver's Ratio*, which equals after-tax cash flow divided by total liabilities and is shown in Table 35.

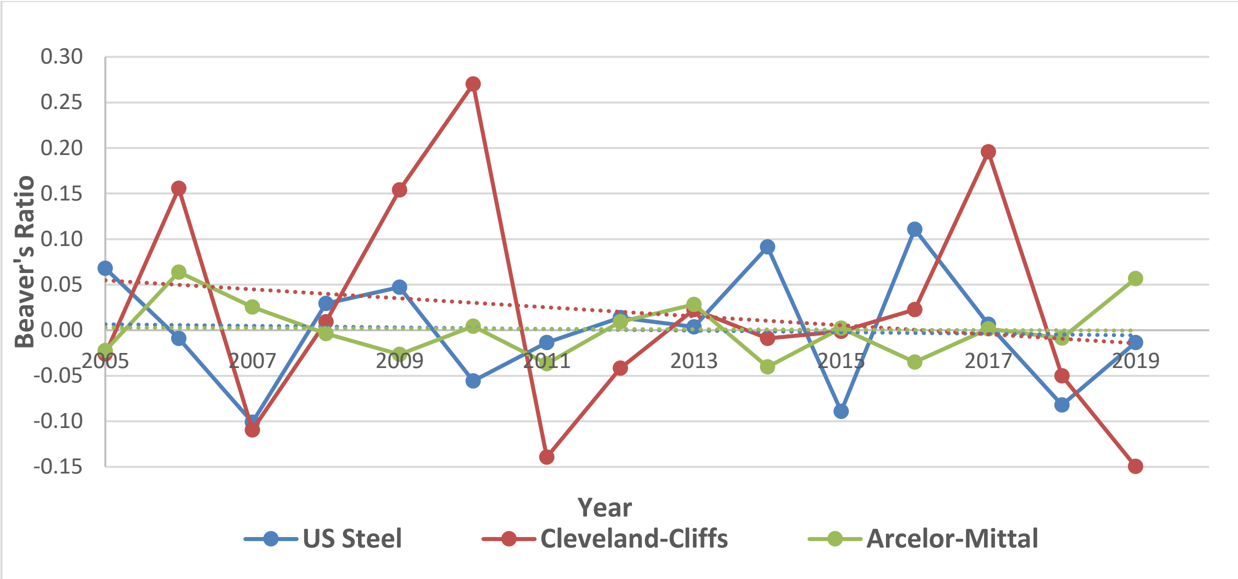
Table 35. Beaver's Ratio for parent companies of mining facilities for 2017-2019.

Company	**2017**	**2018**	**2019**
U.S. Steel	0.01	-0.08	-0.01
Cleveland-Cliffs	0.20	-0.05	-0.15
Arcelor Mittal	0.00	-0.01	0.06

Beaver's Ratio greater than 0.2 indicates solvency, i.e. that the firm can pay its long term debts, while a Beaver's Ratio lower than 0.1 shows poor financial condition in terms of long-term solvency. All three companies have had low Beaver's Ratios during 2017-2019. They have also had negative Beaver's Ratios for 2018 and 2019 (ArcelorMittal only for 2018), showing a worse situation with negative cash flows. This general low trend in Beaver's Ratio is evident for all three companies throughout 2005-2019 as Figure 15 shows, with a mean of 0.02 for Cleveland-Cliffs and 0.00 for U.S. Steel and ArcelorMittal. The largest frequency and size in the fluctuations happen during 2007-2014, when negative cash flows combined with high liabilities, suggesting the great economic recession and oversupply of U.S. steel imports as probable causes.

Further analyzing the Beaver's Ratio from available data, total debt has gone down over the past three years, but cash flows may take time to recover, suggesting that the low trend in solvency might continue for a few more years. However, a low Beaver's Ratio in itself is inadequate to prove weak overall finances or variance eligibility for the parent companies. In addition, all three companies have substantial current assets to help manage solvency despite low cash flows. For any additional assessment of solvency, information on future expected cash flows would be required. While U.S. iron and steel production supplies a small percentage of international demand, domestic production will not be significantly affected by foreign competition. For example iron-ore imports decreased by 10.9% over 2015-2020 owing to sufficient domestic production. Current industry reports predict a substantial fall in iron-ore imports in the next five years as global production recovers from the pandemic (to 2025) (Ross, 2020). Based on this general outlook and evidence of new investments in iron-ore plants and steel companies undertaken by these parent companies in the U.S. market, they generally have positive future business outlooks, indicating capability to manage any long-term solvency issues.

Figure 15. Beaver's Ratio of parent companies, 2005-2019.



Leverage is assessed via the debt-to-equity ratio, which equals long-term liabilities divided by owner's equity and is listed for the three companies in Table 36.

Table 36. Debt-to-equity ratio for parent companies of mining facilities for 2017-2019.

Parent Company	2017	2018	2019
U.S. Steel	1.13	0.85	1.19
Cleveland-Cliffs	-6.63	6.22	7.65
Arcelor Mittal	0.56	0.54	0.65

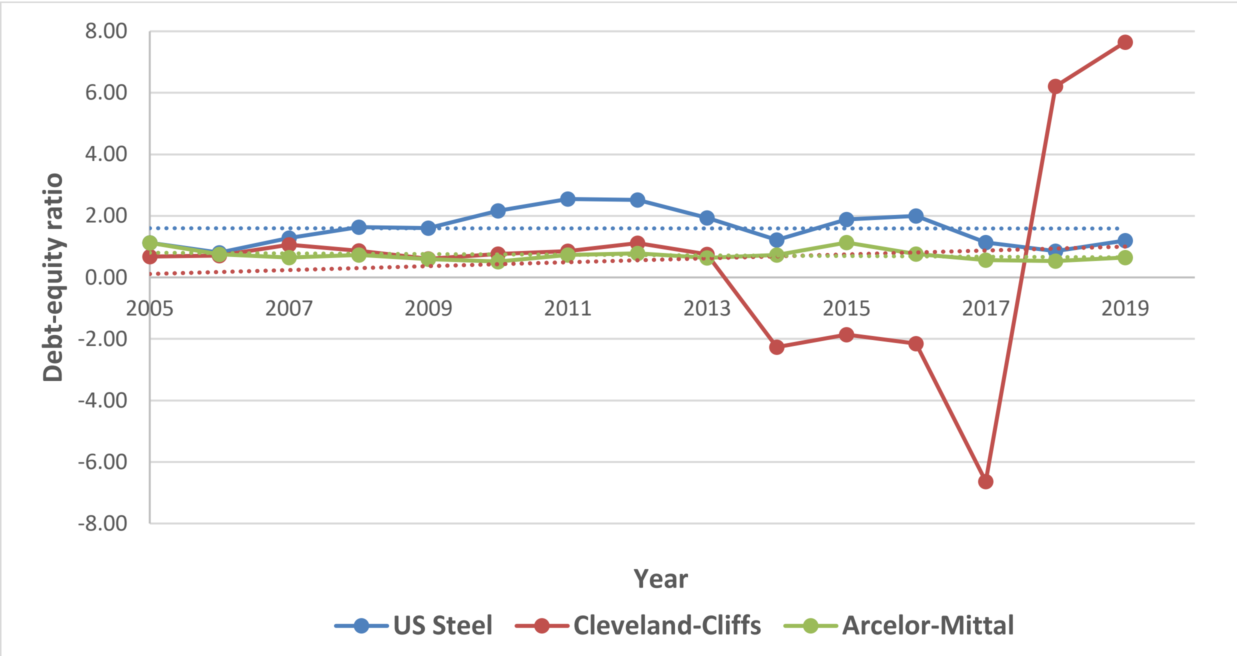
A debt-to-equity ratio between 0 and 1 shows that for each dollar owned by shareholders, the company owes less than $1 to creditors, showing excellent debt capacity or higher than average ability to take on additional debt. A debt-to-equity ratio of between 1.0 and 1.5 generally shows additional debt capacity or the ability to take on additional debt. However, debt-to-equity ratio are typically higher in the manufacturing industries and for large corporations a ratio of 2.0 generally indicates good debt-capacity (Investopedia, 2019).

Based on these principles, ArcelorMittal has had debt capacity lower than 1 for the three past years and a mean of 0.73 for the 15 years data is available, showing excellent debt-capacity. U.S. Steel generally shows good debt capacity for the three years considered. Cleveland-Cliffs has a negative debt-to-equity ratio for 2017 due to negative equity, which indicates a poor financial condition (Bloomenthal, 2019). This situation, as noted before, was likely brought about by a combination of factors: the U.S. economic recession during e-2013 and the steel downturn of 2011-2014 driving changes in iron-ore prices from changes in global demand, which Cliffs was uniquely subject to as a non-integrated seller of iron-ore in the open market through 2019.[4] The company improved to a positive ratio in 2018, and maintained it in 2019, but may face some difficulty borrowing additional capital unless the improvement continues in the near future. Based on long term trends, the company is likely to be in good financial condition in the

[4] *The reduction in global demand for iron-ore during 2013-2018 was largely caused by slowdown in the Chinese economy.*

future since, as Figure 16 shows, it has had additional debt capacity for most of the earlier years and the reduction in debt capacity starting from 2014 is a temporary problem, mainly due to domestic and global business cycles.

Figure 16. Debt-to-equity ratio of parent companies, 2005-2019



In summary, our financial impact analyses based on the primary measure and the secondary measures that the EPA and MPCA use to assess variance eligibility, concludes that the three parent companies Arcelor Mittal USA, Cleveland-Cliffs Inc., and U.S. Steel, are in good financial health for our analysis period and are likely to still be in good financial condition, based on current information from the U.S. iron and steel market. Their financial health based on key economic performance metrics – profitability, liquidity, solvency and leverage – does not provide evidence of a lack of ability to pay compliance costs.

Considering the importance of iron and steel to domestic manufacturing and the strength of these three parent companies in terms of combined market share in iron and steel, together with the evidence on good profitability and liquidity, it is also plausible that these companies would be able to raise their prices or maintain their prices while lowering their costs if needed to maintain positive profits after paying compliance costs, for which support is provided in the upcoming section on exogenous impacts. The MPCA notes that as these are the parent companies of the dischargers facing compliance costs, based on the EPA (1995) guidance, the financial health of these parent companies serves as an indicator of the financial health and viability of the dischargers.

Exogenous factors impacting parent companies

Neither the EPA (1995) guidance nor Minnesota statutes explicitly specify any requirement to explore impacts from any other sources such as: trends in the world market, impacts of the COVID-19 pandemic, application of trade controls such as tariffs, trends in product making technology, or tastes and preferences of consumers as part of a financial impact analysis to determine variance eligibility. Note, though, that any influence of these factors are partly incorporated in a consideration of long-term financial health, which the MPCA has addressed for the parent companies. For example, the EPA's guidance states that "the degree to which the discharger is able to raise prices is difficult to predict, and depends on many factors. Considerations should include 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" (p.3-7).

Even so, the MPCA explored these issues based on a comparison of current news related to the iron and steel industry and available financial information on the mines and their parent companies. They are categorized and discussed in S-19. The topics covered include:

- Trends in world iron-ore and steel prices, trade and trade controls,
- Impacts of the Covid19 pandemic,
- Trends in new products and technology, and
- Consumer tastes and preferences.

The extent to which an industry will be affected by an exogenous event may depend largely on its financial strength and competitiveness. Our exploration of exogenous factors do not suggest a possibility of any significant negative impact on the parent companies in the near future after they have recovered from the impact of the pandemic in 2020. However, it is helpful to keep them in mind in light of possible changes in global reserves, demand, innovation, and production of iron and steel, in the rest of the world. Despite the past five-year fluctuations in world iron-ore prices, the three parent companies maintained their market share and dominance in the U.S. market, while recovering from the economic recession of 2008-2013 and the impacts of the downturn in the steel market in 2011-2016. Furthermore, as the three parent companies controlled the majority of supply and production in the U.S. as of September 2020, and since mining has built-in establishment costs, there are barriers to entry for any domestic competition so that the dominance of these companies in the U.S. iron-ore mining industry is likely to continue in the future. These factors indicate that the domestic iron-ore industry and hence the Minnesota mines will not be significantly affected in terms of performance in the near future.

<u>Valuation of mines by parent companies</u>

The Minnesota iron mining industry contributes significantly to domestic iron-ore and steel production with 85% of U.S. iron-ore production sourced from Minnesota mines in the Mesabi Iron Range, and about 98% of it used as input for steelmaking (Ross, 2020). U.S. iron-ore prices respond mainly to demand from the domestic steel industry, which in turn is affected by industries using steel products, such as construction and automobile manufacturing. As noted before, since 20-30% of production is exported and about 30% of steel demand is met by imports, global demand for iron-ore and steel also affects domestic iron-ore prices and revenue through changes in production and trade.

The individual mines contributing to Minnesota iron-ore production are therefore important for the domestic iron and steel industry. While assessing the financial health of the individual mines is difficult due to lack of financial data, it is possible to examine their finances through this strong industry linkage.

As the parent companies of these mines control 90% of the domestic iron and steel industry, evidence of strong links between these parent companies and individual mines adequately account for the mines' industrial importance. As noted before, the parent firms' valuation for their subsidiaries also depends on the strength of these links. In particular the links lend support to the hypothesis that the parent companies value the subsidiary mines and have substantial stakes in their financial health.

Evidence of this valuation can be seen in several ways. The parent firms value individual facilities for their production of taconite pellets, which are either sold on the open market or used in making another final product. For example, in 2019, taconite pellets produced by the Northshore Mine were sold as a final product by the parent firm Cleveland-Cliffs, while the Minntac and Minorca mines' taconite production was used as an input to steel production by the parent firms U.S. Steel and ArcelorMittal USA. In both cases the production of the individual mines accounts partially for the revenue of the parent firm, either as final product/output or as an input contributing to final sales. The resulting funds may also be used to run these facilities, perform mining operations, and pay employee salaries.

Secondly, the inland steel industry including the parent firms' discussed here have limited ability to move operations out of the nation due to infrastructural problems such as the size of the Great Lakes locks, which would not allow passage of large ships containing imported ore. Given substantial domestic demand for iron-ore, this limitation should boost domestic production as well as increase the parent firms' valuation for continued operation and production of the Minnesota mining facilities (Congressional Research Service, 2016). Below, these and related points are discussed in more detail.

1. Mines' contribution to U.S. production: About 98% of U.S. iron-ore production is sourced from the Great Lakes, with Minnesota mines contributing the largest share of 85%. If any of these mines suffer from production and revenue losses, it means a substantial drop in U.S. production of iron-ore and steel, and therefore slowed business for the parent companies. Therefore, any of the three parent companies would have a substantial interest in ensuring the health of the Minnesota mines, compared to a mine with a less substantial contribution to U.S. iron-ore and steel production.
2. Vertical integration: As noted before, as of 2020, all three parent companies are vertically integrated in their production of iron-ore and steel. The continued financial health of these mines and reasonable capacity utilization would ensure effective use of economies of scale for these parent companies through lowering of production costs and consolidation of production processes for steelmaking. This also helps them compete effectively with imported steel and with price fluctuations driven by changes in the world iron and steel markets. Vertical integration is an important link between parent and subsidiary companies, beneficial to both from a cost reduction and economies of scale perspective.
3. Unique position for competitiveness: The Minnesota mines have a combination of unique features based on their location that provide a competitive advantage compared to mines in other parts of the country. These features include regional concentration, ore quality and availability, existing infrastructure for convenient transportation, and cost-effective topographical features and are described in the following paragraphs.
    a. Regional concentration: The iron-ore mines being concentrated in the Mesabi Iron Range makes the production and processing phases more cost-effective owing to economies of scale. The average distance to processing plants and consequent transportation costs such as haulage fees are lower compared to mines without this location and concentration advantage.
    b. Ore quality and availability: The Mesabi iron range has plentiful supply of both magnetite (high grade) and hematite ores. This reduces exploration and excavation costs.
    c. Transportation infrastructure: The mines are served by an existing seaway infrastructure called the Great Lakes Saint Lawrence Seaway System (GSLS) comprising two systems of navigation passages or 'locks'. Most domestic transportation is conducted through the Great Lakes locks at Sault St. Marie, while the St Lawrence locks in the lower portion of the seaway also permit smaller ships coming in from the Atlantic Ocean. Remaining transport needs to interior plants are conducted using rail transportation. Availability of this useful transport infrastructure combined with regional concentration reduces transaction and transportation costs and makes mining in Minnesota a viable investment for the parent companies.
    d. Topographical advantage: The geology and quality of the iron ore deposits in the Mesabi Range makes it comparatively easier to extend Minnesota's existing iron-ore base in the future. Minnesota has extensive reserves of good quality taconite ore, which will last for a

long time at current production rates. The ore is also located near the surface, and situated in a horizontal direction, which makes it more economical to mine. In contrast, Michigan has limited reserves, located in narrower and more steeply dipping deposits, which makes extending reserves economically unviable in the future, and likely contributed to the closure of the Empire mine in 2016, leaving only one operational iron mine in that state, the Tilden mine (Barnes, 2016). While Minnesota's existing iron-ore base is plentiful, it helps to know that mining is also viable in the future due to possibility of increasing these reserves.

4. Infrastructural limitation Due to the smaller size of the St Lawrence locks that connect the Great Lakes to the Atlantic Ocean, there is a physical barrier to overseas trade in Minnesota iron ore. The Great Lakes locks at Sault Ste. Marie can accommodate ships up to 1,200 feet long (Great Lakes Seaway Partnership, 2015). Great Lakes cargo ships or 'Lakers,' (Boatnerd.com, n.d.) which can be up to 1,000 feet long, are designed for travel through these locks for trade within the upper Great Lakes system, including Canada (Great Lakes Seaway, 2015). The Saint Lawrence locks are only 766 feet long, and therefore can only permit much smaller ships, coming in from overseas (Great Lakes Seaway Partnership, 2015). These ocean-going vessels are called 'Salties' (Sykora, 2013), and due to their small size, cannot carry a profitable load of iron ore imports from overseas. This makes it more unlikely for the parent companies to source foreign ore, for example from Australia or China for steelmaking, therefore increasing their dependence on Minnesota mines. This also protects companies such as Cleveland-Cliffs that have a larger market share in the mining and marketing of iron-ore products (compared to the other parent companies), and who only became vertically integrated this year, from competition with overseas imports. While each parent company should have a substantial interest in the mines it owns in Minnesota due to this infrastructural limitation, the mines owned by Cliffs – Northshore, Hibbing Taconite, and now Minorca - particularly gain from this specific link.
5. Investments by parent companies: Substantial recent investments by these parent companies into new products, infrastructure, and processing plants catering specially to Minnesota taconite lends further support to their valuation of the Minnesota mines. For example, in 2015 Cleveland-Cliffs developed low-silica direct reduced iron (DRI)-grade taconite pellets, which after conversion to HBI, can be processed in an EAF to make high grade steel. In 2018, they spent $100 million on upgrades to their Northshore mining operations (Cleveland-Cliffs, Inc., n.d.), to commercially produce up to 3.6 million metric tons of DRI-grade pellets annually (Cleveland-Cliffs Inc., 2019a, Northshore Mining Fact Sheet). These pellets are an input to the new HBI plant in Toledo, Ohio, where Cliffs reportedly invested $0.8 billion (Cleveland-Cliffs, Inc., n.d.). As noted before, Northshore is the only mine in the U.S. capable of producing standard blast furnace as well as DRI-grade taconite. Given that steel mills are able to produce steel from scrap metal or DRI pellets, the demand for standard pellets could decline in the future, which makes Cliffs' investment both forward-thinking as well as indicating continued valuation for the mines it owns. Apart from these investments in technological advancements and diversification in the iron-ore market, Cliffs became vertically integrated by acquiring AK Steel in March 2020 and became the largest producer of flat-rolled steel in North America after its September 2020 acquisition of ArcelorMittal USA. Cliffs has already reopened its mines in Minnesota after idling from the pandemic in order to resume production and meet demand in both iron-ore and steel products, further showing the importance and value of these mines to the parent company (Cleveland-Cliffs Inc., 2020c).

   As noted before, U.S. Steel invested $1.2 billion in 2019 in a new steel facility in Pittsburgh, Pennsylvania featuring endless casting and rolling technology capable of making steel from Minnesota iron-ore (Tita & Thomas, 2019). It also acquired majority ownership in Big River Steel in the same year leading to further access to new production technologies and higher revenues in the future. These investments made in Minnesota mines and taconite processing plants are further evidence that parent companies are interested and invested in Minnesota taconite (Cleveland-Cliffs, Inc., n.d.). The investments also indicate that it is unlikely for the parent companies to move production out of the domestic market in the near future.

Based on the above strong links between the Minnesota iron-ore mines and their parent companies, the latter should have substantial valuation for domestic taconite production from their subsidiaries in Minnesota.

The MPCA has noted that the parent companies are in good financial health and are not expected to be significantly affected compared to other industries, by relevant exogenous drivers such as global demand for iron and steel, the Covid19 pandemic, innovations in products and technology, or changes in tastes and preferences. Additionally, based on the documented evidence of strong associations between parents and subsidiaries, it is also expected that the individual mines would be in fair financial condition. Import competition from overseas iron-ore is limited by physical barriers and typically meets 5-10% of domestic demand (Tuck, 2020b). Steel imports meet about 30% of domestic demand (Tuck, 2020a). However, most of this trade is with Brazil, Canada, and Mexico (ITA, 2020b), and the recent levying of steel tariffs have helped domestic steel producers to remain competitive with international production, as documented in the future financial outlook for Minnesota mines (Ross, 2020). Therefore, apart from the characteristic cyclical business patterns and the exogenous impact from the COVID-19 pandemic in 2020 (from which the industry is predicted to recover at a notable pace), a downturn based on industry-specific socioeconomic reasons is not expected for the Minnesota mining industry in the near future.

Therefore, if the parent companies' finances can be leveraged for complying with existing water quality standards for their subsidiary taconite mines in Minnesota, this assessment has not proven substantial economic impacts would result from doing so. The strong associations between parent companies and subsidiaries indicate that such leverage can be reasonably expected. If such leverage may not be expected, then to determine variance eligibility or affordability, the MPCA would have to analyze the financial health of the individual mines and determine if they have adequate financial resources to pay the potential costs to comply with the existing standards.

Widespread impacts

As substantial impacts based on financial health cannot be proven at this time, according to the EPA Economic Guidance it is not necessary to examine the question of widespread impacts in support of a variance to comply with WQS. As noted previously, the EPA (1995) states: "If the analysis shows that the entity will not incur any substantial impacts due to the cost of pollution control (e.g., there will be no significant changes in the factory's level of operations nor profit), then the analysis is completed" (p.3-1).

However, considering the economic importance of taconite mining to the Taconite Assistance Area (TAA) as well as to Minnesota and the nation, this SONAR provides a summary of possible ways widespread impacts could be explored for a hypothetical situation where substantial impacts were proven. The MPCA notes that this summary could be meaningful as a realistic application of widespread impacts analysis if the six mining facilities considered here were able to provide further facility-specific financial information that could help prove substantial impacts.

Minnesota's TAA, defined in Minn. Stat. § 273.1341 and delineated by the service area of the Department of Iron Range Resources & Rehabilitation (IRRR), is a triangular area encompassing 13,000 square miles in northeastern Minnesota, flanked by the Mesabi iron range as shown by Figure 12, and including all or a portion of the 7 counties: Aitkin, Cook, Crow Wing, Itasca, Koochiching, Lake, and St.

Louis, and the 53 cities, 134 townships, portions of four tribal nations and 15 school districts located within them (n.d.).

The TAA's population is 353,474, which is approximately 6.3% of state population (Minnesota State Demographic Center, 2019). Employment in the region is 143,649, about 5% of total state employment (Minnesota Department of Employment and Economic Development, 2020b). Iron-ore mining is an important industry in the TAA, ranked tenth in terms of employment, equivalent to approximately 4,152 jobs,[5] therefore accounting for 3% of regional employment. The TAA's median household income is $53, 531, compared to the state median household income of $68,411 in 2018 (Gorecki, 2020). The TAA's Gross Regional Product (GRP) was $18 billion in 2018, accounting for 5% of Minnesota's Gross State Product (GSP) in 2018 (U.S. Bureau of Economic Analysis, 2019). Mining contributes 1% towards Minnesota's GSP and, assuming all mining in Minnesota happens in the TAA (DNR, 2020a),[6] mining contributes 19% towards the TAA's GRP (Federal Reserve Bank of St. Louis, 2020).

The Labovitz School of Business, University of Minnesota, Duluth, used the regional input-output model IMPLAN to conduct a 2012 study (Skurla et al., 2012) on the total economic impact of iron mining[7]. That study showed an impact of 4,000-8,500 jobs in the Arrowhead region[8], and up to 11,000 jobs in the state. Based on a more recent economic impact analysis, conducted as part of a larger study on assessing new technologies for sulfate reduction in north-eastern Minnesota watersheds mining contributed 6,000-10,000 jobs to the Arrowhead region and up to 12,000 jobs to the state (Hudak et al., 2017). The number of direct jobs reported by these studies were 3,975 in 2010; 4,505 in 2014; and 2,679 in 2016. The studies also found that iron mining contributed 30% (Skurla et al., 2012) and 6-13% (Hudak et al., 2017) toward the GRP of the Arrowhead region, which in turn contributed 5% (both studies) toward Minnesota's GSP. Based on estimates on total economic impact from the 2016 study, the iron mining industry contributed about 0.5-0.8% toward Minnesota's GSP.

As noted in our analyses of the individual mines, the iron mines collectively contribute more than $100 million in local taxes annually in the TAA. They are thus a needed funding source to local government agencies and school districts as shown by the distribution of the Production Tax. Revenues from production taxes collectively accounted for 12% of the total funding available to counties, cities, and townships in the TAA in 2018,[9] with a higher percentage for some individual iron range cities, such as Kinney (21%), Mountain Iron (20%), and Silver Bay (16%) (Minnesota Office of the State, 2019).

The average salary in mining is competitive (U.S. Bureau of Labor Statistics, 2019), and many types of mining jobs provide a higher salary compared to other local industries in the TAA, such as recreation and tourism (Minnesota Department of Employment and Economic Development, 2020a). The 2012 study noted above found that one mining job is equivalent to 1.8 other jobs, as one mining job creates an

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[5] *Jobs in iron mining in the TAA are well represented by the categories: metal ore mining and support activities for metal mining.*

[6] *It is a fair assumption that all mining in Minnesota happens in the TAA as Minnesota does not have any oil and gas mining and all metallic ore mining in the state currently comprises iron-ore mining in the TAA. Minnesota does mine for clay, sand, and gravel but these are classified differently compared to metallic-ore mining.*

[7] *Total economic impact is the change in economic activity in a region owing to changes (or continued operation) in a specified sector, comprising direct impacts (impacts to the mining sector), indirect impacts (impacts in sectors supported by mining such as construction and transportation), and induced impacts (impacts due to any additional household spending from direct and indirect impacts such as in hotels and restaurants).*

[8] *4020 in mining, the rest in sectors supported by mining.*

[9] *3.1% for counties, 3.3% for cities, and 5.3% for townships.*

additional 0.8 jobs in terms of indirect and induced employment potential. Due to the concentration of iron mining in the Mesabi Range area, many of these mining jobs are not transferable to other parts of the state and therefore are more valuable to the TAA.

Finally, the Minnesota mines and mining jobs are also socially important to the TAA. Most of these mines have been operating for at least 50 years, and a few have particular historical and cultural value. For example, the 63 year old Northshore mine was the first taconite facility in North America when it opened in 1956 (Cleveland-Cliffs Inc., 2019a). The 55 year old Minntac mine is located in the city of Mountain Iron, also the site of the historic Mountain Iron Mine that opened the Mesabi Range to iron mining in 1892 ("Mountain Iron Mine," 2019). Consequently, they have become socially important in providing a sense of place and cultural identity to the surrounding communities. Losing a mining job, possibly held generationally, could be an important cultural loss, not easily restored by alternative employment. Therefore, in the hypothetical situation where the mining companies have substantial impacts from having to comply with water quality standards, it is possible that there could be wider impacts in the surrounding community of the TAA. However, the occurrence of widespread impacts in reality is unlikely, given our assessment of the financial health of the mines, based on the financial impact analyses on their parent companies, examination of exogenous impacts, and evidence of valuation of the parent companies for their subsidiary mines, has not proven substantial impacts.

Conclusion

All of this analysis demonstrates that the taconite facilities will bear the costs of compliance with any applicable Class 3 and 4 WQS. If the proposed rules are not adopted, that will include the costs of compliance with the existing standards. As noted in the discussion of the costs of compliance with the proposed new standards, the taconite facilities are likely to bear some costs of compliance for new TSD or sulfate standards.

Assessment of differences between the proposed rules and corresponding federal requirements and rules in states bordering Minnesota and states within EPA Region V

Minn. Stat. § 14.131, together with Minn. Stat. § 116.07, subd. 2 (f), requires an assessment of differences between the proposed amendments and corresponding federal requirements, similar standards in states bordering Minnesota, and states within EPA Region 5.

> *14.131 (7) an assessment of any differences between the proposed rule and existing federal regulations and a specific analysis of the need for and reasonableness of each difference;*
>
> *116.07, subd. 2 (f) In any rulemaking proceeding under chapter 14 to adopt standards for air quality, solid waste, or hazardous waste under this chapter, or standards for water quality under chapter 115, the statement of need and reasonableness must include:*
>
> *(1) an assessment of any differences between the proposed rule and:*
>
> *(i) existing federal standards adopted under the Clean Air Act, United States Code, title 42, section 7412(b)(2); the Clean Water Act, United States Code, title 33, sections 1312(a) and 1313(c)(4); and the Resource Conservation and Recovery Act, United States Code, title 42, section 6921(b)(1);*
>
> *(ii) similar standards in states bordering Minnesota; and*
>
> *(iii) similar standards in states within the Environmental Protection Agency Region 5; and*

(2) a specific analysis of the need and reasonableness of each difference.

The water quality standards program, as established by the CWA, is based on the premise that states develop specific standards based on federal guidelines and criteria, and that the state standards will vary depending on state-specific conditions and needs. The CWA expects that states will establish beneficial use classes, but there are no federal regulations or recommended regulations on the appropriate water quality for industrial and agricultural standards. Therefore, an assessment of whether the proposed revisions are more or less stringent is not possible.

Because there are no federal criteria established for industrial, irrigation, or livestock and wildlife watering uses, the standards adopted by different states vary widely, as seen in Table 37. Some states, such as Illinois and Iowa, do not include numeric standards to protect the industrial or irrigation designated uses specifically, but have general use numeric standards, that are calculated to ensure protection for many different designated uses, including industrial and irrigation uses. Other states, such as North and South Dakota, have numeric protections for industrial and irrigation designated uses, but the values vary between states.

Many states and tribes have specific numeric protections for either wildlife or livestock; however, the parameters with numeric standards vary widely. Some states contain standards that directly address livestock drinking water, including values that are similar to those proposed in this rulemaking; while other states and tribes have only wildlife standards that include bioaccumulative contaminants. The states with wildlife standards that include values for bioaccumulative contaminants (DDT, mercury, PCBs, and 2,3,7,8-TCDD) have all taken those wildlife protective values directly from EPA's 1995 criteria for the Great Lakes Water Quality Initiative. These wildlife values consider both exposure via drinking water and consumption of aquatic organisms that contain the contaminant. As discussed in the Specific Reasonableness section for part 7050.0224, Minnesota's Class 2 waters are intended to protect wildlife through the aquatic organisms they consume. However, wildlife are not protected for the water they directly consume in Class 2, so it is reasonable for Minnesota to include standards that are more similar to states that also intend the standards to protect for livestock and wildlife drinking the water.

Table 37. Industrial, irrigation and livestock and wildlife standards for U.S. EPA Region 5 states, states that border Minnesota, and Tribal Nations in Minnesota with water quality standards.

State or Tribal Nation[1]	Industrial standards	Irrigation standards	Livestock and/or wildlife standards
Minnesota (proposed in this rule)[2]	Narrative standard to protect the designated use	Narrative standard to protect the designated use	pH: 6.0 to 9.0 Ttotal dissolved solids: 3,000 mg/L Sulfate: 600 mg/L Nitrate: 100 mg NO_3-N/L
Illinois[3]	None specific to industry – included in general use	None specific to irrigation – included in general use	Sulfate: 2,000 mg/L, as 30-day average, where water is withdrawn for livestock watering
Indiana[4]	Total dissolved solids: 750 mg/L (or specific conductivity of 1,200 µmho/cm	Waters used for agricultural purposes protected by aquatic life and human health values	Waters used for agricultural purposes protected by aquatic life and human health values

State or Tribal Nation[1]	Industrial standards	Irrigation standards	Livestock and/or wildlife standards
Iowa[5]	None specific to industry – included in general use	None specific to irrigation – included in general use	Recommended guidelines to protect livestock narrative standard: Calcium: 1,000 mg/L Chloride: 1,500 mg/L Magnesium: 800 mg/L Sodium: 800 mg/L Sulfate: 2,000 mg/L Nitrate+Nitrite-N: 100 mg/L
Michigan[6]	None specific to industry – but all waters protected for use	None specific to irrigation – but all waters protected for use	None specific to livestock watering – but all waters protected for use
North Dakota[7]	Chloride: 250 mg/L, as 30-day average	Boron: 0.75 mg/L, as 30-day average Sodium: 60% of total cations, as mEq/L	Sulfate: 750 mg/L, as 30-day average
Ohio[8]	"Criteria for the support of the industrial water supply use designation will vary with the type of industry involved."	Arsenic: 100 µg/L Beryllium: 100 µg/L Cadmium: 50 µg/L Total chromium: 100 µg/L Copper: 500 µg/L Fluoride: 2,000 µg/L Iron: 5,000 µg/L Lead: 100 µg/L Mercury: 10 µg/L Nickel: 200 µg/L Nitrates+Nitrites: 100 µg/L Selenium: 50 µg/L Zinc: 25,000 µg/L	Livestock standards are the same as irrigation standards. Waters are protected for "agricultural" use, which includes irrigation and livestock watering.
South Dakota[9]	Total dissolved solids: 2,000 mg/L, as 30-day average and 3,500 mg/L as daily max pH: 6.0 to 9.5	Specific conductivity: 2,500 µmho/cm, as 30-day average and 4,375 µmho/cm as daily max Sodium adsorption ratio: 10	For wildlife propagation and stock watering: Total alkalinity: 750 mg/L as 30-day average and 1,313 mg/L as daily max Total dissolved solids: 2,500 mg/L as 30-day average and 4,375 mg/L as daily max Specific conductivity: 4,000 µmho/cm as 30-day average and 7,000 µmho/cm as daily max Nitrates as N: 50 mg/L as 30-day average and 88 mg/L as daily max pH: 6.0 to 9.5 Total petroleum hydrocarbon: 10 mg/L Oil and grease: 10 mg/L

State or Tribal Nation[1]	Industrial standards	Irrigation standards	Livestock and/or wildlife standards
Wisconsin[10]	None specific to industry – but all waters protected for use	None specific to irrigation – but all waters protected for use	For wildlife only: DDT and metabolites: 0.011 ng/L Mercury: 1.3 ng/L PCBs: 0.12 ng/L 2,3,7,8-TCDD: 0.003 pg/L
Fond du Lac[11]	"The water quality is adequate for use(s) as commercial water supply for business purposes."	"The water quality is adequate for uses in irrigation and livestock watering."	"The water quality is adequate for uses in irrigation and livestock watering." Wildlife has numeric standards: DDT: 11 pg/L Mercury: 0.0013 µg/L PCBs: 120 pg/L 2,3,7,8-TCDD: 0.0031 pg/L
Grand Portage[12]	"all waters of the Reservation shall be of sufficient quality to be used as a water supply for commercial purposes."	Irrigation is not a designated use, but forestry application is included as a designated use.	Livestock is not a designated use. Wildlife has numeric standards: DDT: 1.1×10^{-5} µg/L Mercury: 1.3×10^{-3} µg/L PCBs: 1.2×10^{-4} µg/L 2,3,7,8-TCDD: 3.1×10^{-9} µg/L

[1]Standards included in this table summarize state-wide standards, not those standards developed for specific basins, such as the Great Lakes basins, to be most comparable to Minnesota's Class 3 and 4 standards.

[2]Minn. R. 7050.0223 and 7050.0224

[3] llinois Administrative Code, Title 35, Subpart B, Section 302

[4]Indiana Administrative Code Title 327, Article 2

[5]567 Iowa Administrative Code Chapter 61 and "Iowa Wasteload Allocation (WLA) Procedure" (Feb. 2018), as included in 567 IAC Chapter 61. The livestock values are used to attain the narrative standard provided in 567 IAC 61.3(2)g, which provides livestock watering protection.

[6]Michigan Administrative Code, Part 4, R 323.1100

[7]North Dakota Administrative Code Title 33, Article 16, Chapter 2.1. Water classifications include many designated uses. Values presented in table are for Class III waters and for values based on agricultural/industrial protection, when there are different values for the different classes.

[8]Ohio Administrative Code, Chapters 3745-1-07 and 3745-1-33

[9]Administrative Rules of South Dakota, Chapter 74:51:01. Livestock/wildlife values come from classification that protects fish and wildlife propagation, recreation and stock watering.

[10]Wisconsin Administrative Code, Chapter 102.

[11]Water Quality Standards of the Fond du Lac Reservation, Ordinance# 12/98, as amended

[12]Grand Portage Reservation Water Quality Standards with corrected bacteria criteria Dec. 7, 2017

7) An assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule

Minn. Stat. § 14.131 (8) requires the MPCA to provide: An assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

Minn. Stat. § 14.131 defines "cumulative effect" as "the impact that results from incremental impact of the proposed rule in addition to the other rules, regardless of what state or federal agency has adopted the other rules. Cumulative effects can result from individually minor but collectively significant rules adopted over a period of time."

The assessment of the cumulative effect must be based on a comparison of the proposed rules with other federal and state regulations "related to the specific purposes of the rule." It is important to consider the specific purpose of the rule before determining the cumulative effect. In section 4 of this part, the MPCA has provided a discussion of the alternatives considered that would achieve "the purpose of the proposed revisions." That discussion of the purpose of the rules is relevant to the question of the cumulative effect of the proposal.

The purpose of the water quality standards in general is to protect beneficial uses. As standards are modified, based on new scientific information, the associated wastewater treatment requirements are also affected. Water quality standards originally only required simple treatment to remove solids, then they required wastewater treatment to eliminate pathogens. Over the past several decades, facilities have been required to address other pollutants by installing certain treatment technology to meet technology-based effluent limits (TBELs) and now states are requiring facilities to meet WQBELs.

In the context of these rules, it is important to remember that there are existing numeric standards in place that could require treatment. In most cases, the proposed revisions will allow for lesser treatment, possibly reducing the impact of the Class 3 and 4 standards. In some cases, the proposed revisions will require some facilities to conduct additional treatment to meet a numeric standard. However, because the Class 3 and 4 standards have not been fully implemented in the past, due primarily to lack of data, it may be tempting to find the that revision and narrative translator represent a new standard. The Class 4B standards for sulfate and nitrate are undoubtedly new.

The addition or revision of a water quality standard to reflect current understanding of the pollutant or to improve the effectiveness of the standard does not duplicate an existing standard. Each new or revised standard is addressing a new or additional purpose or replacing an existing standard based on new information. The more accurate question related to assessing the cumulative effect is whether the proposed revisions duplicate an existing rule that achieves the same purpose. The proposed revisions do not duplicate an existing rule on either a state or federal level.

Although some components could be considered to be new, the MPCA believes that the overall effect of the rulemaking is to reduce the cumulative effect or burden of treating wastewater to reduce salts in the discharger.

8) Consult with MMB on local government impact under Minn. Stat. § 14.131

As required by Minn. Stat. § 14.131, the MPCA has consulted with Minnesota Management and Budget (MMB). The MPCA sent MMB copies of the documents that it sends to the Governor's office for review and approval on the same day the documents were sent to the Governor's office, prior to publishing the Notice of Intent to Adopt. The documents included: the Governor's Office Proposed Rule and SONAR Form; the proposed rules; and the SONAR. The MPCA will submit a copy of the cover correspondence and any response received from MMB to the Office of Administrative Hearing (OAH) at the hearing or with the documents it submits for Administrative Law Judge review.

9) Agency's intent to send a copy of the Statement of Need and Reasonableness to the Legislative Reference Library when the notice of hearing is mailed

Minn. Stat. § 14.131 requires that "The agency must send a copy of the statement of need and reasonableness to the Legislative Reference Library when the notice of hearing is mailed under section 14.14, subdivision 1a."

The MPCA will send the required documents to the Legislative Reference Library when the notice of hearing is mailed.

B. Additional statutory mandates for rulemaking

Statutes in addition to Minn. Stat. § 14.131 also establish specific requirements for information to be addressed in a Statement of Need and Reasonableness.

1) Mandate of Minn. Stat. § 14.002 regarding performance-based standards

Minnesota Stat. § 14.002 requires state agencies, whenever feasible, to develop rules that are not overly prescriptive and inflexible, and rules that emphasize achievement of the agency's regulatory objectives while allowing maximum flexibility to regulated parties and to the agency in meeting those objectives.

Minnesota's existing water quality standards, including the existing Class 3 and 4 standards, are a performance-based regulatory system, and the proposed revisions continue to embody that system. The water quality standards identify the conditions that must exist in Minnesota's water bodies to support each beneficial use. The proposed revisions do not dictate how a regulated party must achieve the industrial, irrigation, or livestock and wildlife beneficial uses or prescribe how they must operate to ensure compliance. The MPCA's proposed revisions, which move to narrative standards with implementation procedures that are tailored to the specific environmental conditions, allow maximum flexibility to regulated parties in choosing how to meet the standards and the existing rules also allow for variances.

2) Mandate of Minn. Stat. § 14.127 requiring determination of the effect of the proposed rule on small cities and small businesses

Minn. Stat. § 14.127, subds. 1 and 2) require an agency to "determine if the cost of complying with a proposed rule in the first year after the rule takes effect will exceed $25,000 for any one business that has less than 50 full-time employees, or any one statutory or home rule charter city that has less than ten full-time employees."

The intent of the statute is to have agencies discuss the effect of the proposed regulations on small cities and small businesses. As extensively discussed in the sections on the costs of compliance and the probable costs of not adopting the rules, this rulemaking generally serves to decrease the burden on small cities by increasing flexibility. Small cities have been among the most vocal proponents of the MPCA's decision to revise and update these rules, and many small cities endorsed comments in support of this rulemaking.

The MPCA expects that the majority of small cities and businesses would not have any new costs in the first year after the proposed rule takes effect. This is primarily because only a small number of cities and small businesses that operate wastewater treatment plants are likely to receive a new effluent limit because of the proposed rule. Small cities and small businesses that do not operate wastewater treatment plants or that operate wastewater treatment plants that do not discharge to surface water would not be affected by the proposed rule.

The proposed Class 4B water quality standards for total dissolved solids and sulfate are likely to be the driver of new effluent limits, and those effluent limits could impose new costs for wastewater dischargers. This is discussed for the permitted dischargers the MPCA expects to receive new effluent limitations, as described in section five above. The MPCA does not have sufficient information to know whether every one of these dischargers meets the definition of a small city or business, so for the purpose of this analysis, it reasonable assume that all identified businesses are small cities or businesses.

It is unlikely that the majority of the cities and businesses identified as requiring new limits would experience new costs in the first year after adoption of the proposed rule. This is primarily because of 'time lags' that are a necessary part of NPDES permitting, and which result in the cost of compliance with the new water quality standard – the costs that would reach the threshold – past the first year after adoption.

Effluent limits are usually not imposed immediately. Discharge permits are reissued every five years. When a new water quality standard is promulgated, the MPCA does not immediately reopen all 1000+ wastewater discharge permits and immediately add requirements that would impose costs. Instead, permits are evaluated when they next come up for reissuance. Facilities may bear costs for applying for permits – many facilities use consultants to prepare applications – but this cost generally would be borne for any permit application, and is not a direct result of this rulemaking.

If the facility does not monitor its effluent for the pollutant that is the subject of the standard, the first step in the process is generally to add monitoring for the next five-year permit term. This monitoring would cost approximately $200 to $500 per year for the parameters of concern in this rulemaking; monitoring would likely not reach the $25,000 threshold. Once monitoring data is available, the MPCA can determine if the facility has the reasonable potential to cause or contribute to an exceedance of the water quality standard and therefore needs an effluent limit. Any given permitted wastewater facility has approximately a one-in-five chance of having its permit come up for re-issuance within the first year of a newly adopted rule.

Once the MPCA determines that a discharger requires a new effluent limitation, it sends an "ASAP letter" to the permit holder, notifying them of the need for the new effluent limitation and their responsibility to comply as soon as possible. Typically upon receiving the "ASAP letter," the MPCA and the permit holder enter a period of discussion, ranging in length from several days to multiple months, to discuss the effluent limit and the implications of that limit. This period gives the city time to plan and, as needed, consult with legal and engineering professionals in order to better understand the implications of the new effluent limit on city operations. The MPCA is not legally obligated to provide this period of discourse, but it is a long-standing practice and fosters productive conversations that ultimately benefit permitting timelines. Drafting a permit can take a little or a lot of time depending on the complexity of the permit. Some permits can be drafted in a week of work (small municipal wastewater plants, etc.), while complex permits can take months or years to draft (large municipal wastewater plants, ethanol, taconite, etc.). The required public comment period for a permit can take up to 90 days depending on the type of permit. If there are many comments, the MPCA needs to spend time to respond to them. Some types of permits require EPA approval, which can take up to 60 days of review time. The combination of all of these time lags means that most of the affected discharges are unlikely to experience a new cost within the first year of the proposed rule.

The MPCA expects that some of the affected facilities might incur costs in 2021 or 2022 for a consultant to begin the process of evaluating their discharge and treatment options. They may also begin the process of bench-scale studies and facility design, although a variance application is more likely in that case. Although the cost of these activities cannot be estimated because of the uncertainty of the variables, the MPCA expects that they could be significant and could exceed $25,000. It may be possible that many or most of these facilities would qualify for a variance from the Class 3 and 4 effluent limits. In that case, the facility would not immediately incur treatment costs, but would still incur costs to obtain a variance. The cost to obtain a variance involves the fee charged by the MPCA, in this case only for non-municipal dischargers, as well as the cost of developing the variance proposal. Those costs could exceed $25,000, especially for an industrial facility with a complex wastewater discharge.

The MPCA finds that the regulatory threshold of $25,000 may be exceeded for some small businesses and cities in the first year after adoption of the proposed revisions. However, this is unlikely. Although the number of potentially affected small businesses and cities is relatively small compared to all the permitted facilities in Minnesota, and there are many factors and variables that will affect the impact of the adopted revisions, the MPCA expects that in at least some cases, the cost of proposed revisions could exceed the regulatory threshold in the year after adoption.

3) Mandate of Minn. Stat. § 14.128 regarding local implementation

Minn. Stat. § 14.128, subd. 1, requires an agency to make a determination of whether a proposed rule will require a local government to adopt or amend any ordinances or other regulation in order to comply with the rule. The MPCA has determined that the proposed amendments will not have any effect on local ordinances or regulations.

State water quality standards are not implemented at the local level and therefore, no changes will be required to local ordinances or regulations in response to the proposed revisions. However, the proposed revisions may affect a local unit of government in its role as the owner/operator of a wastewater treatment plant, and in that role, the local unit of government may impose additional conditions on discharges to their wastewater treatment plant. An example would be a city requiring pre-treatment of wastewater before it is sent to the city's municipal wastewater facility, or charging higher fees for discharges that contain the pollutants included in the Class 3 and 4 standards. These conditions may be in the form of significant industrial wastewater user contracts, ordinances, or regulations, but they are not specifically required by the proposed revisions.

It is likely that there will be minimal change to significant industrial wastewater user contracts, ordinances, or regulations a city might choose to employ as a result of the proposed rule. This is because under the proposed rule, very few cities operating wastewater treatment plants are likely to experience a new wastewater limit. Industrial wastewater user contracts, ordinances or regulations are typically only altered after the MPCA has formally notified the municipal wastewater permit holder that a new effluent limit will be included in a permit and that a change is needed to meet those limits.

Any changes to industrial wastewater user contracts, ordinances, or regulations as a result of a new wastewater limit are typically decided upon by the city council and mayor in consultation with wastewater treatment professionals, community input and the MPCA. These decisions always involve complex technical, economic and political considerations that are highly specific to the community and wastewater plant in question. The MPCA cannot predict with a reasonable certainty the types of changes, if any, to industrial wastewater user contracts, ordinances or regulations that a city might make in response to a new effluent limit that is a result of the proposed rule.

4) Mandate of Minn. Stat. § 116.07, subd. 2(f) requiring an assessment of the differences between the proposed rules and corresponding federal requirements and rules in states bordering Minnesota and states within EPA Region V

Minn. Stat. § 116.07 subd. 2 requires that for proposed rules adopting air quality, solid waste, hazardous waste, or water quality standards, the SONAR must include an assessment of any differences between the proposed rule and existing federal standards adopted under the Clean Air Act, title 42, section 7412(b)(2); Clean Water Act, United States Code, title 33, sections 1312(a) and 1313(c)(4); and the Resource Conservation and Recovery Act, United States Code, title 42, section 6921(b)(1); similar standards in states bordering Minnesota; and similar standards in states within the U.S. Environmental Protection Agency (EPA) Region 5; and a specific analysis of the need and reasonableness of each difference.

This requirement has been previously discussed in conjunction with the requirement of Minn. Stat. § 14.131.

5) Mandate of Minn. Stat. § 116.07, subd. 6 relating to the economic factors affecting feasibility and practicality of any proposed action

In exercising its powers, the MPCA is required by identical provisions in Minn. Stat. § 116.07, subd.6 and Minn. Stat. § 115.43, subd. 1 to give due consideration to:

> *…the establishment, maintenance, operation and expansion of business, commerce, trade, industry, traffic, and other economic factors and other material matters affecting the feasibility and practicability of any proposed action, including, but not limited to, the burden on a municipality of any tax which may result there from, and shall take or provide for such action as may be reasonable, feasible, and practical under the circumstances…*

The MPCA has met the requirements of this statute by the discussions provided in this part regarding the possible economic effect of the proposed rules.

6) Mandate of 2015 Minn. Session Law, ch. 4, article 3, subd. 2 requiring enhanced economic analysis and identification of cost-effective permitting

2015 Minn. Session Law, chapter 4, article 3, subdivision 2 authorized funds for "enhanced economic analysis in the water quality standards rulemaking process, including more specific analysis and identification of cost-effective permitting."

The MPCA has considered the effect of the proposed revisions as they relate to the MPCA's permit process for both industrial dischargers and municipal dischargers. The MPCA believes these changes will result in more cost-effective permitting, given the narrative translator methods implementation of site-specific and tailored local conditions. The MPCA has provided detailed economic analysis in this section, under items 5 and 6.

7) Mandate of Minn. Stat. § 115.035 requiring external peer review

Minnesota Statute § 115.035, as amended, requires that the MPCA commissioner conduct an external peer review during the promulgation or amendment of a water quality standard, or to state in the SONAR why such a peer review was not conducted: "*Every new or revised water quality standard must be supported by a technical support document that provides the scientific basis for the proposed standard and that has undergone external, scientific peer review. Numeric water quality standards in which the agency is adopting, without change, a United States Environmental Protection Agency* *criterion that has been through peer review are not subject to this paragraph. Documentation of the external peer review panel, including the name or names of the peer reviewer or reviewers, must be included in the statement of need and reasonableness for the water quality standard."*

The MPCA conducted an external peer review on the draft TSD (S-7) published for public comment on March 11, 2019. The peer reviewers also had access to the MPCA's Class 3 and 4 rulemaking webpage and all of the public comments received during the 2019 request for comment period. More information on the peer review is provided in the section on MPCA's rule development activities and in S-8.

8. Notice plan

Minn. Stat. § 14.131 requires that an agency include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule or must explain why these efforts were not made.

The MPCA utilizes a self-subscription service for interested and affected to register to receive rule related notices. Request for U.S. Mail service is available. Rule projects are listed on the Agency's Public Rulemaking docket. Once projects are active (i.e., no longer listed as a future project), a self-subscription list for that specific rule is established and an electronic notice is sent to individuals who have self-subscribed to receive notice for all rulemakings. The Agency also purchases the League of Minnesota Cities' email address list on a yearly basis. The list is used to reach out to new government officials that may not be familiar with the electronic delivery system used by the MPCA to send rule notices, public notices and other information. An electronic message is sent inviting individuals to subscribe to topics that interest them.

A. Required notice

The first rulemaking notice, required by Minn. Stat. § 14.101, is the Request for Comments (RFC). On both February 8, 2016 (S-11) and March 11, 2019 (S-12), the MPCA published notices in the *State Register* requesting comments on planned rule amendments to Minn. R. ch. 7050, related to revisions to Classes 3 and 4 standards. To further inform the public, the notices were placed on the MPCA's Public Notice webpage (https://www.pca.state.mn.us/public-notices*)* and the rule-specific webpage at https://www.pca.state.mn.us/water/amendments-water-quality-standards-use-classifications-3-and-4. The MPCA also notified interested parties who are subscribed to the Class 3 and 4 Rulemaking GovDelivery list of the RFC on the same day it was published.

B. Remaining required notifications

The remaining required notifications are listed below, together with a description of how the MPCA will comply with each.

1) The MPCA intends to send an electronic notice, using GovDelivery, with a hyperlink to the webpage where electronic copies of the Notice, SONAR and the proposed rule amendments can be viewed. The GovDelivery notice will be sent to all parties who have registered with the MPCA for the purpose of receiving notice of rule proceedings, as required by Minn. Stat. § 14.14, subd. 1a, on the date the Notice is published in the State Register. Parties within this group that have requested non-electronic notice will receive copies of the Notice and the proposed rule amendments in hard copy via U.S. Mail.

2) The MPCA intends to send a cover letter by e-mail with a hyperlink to electronic copies of the Notice, SONAR and the proposed rule amendments to the chairs and ranking minority party members of the legislative policy and budget committees with jurisdiction over the subject

matter of the proposed rule amendments as required by Minn. Stat § 14.116, on the date the Notice is published in the *State Register*.

3) Minn. Stat. § 14.111 requires an agency to provide a copy of the proposed rule changes to the Commissioner of Agriculture no later than thirty days before publication of the proposed rule in the State Register, if the rule has an impact on farming operations. This rule is expected to impact agricultural land or farming operations. The MPCA provided a copy of the proposed rule changes via e-mail to the Commissioner of the Minnesota Department of Agriculture on October 30, 2020.

4) The MPCA will send a copy of the SONAR to the Legislative Reference Library, in accordance with Minn. Stat. § 14.131, when the Notice required under Minn. Stat. § 14.14, subd. 1a is sent.

5) The proposed amendments are being conducted under the authority of Minn. Stat. § 115.44, which states:

   > *"For rules authorized under this section, the notices required to be mailed under sections 14.14, subdivision 1a, and 14.22 must also be mailed to the governing body of each municipality bordering or through which the waters for which standards are sought to be adopted flow."*

   Therefore, the MPCA will provide electronic notification to every municipality in Minnesota at least 33 days before the end of the comment period. To do so, the MPCA will use its April 28, 2020 list of all County Chairpersons and its April 28, 2020 list of all municipal officials purchased through the League of Minnesota Cities to send an e-mail that includes a hyperlink to the webpage where the Notice, proposed amendments and SONAR can be viewed, to 825 cities and 87 counties. The MPCA visited municipal websites to fill in available but missing city email addresses. The MPCA will send, via U.S. mail, a copy of the Notice of Hearing to township clerks (or chairperson, where clerk was not listed) using its August 5, 2020 list of township officers and to city officials not providing email addresses in the aforementioned League of Minnesota Cities list. This includes mailings to approximately 1,775 townships and 29 cities. Due to the COVID-19 pandemic and restricted building access, leading to low administrative staffing, this large mailing may not be completed on the same day as the Notice is published in the *State Register*, but it will be completed at least 33 days prior to the hearing.

The following notices are required under certain circumstances; however, they do not apply to this rulemaking and will not be sent:

1) Minn. Stat § 14.116 states that if the mailing of the notice is within two years of the effective date of the law granting the Agency authority to adopt the proposed rules, the Agency must make reasonable efforts to send a copy of the notice and SONAR to all sitting house and senate legislators who were chief authors of the bill granting the rulemaking. This does not apply because no bill was authored within the past two years granting rulemaking authority for the proposed amendments.

2) Minn. Stat § 116.07, subd. 7 requires notification of specific legislators of the adoption of rules apply to feedlots and fees. The proposed amendments do not relate to feedlots or fees, so this requirement does not apply.

In addition, a copy of the Notice, proposed rule amendments and SONAR will be posted on the MPCA's Public Notice webpage: https://www.pca.state.mn.us/public-notices.

C. Additional notice plan

Minn. Stat. § 14.14 requires that in addition to its required notices:

> *"each agency shall make reasonable efforts to notify persons or classes or persons who may be significantly affected by the rule being proposed by giving notice of its intention in newsletters, newspapers, or other publications, or through other means of communication."*

The MPCA's plan to notify additional parties includes the following components:

1) Publishing the Notice of Hearing on the proposed rule amendments on the MPCA's Public Notice webpage at https://www.pca.state.mn.us/public-notices.
2) Providing an extended public comment period. The MPCA is going to provide a 52-day comment period on the proposed rule. Extending the comment period beyond the 30-day minimum provides additional opportunity for potentially interested parties to review the proposed rules and to submit comments or hearing requests.
3) Providing specific notice to tribal authorities for all 11 federally-recognized Tribal Nations in Minnesota. Many representatives of tribes are already registered to receive GovDelivery notices. The MPCA maintains a list of tribal contacts for all Tribal Nations in Minnesota. The MPCA will also send specific electronic notice to the designated water quality contact persons for tribal communities. The notice will be sent on or before the day the proposed amendments are published in the *State Register*, and it will have a hyperlink to the location where electronic copies of the Notice of Hearing, SONAR, and proposed rule amendments can be viewed.
4) Provide specific notice to associations, environmental groups, and other entities, with a request that they share this information with their members, as applicable. The MPCA will send an electronic notice with a hyperlink to electronic copies of the Notice of Hearing, SONAR, and proposed rule amendments to the following entities on or before the day the proposed rule amendments are published in the State Register (Note: some members of these entities may already subscribe to receive GovDelivery notices):
   - Central Minnesota Irrigators
   - Coalition of Greater Minnesota Cities
   - Environmental Initiative
   - Hmong American Farmers Association
   - Irrigators Association of Minnesota
   - Isaak Walton League (Minnesota Division)
   - Minnesota AgriGrowth Council
   - Minnesota Association of Soil and Water Conservation Districts
   - Minnesota Association of Watershed Districts
   - Minnesota Association of Wheat Growers
   - Minnesota Center for Environmental Advocacy
   - Minnesota Chamber of Commerce
   - Minnesota Corn Growers' Association
   - Minnesota Environmental Partnership
   - Minnesota Environmental Science and Economic Review Board
   - Minnesota Farm Bureau
   - Minnesota Farmers' Union
   - Minnesota Lamb and Wool Producers Association
   - Minnesota Milk Producers
   - Minnesota Municipal Utilities Association

- Minnesota Nursery and Landscape Association
- Minnesota Pork Producers Association
- Minnesota Soybean Growers Association
- Minnesota State Cattlemen's Association
- Minnesota Trout Unlimited
- Minnesota Turkey Growers Association
- WaterLegacy

5) Provide notice to permitted wastewater dischargers through the MPCA's OnPoint electronic newsletter. The MPCA uses electronic newsletters to provide updates and information about rulemakings, as explained in Section 3 of the SONAR. The MPCA will include information in the OnPoint newsletter, which is distributed to subscribed wastewater discharge permit holders around the state. In addition to subscribing to the GovDelivery list for this rulemaking, most owners/operators of permitted facilities subscribe to MPCA's GovDelivery list for the OnPoint newsletter. The OnPoint newsletter has 3,238 subscribers as of December 1, 2020. The additional notice in the OnPoint newsletter provides another opportunity for owners/operators to take notice of this information, including a hyperlink to the webpage where electronic copies of the Notice of Hearing, SONAR, and proposed rule amendments can be viewed.
6) In addition to providing notice to MPCA permittees, the MPCA will provide specific notice to persons who use water for irrigation or livestock watering. Persons who use water for these purposes may be affected by discharges from permitted wastewater dischargers. As per Minn. Stat. § 103G.265, the DNR maintains a water appropriations permitting database that lists all holders of water appropriations permits. This is the most comprehensive list of water appropriators available. Several categories in the DNR database identify industrial and agricultural permittees who are authorized to withdraw water for industrial and agricultural uses. The MPCA will provide notice to holders of DNR appropriation permits related to both industrial and agricultural categories. The MPCA will send an electronic notice with a hyperlink to electronic copies of the Notice of Hearing, SONAR, and proposed rule amendments to those DNR appropriation permit holders that have provided their email address to the DNR. This will occur on or before the day the proposed rule amendments are published in the *State Register*.
7) Post relevant rulemaking updates and associated documents on the MPCA's Class 3 and 4 Revisions webpage at https://www.pca.state.mn.us/water/amendments-water-quality-standards-use-classifications-3-and-4.

The MPCA believes that by following the steps of this Additional Notice Plan, and its regular means of public notice, including early development of the GovDelivery mail list for this rulemaking, publication in the *State Register*, and posting on the MPCA's webpages, the MPCA will adequately provide additional notice pursuant to Minn. Stat. § 14.14, subd. 1a.

9. Environmental Justice and Tribal policies

The MPCA has internal policies that require specific attention to issues around the impact of proposed rules on certain populations, and the engagement of key groups in rulemaking that is likely to affect those groups. The following discusses how the Agency's separate policies around environmental justice and tribal engagement and consultation were considered in this rulemaking. It is included in this section of the SONAR for ease of review with the regulatory analysis, though these analyses are not required under Minnesota's APA.

A. Environmental Justice

1) Environmental Justice policy

The MPCA's Environmental Justice Framework describes the MPCA's history with environmental justice (EJ):

> *Following action on the national level, the MPCA began formally working on environmental justice in the mid-1990s. Presidential Executive Order 12898, issued in 1994, directed each federal agency to make 'achieving environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority and low-income populations.' The Presidential Executive Order built on Title VI of the Civil Rights Act of 1964. Title VI prohibits discrimination on the basis of race, color, or national origin. As a recipient of federal funding, the MPCA is required to comply with Title VI of the Civil Rights Act (Brooks & Solas, 2015, p.3).*

The MPCA operates under a policy for environmental justice that closely mirrors the EPA policy. The MPCA's policy states:

> *The Minnesota Pollution Control Agency will, within its authority, strive for the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.*
>
> ***Fair treatment** means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies.*
>
> *Meaningful involvement means that:*
>
> - *People have an opportunity to participate in decisions about activities that may affect their environment and/or health;*
> - *The public's contribution can influence the regulatory agency's decision;*
> - *Their concerns will be considered in the decision making process; and*
> - *The decision-makers seek out and facilitate the involvement of those potentially affected.*
>
> *The above concept is embraced as the understanding of environmental justice by the MPCA.*
>
> *As explained on page 11 of the EJ Framework, when undertaking rulemaking the MPCA considers how the impacts of a proposed rule are distributed across Minnesota, with a particular focus on the possibility of differential impacts that may lead to a*

disproportionate burden on communities that have a higher proportion of low-income people or a higher proportion of people of color and indigenous people. The MPCA also works to actively engage all Minnesotans in rule development, facilitating involvement so that all concerns are considered in the decision making process. (MPCA, 2010, "policy" section)

2) Equity analysis

The MPCA strives to evaluate how proposed rule amendments may affect communities that have a higher proportion of low-income residents or of Black, Indigenous, and people of color (BIPOC). In particular, the MPCA's goal is to ensure that implementing the proposed rules will not create disproportionate impacts or worsen existing areas of disproportionate impact (where environmental burdens and the resulting human health effects, or access to environmental benefits, are unequally distributed among the population). Ideally, the proposed rules may help to mitigate existing areas of disproportionate impact.

Where applicable, the MPCA also looks at the distribution of the economic costs or consequences of the proposed rule, and whether those costs are disproportionately borne by low-income populations or communities of color.

The MPCA has established screening criteria based on population characteristics to identify areas of potential environmental justice concern. If a rule (or other agency action) is likely to have a differential impact on areas that meet the screening criteria, the action has a higher likelihood of causing or exacerbating disproportionate impacts and should be further reviewed. The screening criteria are applied to census tracts. Areas of potential environmental justice concern include those census tracts where the population is 50% or more people of color and indigenous people or where 40% or more of the population has a household income less than 185% of the federal poverty level. Federally recognized Tribal areas are also considered as potential areas of concern.

The MPCA does not expect the proposed rule changes to have negative environmental consequences. The proposed rules are designed to be as protective of the industrial and agricultural beneficial uses as the currently applicable Class 3 and 4 water quality standards. All the Class 3 and 4 water quality standards continue to apply statewide, and as a general or default classification to all waterbodies.

Demonstrating the protectiveness of numeric standards is somewhat simpler than demonstrating the effectiveness of narrative standards, as numeric standards are more easily implemented. The proposed Class 4B water quality standards represent simple changes to numeric standards. However, because the existing Class 4B standards are not well documented, the MPCA conducted a current review of the appropriate parameters and concentrations to be included in Class 4B. The MPCA considered available information, including science generated since the original rulemaking, to inform decisions on the appropriate standards to include in this rulemaking. As a result of this review, the MPCA added components of duration and frequency to the standards; added new numeric standards for sulfate and nitrate plus nitrite; replaced the outdated salinity standard with a new numeric standard for total dissolved solids; and retained the current numeric pH standards. These proposed changes to the Class 4B numeric standards will maintain the protection of the livestock and wildlife use class and will not be further evaluated in this portion of the SONAR.

The proposed changes to the Class 3 and Class 4A water quality standards are more substantial changes, with the move to a narrative standard and the design of new implementation procedures. It is these changes that are evaluated more specifically for the potential to create or exacerbate disproportionate impacts. Some commenters have raised concerns that a narrative standard is inherently less protective. These comments raise concerns that the changes will allow dischargers to increase the level of pollutants that they are discharging into Minnesota's waters.

As described in other sections of this SONAR, a narrative standard is not inherently less protective nor does the proposed rule allow increased discharge of pollutants. A robust and properly implemented narrative standard is protective of the beneficial uses. Thus, the MPCA has taken care to craft detailed implementation procedures – particularly a narrative translator for determining where protective permit limits are needed - to ensure that the proposed narrative standards are well implemented and effective.

As with the current Class 3 and 4 standards, the water quality standards in the proposed rule apply statewide, providing the same level of protection of the beneficial use in all parts of the state. However, implementation is reasonably based on local conditions. For Class 3 and Class 4A, the narrative translator process means that implementation will be focused towards ensuring specific conditions are met at the point where water is (or has been) appropriated for use for industrial purposes or for irrigation (i.e., at the point of appropriation for the beneficial use). If appropriation permits are not equally spread around the state, or if fewer are found in areas of potential environmental justice concern than the MPCA would expect, there may be the potential for a disproportionate impact – in that dischargers to water bodies located in areas of EJ concern would be less likely to be reviewed to determine if they caused a concern for meeting the water quality standards.

The MPCA mapped the location of agricultural appropriators (Figure 17) and industrial appropriators (Figure 18) overlaid with the census tracts that meet the screening criteria as being areas of potential EJ concern, including Tribal areas.

Figure 17. Agricultural appropriations and areas of environmental justice concern.

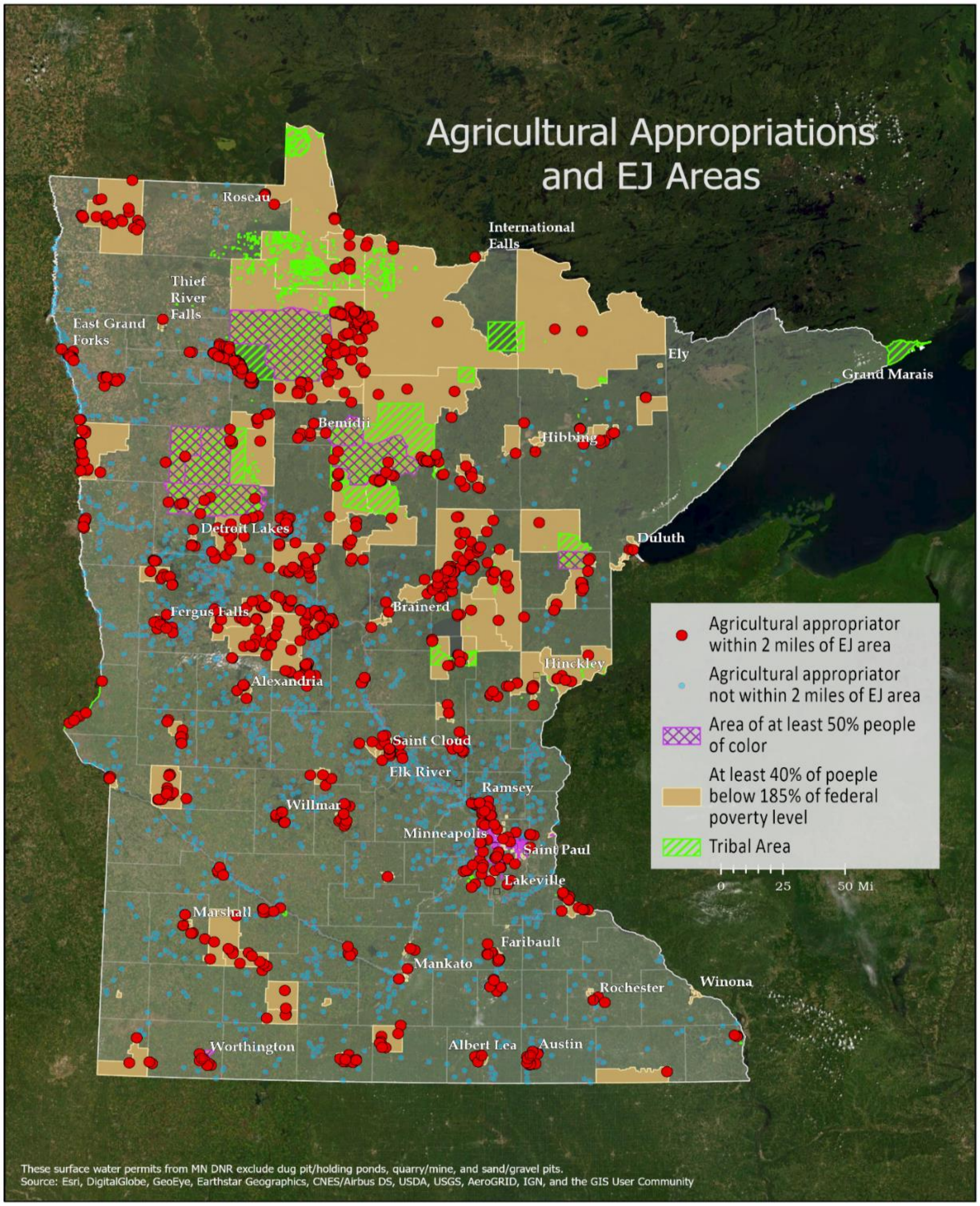
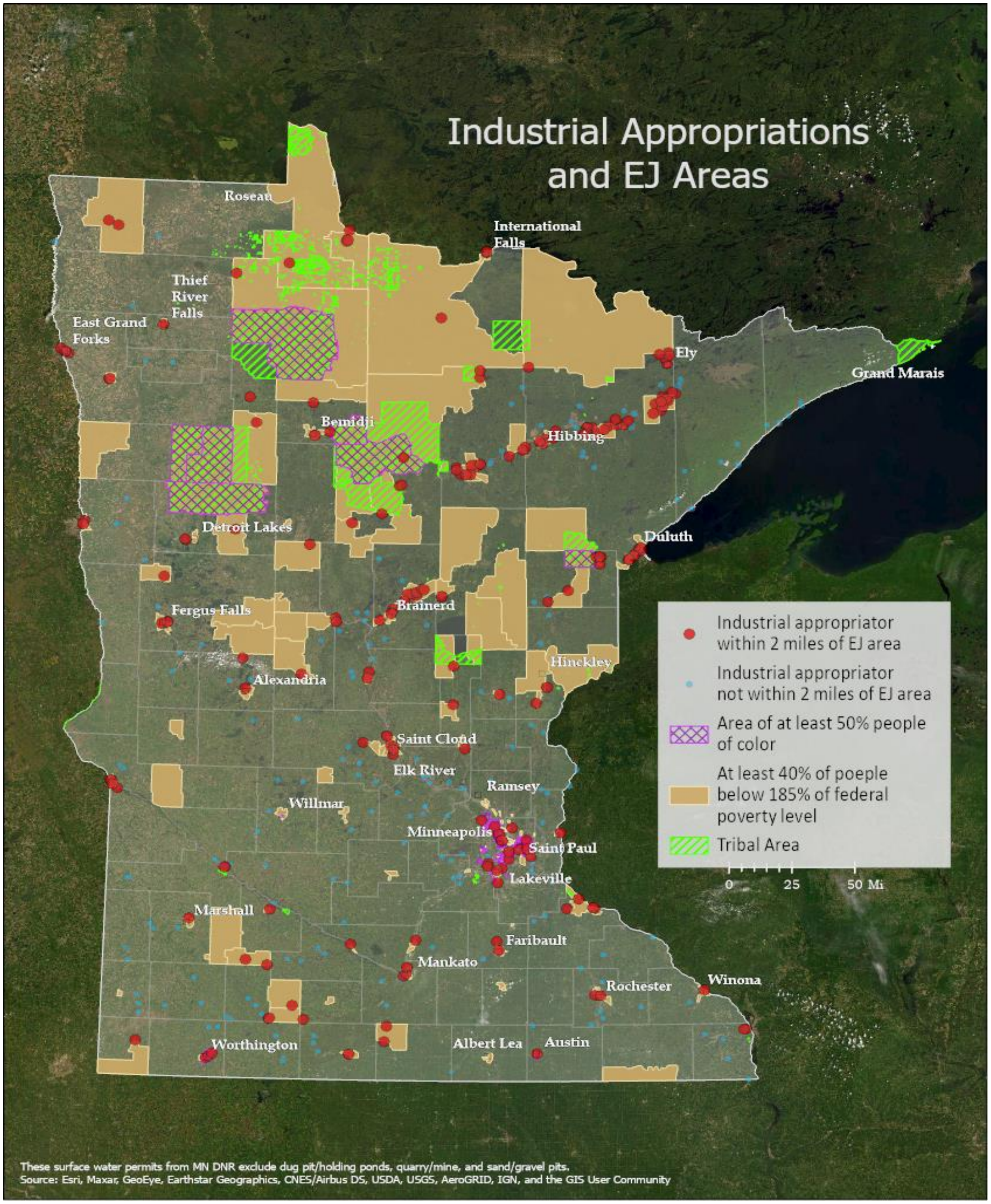


Figure 18. Industrial appropriations and areas of environmental justice concern.



There are a total of 3,158 agricultural appropriators and 560 industrial appropriators. There are 1,158 agricultural appropriators and 290 industrial appropriators within two miles of a Tribal area, or an area where at least 40% of the people are below 185% of the federal poverty level, or an area with at least 50% BIPOC. Two miles was used in developing the translator approach as likely the farthest distance that a water appropriator would move water – i.e., an appropriating industry or irrigated field is likely to be located within two miles of its appropriation point. It is a reasonable distance for whether a location of appropriation could be considered to be "near" an area of potential EJ concern.

Based on this analysis, the total number of agricultural appropriation permits considered was 3,158 and industrial appropriation permits considered were 560; with 1,158 and 290 of those permits (or points of appropriation) respectively, located within 2 miles of census tracts that are areas of potential EJ concern including Tribal areas. (Approximately 39% of the appropriations.)

The total number of census tracts within Minnesota is 1,338. The number of census tracts that meet MPCA's screening criteria to be considered as areas of potential concern for EJ including Tribal areas is 470 (Approximately 35% of all of Minnesota's census tracts.)

The distribution of highly polluting industries might provide evidence of potential disproportionate impact – i.e., that there are more permits for highly polluting industries within the areas of potential concern. However, in this case the MPCA is looking at permits to appropriate, or take water out.

(While there may be concerns about water being over-appropriated in certain areas, the MPCA does not issue appropriation permits and the proposed water quality standard rule does not impact the way that water appropriations are managed. The Minnesota Department of Natural Resources has authority for water appropriations under Minn. Stat. § 103G.)

As noted elsewhere in this SONAR, while the standards apply to all waters, the MPCA's planned implementation approach will focus on the locations of appropriation permits. These locations are the points that will be reviewed and evaluated to determine the need for an effluent limit to be applied to an upstream discharger, and to establish such a limit if needed. For the purposes of this analysis, therefore, the apparent over-representation of appropriation permits within areas of potential EJ concern might actually result in more effluent limits being applied to facilities that appropriate waters close to those areas of potential concern.

The proposed rule, and associated implementation approach, should not result in any adverse impact.

B. Tribal engagement and coordination

The geography that called Minnesota is also home to 11 federally recognized Tribal Nations. In 2019, an executive order directed "[m]eaningful and timely consultation between the State of Minnesota and the Minnesota Tribal Nations [to] facilitate better understanding and informed decision making by allowing for collaboration on matters of mutual interest and help to establish mutually respectful and beneficial relationships between the State and Minnesota Tribal Nations" (Minnesota Executive Order 19-24, 2019). The executive order calls for the agencies to implement tribal consultation policies and requires that state agencies "must consider the input gathered from tribal consultation into their decision-making processes, with the goal of achieving mutually beneficial solutions."

The MPCA's tribal consultation policy is currently under revision, as it was drafted to support a prior executive order. Key components of the current tribal consultation policy, however, are very much in line with EO 19-24. The MPCA's (2013) policy states that the MPCA will consult "when MPCA actions and decisions may directly affect Tribal interests" and directs that "[c]onsultation should occur early enough to allow Tribes the opportunity to provide meaningful input that can be considered prior to MPCA deciding whether, how, or when to act on the matter under consideration."

The policy also notes that consultation does not replace ongoing communication and more routine conversation and engagement between MPCA and Tribal Nations. The MPCA is fortunate to have a relatively long history of staff-level engagement between MPCA programs and their counterparts in Tribal environmental departments. This ongoing engagement ranges from individual connections and small group discussions to participation in larger conversations such as those that occur at the Minnesota Tribal Environmental Council (MNTEC) meetings. These conversations result in information and opinion sharing and input, but certainly do not always result in mutual agreement on a path forward for any given issue.

The Class 3 and 4 rulemaking has been the subject of multiple engagement conversations and participation steps with varying degrees of focus and formality. This section covers the specific concerns raised by Tribal nations and interests and how the MPCA reviewed and responded to those concerns.

1) Tribal comments

Request for Comments

The MPCA published two specific Requests for Comment (RFCs) on possible amendments to rules governing water quality standards for Class 3 and Class 4 designated uses. The first was on February 8, 2016 (40 SR 965, S-11), and the second RFC was published on March 11, 2019 (43 SR 1067, S-12). Prior to those specific RFCs, formal opportunities for the public to comment on the scope and options for the revisions occurred during the 2008, 2013, and 2017 Triennial Standards Reviews.

Tribal comments were received in response to the 2019 RFC, from Fond du Lac, Grand Portage, and the Great Lakes Indian Fish and Wildlife Commission (GLIFWC). GLIFWC is an agency with delegated authority from 11 federally recognized Ojibwe (or Chippewa) tribes in Wisconsin, Michigan, and Minnesota, including the Fond du Lac and Mille Lacs bands in Minnesota.

In their comment letter, Grand Portage requested tribal consultation on this rulemaking. In subsequent discussions with MPCA's Tribal liaison, Grand Portage staff indicated that their key concern was ensuring that their comments had been heard and considered by the MPCA. This section of the SONAR is designed to demonstrate that consideration; it was shared with Tribes who had expressed interest in this rulemaking on August 24, 2020 in advance of the formal rule proposal.

Some common themes were expressed by all tribal commenters in their responses to the RFC. Following are the themes expressed each followed by MPCA's response.

1. ***Narrative standards are less protective and rarely enforced:*** Grand Portage and GLIFWC do not support the change from numeric to narrative standards proposed for Class 3 and Class 4A; they see narrative standards as less protective and less enforceable. Fond du Lac commented that MPCA has a history of not enforcing narrative or numeric standards, and that the replacement of numeric standards with narrative standards is not scientifically defensible.

The MPCA recognizes that many older narrative standards are not regularly enforced, in that they are not generally incorporated into permit limits. To ensure that these new narrative standards are fully implemented and providing appropriate protection for the beneficial uses to which they apply, the MPCA has developed a detailed implementation process for these rules. In SONAR Section 6.B, the MPCA describes a specific process for developing numeric permit limits to implement the narrative standard (also known as a translator approach). This approach includes detailed consideration of the science of the factors that result in waters not being able to support the industrial or agricultural beneficial uses.

2. ***Protective aquatic life water quality standards are needed before this rulemaking should go forward; protect the most sensitive use***. Tribal commenters do not support moving forward with Class 3 and Class 4 rulemaking until appropriate Class 2 standards are in place to protect aquatic life from known effects of salty parameters. GLIFWC suggests developing a specific conductance or total dissolved solids Class 2 standard to protect aquatic life from effects of salinity. Fond du Lac comments that MPCA is removing the most restrictive standards for salty parameters, and cites Minn R. 7050.0450: "if the water quality standards for particular parameters for the various classes are different, the more restrictive of the standards apply." They further commented that eliminating the specific conductance

standard would constitute backsliding. Grand Portage commented that “MPCA is well aware of the adverse impacts to aquatic life from salty discharges” and quoted 40 CFR. § 131.11(a), which states “For waters with multiple use designations, the criteria shall support the most sensitive use.”

The MPCA is aware of, and shares, the concern over the likely impact of salty parameters (e.g., ionic pollutants such as chloride, sulfate, and specific conductance) on aquatic life. The MPCA is working to respond to this issue on multiple fronts and as discussed below, continues to follow the federally-led efforts to develop a water quality criteria for sulfate and chloride. The MPCA will soon be developing our next water quality standards workplan as part of the upcoming 2021 Triennial Review, and will be considering (and requesting comment on) where these standards should fall on our priority list. MPCA understands that simply the promise of future action on these issues is not compelling to the Tribal entities that have raised these concerns both in discussions around this rulemaking and in other discussions over the past few years. The MPCA acknowledges the past history of MPCA and other government entities making promises and not fulfilling them.

The MPCA is undertaking, or planning to undertake, several steps related to the protection of our water resources from salty parameters. As required by MPCA, some wastewater treatment facilities started monitoring for chloride and other salty parameters in 2009. Based on the monitoring, some wastewater treatment facilities are now receiving effluent limits for chloride in reissued permits. Actions taken to reduce chloride discharge will, in many cases, also reduce the discharge of other ionic pollutants.

As identified in MPCA’s most recent triennial standards review, the agency plans to revise the aquatic life chloride standard and develop a new aquatic life sulfate standard. These revisions will be based on recent toxicological studies supported by the EPA, once those studies have been published in the peer reviewed literature. Because ion toxicity to aquatic life, both on an individual basis and well as in combination, is of national interest, the agency intends to work closely with the EPA in the development of these standards.

40 CFR § 131.11 requires states to adopt water quality standards that protect the designated uses for each use classification. The water quality standards developed for Class 3 and 4 only ensure that the intended designated use is protected (i.e., industrial consumption, irrigation, livestock or wildlife). A water quality standard in one class does not protect for a designated use in another class. That is because the target is different for each class. For Class 3 and 4, the target is protection of industrial, irrigation, livestock or wildlife beneficial uses; while the Class 2 target is protection of aquatic life and recreation beneficial uses. The water quality needs of irrigation or livestock or industry are inherently different than the water quality needs for aquatic life. In addition, the science supporting the protection of aquatic life is significantly different that the science supporting the protection of crop irrigation or industrial use. Because these targets are so different, it is impossible to develop one unified water quality standard that protects every designated use at the same time. This concept is fundamental to the Clean Water Act which encourages states to adopt multiple water quality classes for the targeted protection of different beneficial uses. Minnesota rule Minn. R. 7050.0140 and 40 CFR § 131.10 intentionally require distinct designated uses to ensure that tailored water quality protections are developed that are specific only to the designated use.

For states, like Minnesota, that have multiple use classifications, the Clean Water Act requires the state when setting effluent limits in permits to apply the water quality criteria that supports the most sensitive use. This requirement applies during implementation of the entire panoply of water quality standards adopted across use classes; it does not apply during the establishment of a water quality standard to protect a specific beneficial use. If that were the case, then there would not be a need for multiple use classes to protect distinct beneficial uses. It is logical that if two water quality standards exist to protect several beneficial uses in a single waterbody, the most restrictive water quality standard is the determining factor in setting an effluent limit in a permit. You could separately calculate effluent limits based on each of the water quality standards, but the lesser restrictive limit will always be superseded by the more restrictive limit because they both apply to the same waterbody and the same discharger.

While the Class 2 aquatic life use is likely to be more sensitive to certain pollutants than the uses covered in this rulemaking, there are currently no federally recommended criteria for aquatic life for many of these salty parameters – such as sulfate or specific conductance. The studies referenced above, and the development of a recommended criteria by EPA, are important steps towards the development of a Class 2 water quality standard to protect aquatic life from these pollutants.

However, there is significant scientific development still needed to move towards ion-specific standards. This science would need to be well-developed, go through the peer review process mandated in Minn. Stat. § 115.035, and be sufficient to allow the MPCA to make reasonable choices about the magnitude, duration, and frequency of the standard(s) values chosen. It would stymie the MPCA's ability to keep our rules updated if no changes could be made unless and until standards for all pollutants that may possibly impact aquatic life are developed. This is one of the reasons that Minnesota, along with many other states, have narrative standards to protect aquatic life – to address areas where impacts are occurring but the science to support a numeric standard may still be in development.

Driven by these comments, the MPCA has developed an interim translator approach that will allow the development of permit conditions as needed to ensure that aquatic biology is protected from the potential adverse impacts of ionic parameters. As part of this rulemaking, the MPCA has developed the first phase of this process by reviewing biological data and specific conductance levels, and analyzing those waters most likely to have biology that is adversely impacted by salty parameters. The determination of potentially impacted waters is conducted through a weight of evidence approach that looks at biological data and macroinvertebrate index of biological integrity (MIBI) scores, a conditional probability of IBI impairment based on specific conductance, and specific conductance levels compared to regional benchmarks.

The MPCA then looked upstream of those potentially impacted waters, to see which dischargers are likely to be contributing to levels of salts. The analysis has assumed that specific conductance is the pollutant of most concern and that it is an appropriate surrogate for effects from salty parameters.

The list of waters and permittees, along with more details on the analysis are included in S-5. Moving forward, when permits for the identified dischargers are reissued or revised, or when new permits are issued for discharges into those waters, the permitting process will specifically consider what permit conditions are needed to ensure the protection of the biological community. Some potential permit actions and conditions are described in the Appendix. The MPCA expects there would be substantial engagement with interested Tribes to implement this approach on a permit by permit basis. This approach was discussed at a meeting with interested tribal technical staff on November 6, 2019. The initial tribal response is further discussed in the following section, which documents that engagement meeting.

3. ***More information is needed on the narrative translator, which should be developed before proposal of the rule.*** GLIFWC commented that that it was not clear how reasonable potential (RP) would be calculated, and that the narrative translator should be described in enough detail to determine what the equivalent numeric value would be. Fond du Lac did not support the use of a working group to develop a process to translate the narrative standard into a numeric value. In their comments, Fond du Lac said it is the MPCA's responsibility, under its delegated CWA authorities, to determine how water quality standards will be implemented in a manner consistent with state and federal regulations.

The MPCA generally agrees with these comments and has proceeded accordingly. The MPCA has developed the translator as part of the proposed rule and proposed incorporating the methods by reference. The translators for both Class 3 (S-3) and Class 4B (S-4) are described in Section 6.B of this SONAR

In addition to simply describing the translator process, the MPCA has provided significant detail about how the translator process will be applied. This SONAR includes 7.A.1), a discussion of the classes of people and organizations that would be affected by the existing Class 3 and 4 water quality standards and the proposed new standards. That analysis focuses on NPDES wastewater dischargers and how they would be affected by the proposed rule. Included are lists of affected wastewater treatment plants (WWTPs), what limits they might receive under the current and proposed rules, and the likely costs of compliance with any limits. The underlying data, processes and results of the Class 4A translator are visible in an online data viewer that is designed so that a user could see the specifics of the likely outcomes of the class 4A translator for every WWTP in the state. In addition, the Class 3 translator includes substantially more detail than in the draft TSD (S-7) and specific examples of how the translator will be used are included. The MPCA believes all this information will provide clarity on how the translator will work and where it will be applied, demonstrating the MPCA's commitment to implementation and providing tools for outside parties to ask questions and otherwise hold the MPCA accountable for appropriate implementation.

4. ***Protect the most sensitive species rather than convert to a narrative*.** GLIFWC commented that having a wide range of tolerances is not a reason to convert to a narrative standard for 4A. The most sensitive species (i.e., blackberries are sensitive to boron) should be protected.

This rulemaking takes care to ensure that the most sensitive species or condition is protected within a designated use. (See the discussion on item 2, above, about protecting the most sensitive use.) It is important to remember that these are water quality standards for Minnesota, and should take into account the conditions in Minnesota.

The current Class 4A irrigation water quality standards are conservatively protective of irrigation in areas with arid climates and salinized soils like the central valley of California. Thus, they are overly protective of the most sensitive irrigation conditions in Minnesota where the climate is much wetter and soils are have lower salinity. The MPCA feels that the proposed water quality standards should protect sensitive conditions in Minnesota not those in southwestern states with crops, climates, and soils that are unlike Minnesota. For example, avocadoes are particularly sensitive to salinity, but they are a tropical fruit and protecting tropical fruits in a non-tropical climate does not make sense.

The proposed irrigation narrative translator identifies crops and soils that are sensitive to salts in irrigation water and protects irrigation water quality used on those sensitive crops through appropriately protective numeric values tailored for Minnesota. The MPCA believes that, because of the diversity of crops and soils in Minnesota, the narrative standard coupled with our translation approach for developing effluent limits is the best way to ensure that the standard is appropriately protective in as many areas as possible.

The proposed industrial consumption narrative translator protects for sensitive industrial uses such as small businesses with limited revenues. In the case of the Class 4B livestock/wildlife use, the MPCA has chosen to protect the most sensitive species of livestock because livestock and wildlife are likely to be relying on the same water.

5. ***Protection of downstream (particularly Tribal) water quality standards.*** Both the Fond du Lac and Grand Portage bands have Treatment as a State under the Clean Water Act, and have promulgated their own water quality standards that apply to waters within their boundaries. Tribal comments generally raised concern about the impact of the proposed revisions on tribal lands. The Fond du Lac Band in their comments on the 2019 RFC raised concerns that the draft TSD (S-7) does not adequately address or describe how MPCA would ensure a permittee's compliance with downstream water quality standards, and specifically ensure that an upstream permittee would not violate the Band's WQS during low flow conditions.

The MPCA considered the potential impact of the revised water quality standards to Tribal lands, specifically to waterbodies on reservations. The Fond du Lac Band of Lake Superior Chippewa (Fond du Lac) and the Grand Portage Band of Lake Superior Chippewa (Grand Portage) have Treatment as a State under the Clean Water Act allowing them to adopt water quality standards. Other tribes in Minnesota (Leech Lake Band of Ojibwe) are in the process of applying for this status, and any other federally-recognized tribe may do so in the future. Minnesota Rules (Minn. R. 7050.0155) require the MPCA to ensure, in our water management activities, that the water quality standards of downstream states and Tribes with Treatment as a State are adequately protected.

The MPCA implements this rule through our water quality programs, including wastewater permitting. The Agency ensures that permits contain sufficient requirements so that water quality standards are met in the direct receiving water and in all downstream waters, including any waters under the jurisdiction of another State or Tribe and therefore subject to water quality standards that are different than Minnesota's. The MPCA's effluent limit development process regularly takes into account all downstream waters. Applicable water quality standards of a downstream state or Tribe are evaluated as they would be by the implementing state. Both Fond du Lac and Grand Portage have set water quality standards for some of the pollutants which currently have numeric standards in the Class 3 and Class 4A water quality standards that will be moving to narrative standards, and for some of the pollutants with proposed Class 4B numeric standards. The implementation procedures for the narrative standards explicitly call out the need to evaluate whether a discharging facility needs an effluent limit to ensure that any tribal water quality standards will be met. Therefore, these proposed rule changes will not have an impact on the likelihood that tribal water quality standards will be met. While MPCA anticipates and is generally proposing to use a moderate flow condition for the Class 3 and 4 standards, the process explicitly calls out the need to evaluate any downstream standards, including those established by a Tribal nation. If Fond du Lac's relevant standards apply at a low flow condition, MPCA will evaluate the need for permit conditions at that low flow condition.

6. ***Protection of existing uses***. Another big picture concern conveyed by the Tribes is the need to ensure that existing uses – any use that has been in place in the water on or after November 28, 1975 – are protected and maintained. As stated in April 2019 comments from Fond du Lac, "In order to meet the CWA requirement that existing uses be maintained as an absolute water quality floor (Tier 1), MPCA must conduct, and provide for public comment, additional and substantial analysis beyond what is currently in the TSD demonstrating that the proposed revisions will not negatively impact existing uses" (S-10, p. 52) Grand Portage also raised concerns about the protection of the wild rice existing use.

The MPCA has written the proposed rule so that Class 3 and Class 4 uses will continue to apply as a default to all waters of the state; the use is not being removed from any waters where it was previously designated. The translator approach to be used for determining where permit effluent limits are needed relies on DNR appropriation permits. The MPCA finds that the existence of an appropriation permit is the best means of identifying where the irrigation use is occurring and in need of protection. The initial draft TSD (S-7) spoke to using active appropriation permits. However, in response to this concern and comment, in the proposed rule the MPCA is using all active and inactive appropriation permits that have been issued since November 28, 1975. This will ensure additional protection of existing uses.

This rulemaking is not changing the wild rice sulfate water quality standard. The MPCA has engaged in consultation with Minnesota's federally recognized Tribes about the process and procedures to work together to develop a comprehensive path forward for the protection and restoration of wild rice in Minnesota, including the wild rice sulfate standard. While a holistic path forward is not yet clear, the MPCA hopes that we can develop a collaborative process for addressing many concerns related to wild rice, including the protection of existing uses.

In addition to the broader themes above, additional comments specific to the various parts of the rule were received. These are briefly summarized below followed by MPCA responses.

<u>Additional Class 3 comments</u>

7. If industry is capable of treating their incoming water, they should be able to treat the water leaving their facilities as well (Fond du Lac, Grand Portage). In addition, MPCA's TSD relies on skewed or

insufficient data from only a handful of large appropriating industries, including mining (Grand Portage).

This comment is in response to MPCA's discussion in the initial draft TSD (S-7) that industrial users find the consistency of the water quality to be more important than having any specific quality. The MPCA agrees that facilities should be required to treat their outgoing wastewater. Most industries do, whether they discharge it directly to a waterbody or discharge to a municipal wastewater treatment facility as a significant industrial user.

The technologies needed to treat appropriated water (i.e., the water coming in to the facility) are not always the same as the technologies needed to treat an effluent discharge. Treating appropriated water typically requires less treatment than treating effluent. For example, a meat processor might require minimal treatment of appropriated groundwater because it is naturally free of organic matter but would require significant effluent treatment to treat meat processing waste streams.

Under the translation approach developed for these rules and to be further developed for the Class 2 biological narrative, facilities whose discharge could cause an exceedance of the narrative standards will have permit limits that may require treatment of their discharge.

Additional Class 4A comments

8. The Class 4A approach does not account for climate change and unanticipated shifts in Minnesota's future crop rotations. The narrative translators do not provide protection for unanticipated future uses (Fond du Lac).

The MPCA acknowledges that concerns about climate change impacts (including on crops) are real and important. However, the MPCA does not have the ability to predict future agricultural conditions in response to climate change. All data used in the translator approach to determine the need for effluent limits will be updated on an annual basis – this includes the information about crops grown in an area, the information about soil type and salinization risk, and the universe of DNR appropriation permits. Continually updating this information and extending the information that is available will be the best way to ensure that the MPCA is capturing any changes that are ongoing due to climate change, and the approach of a narrative standard and a translation process will allow responses to these changes. The standards continue to apply to all waters to protect future uses.

Additional Class 4B comments

9. Class 4 standards are supposed to protect wildlife. Some wildlife species consume fish, and they could be exposed to additional mercury (Fond du Lac).

Minnesota has adopted (Minn. R. 7050.0222) water column and fish tissue water quality standards for mercury to protect aquatic consumption of fish by humans. Those water quality standards are the applicable standards for mercury. If MPCA determined that standards for mercury were needed to protect wildlife drinking water use, mercury standards could be added to the Class 4B standards. If other standards are needed to protect wildlife in the future, such as through wildlife consumption of fish tissue, the MPCA could make revisions to the Class 4B beneficial use or add a new beneficial use.

Fond du Lac has consistently raised concerns about the role of sulfate in mercury methylation. The MPCA acknowledges that increased concentrations of sulfate have been shown to increase the methylation of mercury in specific aquatic systems – where organic carbon is available and especially where background sulfate concentrations are low. Only methylmercury accumulates in fish, so enhanced production of methylmercury is a significant concern. The MPCA has reviewed what is known about the effect of elevated sulfate on mercury methylation, and finds that the relationship between sulfate and mercury methylation is significantly complex, and it cannot be assumed that a standard on sulfate will decrease mercury methylation. However, this rulemaking does, for the first time, establish a statewide standard for sulfate –

a 600 mg/L standard to protect livestock.

The MPCA has also developed plans for completing the TMDL for mercury in the St. Louis River, a highly methylating water. Studies completed for this water body would be the best way to learn more about the factors influencing methylation.

10. If numeric standards for specific conductance are removed, it can cause removal of sensitive aquatic insects, which is not protective of wildlife (Fond du Lac).

See discussion for item 2, above.

11. Changing total salinity to total dissolved salts is sound. However, increasing the standard to 3000 mg total dissolved solids/L is unlikely protective of all wildlife species. A standard of 1000mg total dissolved solids/L should be used instead.

The TSD (S-2, Section 5.4.3) provides detailed support for the MPCA's proposed 3000 mg/L TDS standard. In summary, there is no supporting information in Class 4B historical rule record for the 1000 mg/L total salinity value. Therefore, it is not clear what the standard was designed to protect. Most data related to effects of water quality to terrestrial animals are centered on livestock and laboratory species, rather than wildlife species. Due to general lack of wildlife data, the MPCA is proposing to use livestock data as surrogate data for terrestrial wildlife species. Current literature and agricultural guidelines support the use of 3,000 mg/L as a protective value for livestock based on poultry and dairy cattle, which are the most sensitive species. Any available wildlife data was also considered. There are some studies that look at the toxicity of saline water to birds. The toxicity varies among species. Review of these studies suggest that birds that are associated with aquatic environments appear to be less sensitive to saline waters than typical poultry species.

Additional comments on wetlands

12. If wetland water quality standards are moved to Class 4A and 4B, then those standards should protect wetland plants. Without adequate data, numeric standards should be set conservatively low. In addition, there is no clear path forward for the goal of moving standards to protect wetlands and wildlife from Class 3 and 4 to Class 2 (GLIFWC).

The MPCA is not moving all of the wetland water quality standards from Class 4C to 4A and 4B. The wetland standards currently in rule in Classes 3D and 4C were added in 1993. The SONAR written for that rulemaking gives background on why the standards were chosen, and it is apparent that most of the standards were not put in place with the intention of protecting the industrial consumption and agricultural designated uses, but rather to protect the known or perceived quality of the wetland itself. Therefore, in revising the Class 3 and 4 standards, MPCA is proposing changes to Classes 3D and 4C that reflect the appropriate protections necessary for the Class 3 and 4 designated uses. This, in some cases, involves moving standards to Class 2D, which protects wetlands for "a healthy community of aquatic and terrestrial species indigenous to wetlands, and their habitats" – a use description more in line with the goals expressed in the 1993 rulemaking of protecting the structure of the wetlands and related aquatic community. The protections in Classes 3D and 4C that are related to maintaining natural wetland conditions are better suited in Class 2D, where the standards are intended to protect wetland habitat and species. MPCA is also proposing to move some of the narrative language about wetland functions to Minn. R. 7050.0186, subp. 1, the general narrative standard for wetlands. This overall re-organization of wetland water quality standards will appropriately place wetland water quality standards within the appropriate beneficial use. Wetlands will maintain their classifications as being protected for industrial consumption, irrigation, livestock and wildlife uses.

Specifically:

a. For wetlands Class 2D, 7050.0222, subp. 6, already contains the requirement to "maintain background" for pH; therefore, the requirement being removed from Class 3D and 4C has no impact;
b. Listed standards for chloride and settleable solids standards currently found in Class 3D and Class 4C will move to Class 2D;
c. The narrative Class 4C standard includes language that wetlands should be "suitable for erosion control, groundwater recharge, low flow augmentation, storm water retention, and stream sedimentation." Because these narrative descriptions of wetland beneficial functions cross use classes, moving the current Class 4C narrative standard to the general narrative standard for wetlands found in Minn. R. 7050.0186, subp. 1 is a more appropriate location. This move will improve clarity in application of wetland standards and indicate that these functions of wetlands benefit all use classes.

Additional tribal engagement

Based on the comments received and general discussion, the MPCA was aware of the major concerns about this rulemaking expressed by the Tribes. The MPCA therefore did additional engagement with tribal environmental staff to discuss the planned rules as they evolved.

This included a presentation at the MNTEC meeting, a gathering of staff from tribal environmental departments at Grand Portage on July 9, 2019. In various short presentations, MPCA offered to meet for more in-depth discussion as requested. An in-depth meeting was held at the MPCA Duluth Regional Office on November 6, 2019. Notes were shared with all attendees after the meeting.

This portion of the SONAR was provided to the same interested Tribal partners on August 24, 2020, in advance of the formal notice period. The MPCA offered to meet with these Tribal partners in September 2020, but Grand Portage and Leech Lake indicated that they did not feel a meeting would be beneficial. In response to that initial draft, Grand Portage provided additional written comments. These included:

1) ***Full consideration of tribal lands***. The comment raised the fact that beyond Tribal reservation land, Tribes also have treaty rights (hunting, fishing, gathering) on large swaths of Minnesota that are ceded territories. "In the Ceded Territory, all the Bands have property rights, and therefore have a legal interest in protecting natural resources."
   a) The MPCA agrees that reservations represent only small areas of traditional tribal land. Therefore, considering only reservation land or relying on maps solely of reservation land does not cover every area that is important to tribal rights and interests. All of Minnesota is ceded territory, with hunting, fishing, and gathering rights retained by the Dakota and Ojibwe tribes. The MPCA takes seriously the need to protect the resources that are the subject of these rights – both for Tribes and for the White Minnesotans to whom the treaties grant rights to hunt and fish. The Class 4B water quality standard proposed in this rule was developed to be protective of wildlife drinking water. In addition, the MPCA has developed the additional approach to protecting aquatic life.
2) Consideration of Tribes as sovereign entities. The comment notes that MPCA should consider tribal policies, as Tribes are sovereign entities, separately from EJ policies that relate to the public.
   a) The MPCA agrees, and the grouping of issues around environmental justice and Tribal concerns was not intended to conflate Tribal sovereign interests with the interests of those members of the public that may be considered members of EJ communities. The MPCA has revised this section of the SONAR in order to make that distinction more clear.

3) Consideration of impacts to wild rice. The comment re-iterated comments raised in the past, that the wild rice beneficial use should be part of the Class 2 aquatic life beneficial use class, rather than the Class 4 use class. The commenter then goes on to note that all the Class 4A standards apply to wild rice, along with the specific sulfate standard, and that MPCA has not adequately addressed the impact of removing the numeric Class 4A standards on wild rice.
   a) The MPCA agrees with the interpretation that current structure of the Class 4A rules applies all the Class 4A water quality standards to the subset of Class 4A waters that are called "waters used for production of wild rice" and then imposes the additional sulfate standard on those waters. Because changes to the wild rice water quality standard are outside the scope of this rulemaking, the MPCA did not consider moving the wild rice use to the Class 2 use class or changing the way the Class 4A rules apply.

However, investigation into the past rulemakings shows that the numeric class 4A standards were established to protect crops that are irrigated, not wild rice. It does not appear that the numeric values established in the general Class 4A water quality standards are critical to the protection of wild rice. When the MPCA was working to amend the wild rice sulfate standard, multiple studies were conducted to look at the pollutants that might impact wild rice health and growth. In one, "potential wild rice habitat was characterized for 64 chemical and physical variables in over 100 sites spanning a relatively steep climatic and geological gradient in Minnesota" (Myrbo et al., 2017). Specific conductance was one of these variables. It was not shown to be correlated with wild rice presence or absence. While the wild rice sulfate rule revisions were not completed, the Administrative Law Judge specifically found "that the MPCA presented sufficient evidence to demonstrate that there is an adequate scientific basis to conclude that the proposed equation-based sulfate standard is supported by peer-reviewed science and is needed and reasonable" (Pust, 2018, Finding 251). The MPCA is continuing to explore paths forward on the wild rice standard for sulfate and is not changing the standard in this rulemaking. The wild rice specific sulfate standard is the best way to protect wild rice.

In addition to the information from extensive wild rice studies, MPCA scientists have done some investigation of Minnesota wetland plant response to salinity stressors: conductivity, chloride, and sulfate. They note that "aquatic plants are sensitive to specific conductance, chloride and sulfate and their response should be considered in development of any aquatic life salinity related criteria or standards development". The MPCA therefore would consider the response of wetland plants to these pollutants as the MPCA proceeds in future rulemakings to develop aquatic life based water quality standards.

4) Although the review notes that additional data and analysis regarding wetland plant responses are needed, the MPCA scientists did construct preliminary XC95 values for select wetland plant species related to conductivity both statewide and in three ecoregions. Extirpation response benchmark or XC95 (extirpation concentration at 95%) represents the concentration below which 95% of observations of specific species occur. This included estimates of XC95 values with conductivity for wild rice, statewide and in the mixed wood plains ecoregion. These respective XC95 values for wild rice were 407 µS/cm statewide and 398 µS/cm in the mixed wood plains ecoregion. These values are roughly similar to those constructed for macroinvertebrate response to conductivity (S-5). Therefore, the interim approach to protecting aquatic life should be sufficient for both macroinvertebrates and wetland plants. Contradiction between MPCA's statements about ionic pollutants and about salt. The commenter raises the fact that there appears to be a contradiction between MPCA's statement in this SONAR that it does "not expect significant increases in ionic pollutants or specific conductance relative to existing conditions, because of the plans to develop detailed implementation procedures for the considered narrative standards" and an MPCA fact sheet on smart salting that states that "The data show that salt concentrations are continuing to increase in both surface waters and groundwater across the state"

a) The MPCA's statement that it does not expect significant increase in ionic pollutants is specific to the impacts of this rulemaking on ionic pollutants discharged from permitted sources. Because of the implementation procedures being established, the MPCA does not expect permitted dischargers to increase their discharge of ionic pollutants, which in this case refers to a broad range of salts. The statement about increased salt concentration refers specifically to one salt, chloride, which primarily enters Minnesota's waters through de-icing salt or from municipal wastewater plants that receive water from homes that are using water softeners. Minnesota has a Class 2 water quality standard for chloride that is being maintained.

5) Sufficient information to do aquatic life standards. The comment states a belief that the the MPCA's Permitting Framework for Aquatic Life (S-5) demonstrates that the MPCA has sufficient information to develop aquatic life standards for specific conductance and could adopt the developed benchmarks.

    a) The MPCA disagrees with this conclusion, which is why the regional benchmarks are only being used as screening levels in conjunction with other measures.

At this time MPCA finds that the best approach to addressing potential impact on aquatic life will be ion-specific standards. The current and background composition of ions that contribute to specific conductance measurements vary across Minnesota. Similarly, the toxicity to aquatic life of these individual ions and ionic mixtures also vary. As such, it is the preference of the MPCA to have ion-specific standards to address the potential impact on aquatic life, while using specific conductance as an additional screening tool to find areas of high ionic concentrations.

The dataset used by the MPCA to develop regional benchmarks for specific conductance does not include adequate individual ion data to develop field-based, ion-specific standards, and as suggested, is best used to support a screening tool for potentially problematic sources of ion-related stress. The work presented in the framework (S-5) may be early work that partially supports a future water quality standard, but it is not yet sufficient to fully support such a standard.

Secondly, new numeric water quality standards are required to go through peer review. MPCA will need to develop a detailed TSD and go through that peer review process prior to any promulgation of numeric water quality standards for either individual ions or specific conductance.

6) Technology based standard. The commenter states that "the existing Class 3 and 4 criteria for industrial and agriculture uses are considered attainable because they can be achieved if technology based standards are imposed on point source dischargers (through sections 33 USC § 1311 and § 1316 of the CWA)"

    a) The MPCA disagrees with this conclusion. 33 USC § 1311 (b)(1)(A)(i) references to effluent limitations that require "best practicable control technology". EPA implements this through promulgation of effluent guidelines and technology based effluent limits (TBELs). The EPA Office of Water (2014) states that "Effluent Guidelines are national wastewater discharge standards that are developed by EPA on an industry-by-industry basis. These are technology-based regulations and are intended to represent the greatest pollutant reductions that are economically achievable for an industry."Effluent guidelines cover conventional pollutants, which include biochemical oxygen demand (BOD5), total suspended solids (TSS), fecal coliform, pH, and oil and grease. They also cover toxic pollutants, a specific list of types of pollutants that does not cover ionic pollutants, and non-conventional pollutants. The MPCA is not aware of any ELGs that limit specific conductance, sulfate, or any other ionic pollutants.

On October 5, 2020, MPCA was copied on a letter to Governor Tim Walz from multiple Tribal Nations. The letter touched on several issues but included the following statement: "MPCA is now proposing to weaken salty discharge criteria statewide for Beneficial Use Classes 3 and 4 (industrial, agricultural, and wildlife) water quality standards—at the request of U.S. Steel, owner of Minntac. Wild rice is a Class 4 Beneficial Use, yet MPCA has not considered the effect that these changes may have on wild rice. We ask for state-tribal consultation on this matter before any final decision."

A virtual and phone meeting was held on October 14 between MPCA (Commissioner Laura Bishop, Assistant Commissioner Katrina Kessler, Tribal Liaison Helen Waquiu, and Manager Catherine Neuschler), members of the Governor's staff, and leaders and staff of Minnesota's Tribes. The MPCA provided information on how Tribal comments had been addressed and changes incorporated into the rule. Detailed comments were provided by April McCormick, Secretary/Treasurer of the Grand Portage Band, verbally during the call and afterwards in writing. The MPCA addresses the items in the comments throughout this SONAR.

10. Attachments, authors, witnesses, and SONAR exhibits

A. Authors

1) Scott Kyser, Senior Engineer, MPCA
2) Laura Lyle, Research Scientist, MPCA (former staff)
3) Gerald Blaha, Research Scientist, MPCA (former staff)
4) Catherine Neuschler, Manager, MPCA
5) Baishali Bakshi, Economist, MPCA
6) Patricial Engelking, Policy Specialist, MPCA
7) Andrea Borich, Research Analysis Specialist, MPCA
8) Casey Scott, Research Analysis Specialist, MPCA
9) Emily Brault, Research Specialist, MPCA
10) Mark Gernes, Wetland Specialist, MPCA
11) Joel Chirhart, Macroinvertebrate Biologist, MPCA

B. Witnesses and other staff

The agency expects that the proposed amendments will be controversial and intends to hold public hearings regarding the proposed revisions. The agency anticipates having the listed authors testify as witnesses in support of the need for and reasonableness of the rules.

1) Lead Scientist, Scott Kyser, Senior Engineer, MPCA. Mr. Kyser is a primary author of the SONAR and a lead scientist in the rule development. Mr. Kyser will testify on the underlying science and development of the rule and SONAR.
2) Manager, Catherine Neuschler, MPCA. Ms. Neuschler is the manager of MPCA's Water Assessment Section in the Environmental Analysis and Outcomes Division.
3) Legal Counsel, Jean Coleman, MPCA. Ms. Coleman is a staff attorney to the agency and will introduce the required jurisdictional documents into the record.
4) Rule Coordinator, Claudia Hochstein, MPCA. Ms. Hochstein is the project rule coordinator and will testify on any Minnesota Administrative Procedures Act process questions.

C. SONAR exhibits

S-1. List of References for this SONAR.

S-2. MPCA. (2020). Class 3 and 4 Water Quality Standards Revised Technical Support Document (TSD).

S-3. MPCA. (2020). Class 3 Translator Method: Draft Industrial Consumption Narrative Translator.

S-4. MPCA. (2020). Class 4A Translator Method: Draft Irrigation Narrative Translator.

S-5. MPCA. (2020). Permitting Framework for Aquatic Life Narrative Standard.

S-6. University of Minnesota. (2010). Class 3 and Class 4 water quality standards review: Minnesota surface water quality investigation- industrial supply, irrigation and livestock uses.

S-7. MPCA. (2019). *Draft Technical Support Document (TSD) for Class 3 and 4 Water Quality Standards Revision*.

S-8. MPCA (2020). *Appendix A to the TSD: Peer review summary.*

S-9. Comments received in response to the first Request for Comments on Planned Amendments to Rules Governing Water Quality Standards- Use Classifications 3 and 4, *Minnesota Rules*, chapter 7050 - February 8, 2016 RFC.

S-10. Comments received in response to the second Request for Comments on Planned Amendments to Rules Governing Water Quality Standards- Use Classifications 3 and 4, *Minnesota Rules*, chapters 7050 and 7053 - March 11, 2019 RFC.

S-11. MPCA. (2016, February 8) Request for Comments on Planned Amendments to Rules Governing Water Quality Standards - Use Classifications 3 and 4, Minnesota Rules chapter 7050 and 7053.

S-12. MPCA. (2019, March 11) Request for Comments on Planned Amendments to Rules Governing Water Quality Standards - Use Classifications 3 and 4, Minnesota Rules chapter 7050 and 7053.

S-13. EPA Water Quality Standards Handbook, chapter 3

S-14. MPCA (2020). Class 4A Irrigation Narrative Translator Tool.

S-15. U.S. Environmental Protection Agency. (2015, August 21). Preamble to Water Quality Standards Regulatory Revisions Final Rule in Federal Register, Vol. 80., No. 162.

S-16. U.S. Environmental Protection Agency, Standards and Health Protection Division. (2008, September 5). Existing use memo.

S-17. MPCA. (2017, August 2). Draft overview of survey results (survey of industrial water appropriators).

S-18. Bernstein, Leon. (1966, February 4). Water quality standards proposed for irrigation by Water Pollution Control Commission, Minnesota (memo).

S-19. MPCA. (2020). Taconite industry enhanced economic analysis.

S-20. Kyser, Scott. (2020, November 18). Chloride linkage justification (memo).

11. Conclusion

In this SONAR, the agency has established the need for and the reasonableness of each of the proposed amendments to Minn. R. chs. 7050 and 7053. The agency has provided the necessary notifications and in this SONAR documented its compliance with all applicable administrative rulemaking requirements of Minnesota statute and rules.

Based on the forgoing, the proposed amendments are both needed and reasonable.

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Laura Bishop, Commissioner
Minnesota Pollution Control Agency

______December 12, 2020___________
Date